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# An Explanatory Study of Media Used in Blended Learning at Austrian Universities of Applied Sciences

DOCTORAL DISSERTATION

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**Abstract**

The proportion of degree programmes offered by higher education institutions in a blended learning setting is increasing. Research on the lecturers who have been teaching on such blended learning programmes for a long time is rare and even virtually non-existent for specific areas such as universities of applied sciences. This thesis explores the media use of lecturers who teach in blended learning settings at Austrian universities of applied sciences. The study at hand is the first to survey the technological, pedagogical and content knowledge (TPACK) of lecturers at universities of applied sciences for an entire country. The participants in the quantitative part of the study were 419 lecturers who teach in blended learning settings at Austrian universities of applied sciences. In a subsequent qualitative survey, 20 programme directors were interviewed who work as lecturers themselves and lead programmes at universities of applied sciences that were already run as blended learning programmes before the COVID-19 Distance Learning Phase. The results of the qualitative interviews explain the results of the quantitative survey in more detail and take them further. The thesis identifies various factors that influence the TPACK of Austrian lecturers who teach in blended learning settings. Furthermore, it documents the influence of the lecturers' didactic education on their media use and the differences and influences in their use of synchronous and asynchronous media. The preferred forms and contents for pedagogical support and further training were surveyed for the qualitative study. In addition, the lessons learned by the programme directors from the COVID-19 Distance Learning Phase and their expectations for changes after this period provide particular insights into recent developments. The thesis offers more profound insights into the media use of lecturers who teach in blended learning settings and concrete recommendations for their pedagogical support and training. Therefore, the results are relevant both for programmes that are already in a blended learning format and those that will be in future.

Keywords: blended learning, universities of applied sciences, TPACK, media use

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**Declaration in Lieu of an Oath**

I hereby declare that my dissertation titled "An Explanatory Study of Media Used in Blended Learning at Austrian Universities of Applied Sciences" is based on my own work except where stated otherwise by reference.

I also declare that this dissertation has not been submitted to any institution or university to obtain an academic degree other than the Consortium, International Cooperative Cross-Border Interdisciplinary Doctoral Programme in Educational & Communication Sciences.

Barbara-Christine Geyer

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## List of Abbreviations

| | |
|---|---|
| ACODE | Australasian Council on Open, Distance and E-learning |
| ADDIE | analysis, design, development, implementation, and evaluation model |
| AECT | Association for Educational Communications and Technology |
| ANOVA | analysis of variance |
| ARCS | attention, relevance, confidence, and satisfaction model |
| ASSURE | analyse, state, select, utilise, require, and evaluate model |
| AQ Austria | Agency for Quality Assurance and Accreditation Austria |
| BNCL | beliefs about a new culture of learning |
| BLC | blended learning curriculum design model |
| CATLM | cognitive-affective theory of learning with media |
| CK | content knowledge |
| CLT | cognitive load theory |
| CTML | cognitive theory of multimedia learning |
| DD | design disposition |
| DDD-E | decide, design, develop, and evaluate model |
| DT | design thinking |
| eMM | e-Learning maturity model |
| ECL | extraneous cognitive load |
| ERT | emergency remote teaching |
| fnma | Forum Neue Medien Austria (forum new media Austria) |
| GCL | germane cognitive load |
| HE | higher education |
| HELAM | hexagonal e-learning assessment model |
| ICL | intrinsic cognitive load |
| ICT | Information and Communication Technologies |
| IDM-BHE | instructional design model for blended higher education |
| iNACOL | International Association for K-12 Online Learning |
| ISCED | International Standard Classification of Education |
| ISCED-F | International Standard Classification of Education Fields of Education and Training |
| IST | Information Society Technology |
| ISTE | International Society for Technology in Education |

| | |
|---|---|
| LDP | lesson design practice |
| LMS | Learning Management System |
| MS | mean square |
| MANOVA | multivariate analysis of variance |
| MKO | more knowledgeable other |
| MRK | model of Ross and Kemp |
| N | total number of cases |
| PCK | pedagogical content knowledge |
| PEOU | perceived ease of use |
| PK | pedagogical knowledge |
| SD | standard deviation |
| SDT | self-determination theory |
| SILSTI | student, instructor, learning design, support, technology environment, and institutional dimension perspective model |
| SRL | self-regulated learning |
| STLDM | scaffolded TPACK lesson design model |
| TAD | teacher as designer |
| TAM | technology acceptance model |
| TCK | technological content knowledge |
| TEL | technology-enhanced learning |
| TPACK | technological, pedagogical and content knowledge |
| TPCK | technological pedagogical content knowledge |
| TPK | technological pedagogical knowledge |
| TRA | theory of reasoned action |
| TK | technological knowledge |
| UAS | university of applied sciences |
| UB | use behaviour |
| UDL | universal design for learning model |
| Web-TK | Web-based technological knowledge |
| ZPD | zone of proximal development |

# 1 Introduction

When the research questions for this thesis were phrased, blended learning was only relevant for a small group of higher education (HE) institutions. However, COVID-19 has influenced teaching and learning on all continents (United Nations, 2020). In German-speaking countries, HE institutions were forced to switch entirely to distance learning (Ahrens & Zascerinska, 2021; Ebner et al., 2020). The result has been an increasing interest in teaching with digital media and distance learning (Väätäjä & Ruokamo, 2021).

The Horizon Report 2020 (Brown et al., 2020) listed three trends in HE: changes in student population, alternative pathways to education, and online education. Online education is increasingly used to scale courses and reach non-traditional student groups. Brown et al. (2020) argued that lecturers need to be prepared to teach in online-only, blended learning, or face-to-face settings. According to the Horizon Report 2020, HE institutions will need to develop new online programmes and models, and lecturers should be prepared to teach in all of these scenarios.

During the COVID-19 Distance Learning Phase, teaching online was a new experience for most teachers. Thus, the focus on best practices in online teaching became stronger (Stewart, 2021). Some blended learning programmes have always conducted parts of their teaching online, and the experience gathered by the lecturers teaching on these programmes is now relevant to a broader audience due to the forced digitisation of teaching associated with COVID-19. This thesis focuses on lecturers' experiences using media in blended learning programmes at Austrian universities of applied sciences (UAS).

The Austrian HE sector consists of public universities, UAS, private universities, and university colleges of teacher education (Wadsack & Kasparovsky, 2007). In this domain, part-time study programmes are mainly offered by UAS, almost half of these degree programmes are part-time. In 2019, nearly 10% of these were blended learning study programmes that had shifted a significant number of their face-to-face units online, allowing lecturers to gather experience with blended learning.

Most studies on online teaching and blended learning address the recipients, that is, the students. Zhang and Zhu (2017) and Mozelius and Hettiarachchi (2017) found that teachers' factors are still less frequently dealt with in blended learning studies. Most of the research work carried out with lecturers is restricted to one or a selected number of universities. As we know from research on teaching, the critical element with the most significant impact on learning success is the teacher (Hattie, 2009). Therefore, this work focuses on the lecturers teaching in blended learning courses at Austrian UAS. The thesis at hand covers blended learning in the entire HE sector of a country from the lecturers' perspective, an area of HE that has provided a large amount of teaching online in the past.

In the European HE area, efforts have been made to increase the digitisation of teaching for more than two decades (Martínez-Torres et al., 2008). The European Union established digital competencies as part of the key competencies for lifelong learning (European Commission, 2006). This was expressed as a European framework in the form of DigCompEdu, the Digital Competence Framework for Educators of the European Union (Redecker, 2017), which mainly applies to schools. However, before the COVID-19 crisis, universities in German-speaking countries only used digital media to a limited extent (Vallaster & Sageder, 2020). An exception worth mentioning was blended learning programmes, which already conducted part of their teaching online before the crisis.

Blended learning as a combination of teaching that takes place in the lecture halls at the university and elements that the students carry out by themselves outside of the classroom has been around for decades. However, due to technological developments, particularly the widespread expansion of the internet, the easier availability of affordable technical equipment, and the development of freely accessible online programmes for teaching, the general conditions for this form of education have changed. Therefore, the elements that influence blended learning in the context of new technological developments are under closer scrutiny in both research and teaching.

## 1.1 Purpose of the Study

The purpose of this explanatory mixed-methods study is to investigate the relationship between the use of media and the TPACK of lecturers who teach blended learning courses at Austrian UAS.

The focus is on four objectives: (1) to analyse differences and relationships between lecturers' TPACK and media use, (2) to research influencing factors, especially for synchronous and asynchronous media, (3) to identify types and content of pedagogical support that underpin the media use of lecturers teaching in blended learning, and (4) to explore the experience of COVID-19 in terms of lecturers' media use and expected changes after the Distance Learning Phase.

This research aims at a better understanding of the media use of lecturers teaching in blended learning settings at Austrian UAS. To achieve this goal, an explanatory, sequential design was chosen, in which the qualitative study results explain and deepen the quantitative study results. The participants in the quantitative part of the study are lecturers at Austrian UAS who teach in blended learning settings. For the qualitative study, programme directors of blended learning study programmes at UAS who also lecture were interviewed.

### 1.2 Research Questions and Hypotheses

The topic of the thesis developed out of a desire to better understand the use of media by lecturers. The author is a lecturer and programme director at an Austrian UAS. Her programme was already conducted in a blended learning format before COVID-19. This initial situation stimulated the desire and offered the possibility to choose lecturers of these study programmes as the object of research. COVID-19 then led to a rise in the relevance of blended learning and the lecturers' media use.

A comprehensive literature search was carried out based on this initial situation. The result is that the TPACK model is one of the most influential theoretical concepts in both blended learning (Valverde-Berrocoso & Fernández-Sánchez, 2020) and educational technology (Hew et al., 2019). However, the model was rarely adopted in German-speaking countries (Delere, 2020; Endberg, 2019). One conclusion was that the TPACK of Austrian UAS lecturers who teach in blended learning settings should be examined more closely. Research Questions 1, 2, 4, 5 and 7 are dedicated to this topic. These questions ask whether the TPACK of lecturers differ based on their fields of education, didactic education, gender, age, years of service, full-time or adjunct status and teaching with high or low media infusion and whether a relationship exists between TPACK and technology use.

The literature research on media use revealed a heterogeneous picture. On the one hand, the intensity with which a learning management system (LMS) is used is often measured in this area, which this thesis also does, based on Research Question 7. On the other hand, there were only few and outdated classifications for the media used in teaching, as documented in Chapter 5.2. Therefore, based on the existing classification systems, the author developed an improved classification of media use in teaching for this thesis, which served as the foundation for measuring the media use of the lecturers in Research

Questions 3, 5 and 6. In addition to measuring media use, Research Question 8 addresses the difficulties of technology use. The research questions that guided the thesis on media used in blended learning at Austrian UAS, listed with the corresponding hypotheses, are:

Research Question 1: Is there a statistically significant difference in the level of technological, pedagogical, and content knowledge (TPACK) of lecturers teaching in blended learning study programmes based on the ISCED fields* of education of universities of applied sciences in Austria?

Hypothesis 1: There is a statistically significant difference in the level of technological, pedagogical, and content knowledge (TPACK) of lecturers teaching in blended learning study programmes based on the ISCED fields* of education of universities of applied sciences in Austria.

Research Question 2: Is there a significant difference in TPACK based on lecturers' education, gender, age and years of service, in blended learning study programmes at universities of applied sciences in Austria?

Hypothesis 2: There is a statistically significant difference in TPACK based on lecturers' education, gender, age and years of service, in blended learning study programmes at universities of applied sciences in Austria.

Research Question 3: Is there a significant relationship between lecturer's didactic education and their media use in blended learning study programmes at universities of applied sciences in Austria?

Hypothesis 3: There is a statistically significant relationship in lecturer's didactic education and their media use in blended learning study programmes at universities of applied sciences in Austria.

Research Question 4: Is there a significant difference in lecturers' TPACK based on their full-time or adjunct status in blended learning study programmes at universities of applied sciences in Austria?

Hypothesis 4: There is a statistically significant difference in lecturers' TPACK based on their full-time or adjunct status in blended learning study programmes at universities of applied sciences in Austria.

Research Question 5: Is there a difference in lecturers' TPACK based on their teaching with media infusion in blended learning study programmes at universities of applied sciences in Austria?

Hypothesis 5: There is a statistically significant difference in lecturers' TPACK based on their teaching with media infusion in blended learning study programmes at universities of applied sciences in Austria.

Research Question 6: Is there a significant difference in the frequency of use of synchronous or asynchronous media in the online part of blended learning based on the ISCED fields of education* of universities of applied sciences in Austria?

Hypothesis 6: There is a statistically significant difference in the frequency of use of synchronous or asynchronous media in the online part of blended learning based on the ISCED fields of education* of universities of applied sciences in Austria.

Research Question 7: Is there a significant relationship between TPACK and technology use in blended learning?

Hypothesis 7: There is a significant relationship between TPACK and technology use in blended learning.

Research Question 8: Is there a significant relationship between difficulties in technology use and ISCED fields*?

Hypothesis 8: There is a significant relationship between difficulties of technology use and ISCED fields*.

* "ISCED is designed to serve as a framework to classify educational activities as defined in programmes and the resulting qualifications into internationally agreed categories. The basic concepts and definitions of ISCED are therefore intended to be internationally valid and comprehensive of the full range of education systems" (UNESCO, 2012, p. 6).

The results of the tested hypotheses, together with the literature, formed the basis for developing the interview protocol for the qualitative interviews with the aim of better understanding the quantitative results. This led both to a deeper understanding of the first eight research questions and to further questions.

Concerning media use, both the literature research and the results of Research Questions 3 and 6 showed the relevance of the different uses of synchronous and asynchronous media in the online part of blended learning. Therefore, Research Question 9 deals with influences on the use of synchronous and asynchronous media.

A recurring theme in the quantitative survey results was the importance of didactic support and further training for lecturers. This topic was particularly evident in Research Questions 4, 5 and 8, which showed that more didactic education for lecturers leads to higher media use. Further insights were that part-time lecturers have lower TPACK levels in the educational field and that lecturers perceive a lack of pedagogical models for using technology for learning and insufficient pedagogical support as obstacles. Therefore, Research Questions 10 and 11 address the lecturers' assessment of pedagogical support and the knowledge they should be given to use media effectively in teaching. These questions were prompted by secondary literature. In their article on the development of TPACK science, Saubern et al. (2020) argue that “all TPACK research should have one fundamental purpose: to understand the knowledge that teachers need to use technology effectively for teaching and learning” (p. 6).

The qualitative interviews were conducted during the COVID-19 Distance Learning Phase. The impact of COVID-19 on teaching at Austrian universities was severe, and it was not possible to conduct interviews at this time without including the influence of COVID-19. For this reason, two questions about COVID-19 were asked at the beginning of the qualitative interviews, namely, about the lessons learned and what should remain after the COVID-19 Distance Learning Phase. The answers to these short questions were so extensive, complex and relevant for the pedagogical practice that Research Questions 12 and 13 were formulated on this basis.

The five additional research questions related to the qualitative study are:

Research Question 9: What influences the use of synchronous and asynchronous media of lecturers in blended learning study programmes at Austrian universities of applied sciences?

Research Question 10: What are lecturers' perspectives on the pedagogical support in blended learning study programmes at Austrian universities of applied science?

Research Question 11: What knowledge do lecturers in blended learning study programmes at Austrian universities of applied sciences need to be taught to use media effectively for teaching?

Research Question 12: What are the lessons learned by the programme directors of blended learning programmes at Austrian universities of applied sciences from the COVID-19 Distance Learning Phase?

Research Question 13: What should be adopted from the COVID-19 Distance Learning Phase for blended learning study programmes at Austrian universities of applied sciences in the future?

# 2 Blended Learning

This chapter covers blended learning and begins by presenting its theoretical foundations, including blended synchronous and asynchronous learning, as this topic is related to the research questions. An overview of blended learning research and its implementation in HE concludes the chapter.

Blended learning has multiple definitions but not a single generally accepted definition. It is used synonymously with distance learning, online learning, e-learning, blended teaching, e-teaching, blended e-learning, hybrid learning, and flexible learning (Caravias, 2015). The literature defines blended learning in a variety of ways. According to Hrastinski (2008), the most quoted definition is from Garrison and Kanuka (2004), who state that “At its simplest, blended learning is the thoughtful integration of classroom face-to-face learning experiences with online learning experiences” (p. 96). Another widely cited definition of blended learning derives from Graham (2005): “Blended learning systems combine face-to-face instruction with computer-mediated instruction” (p. 5). A third influential definition was coined by Allen and Seaman (2010), who classify courses according to their proportion of content delivered online, as shown in Table 1.

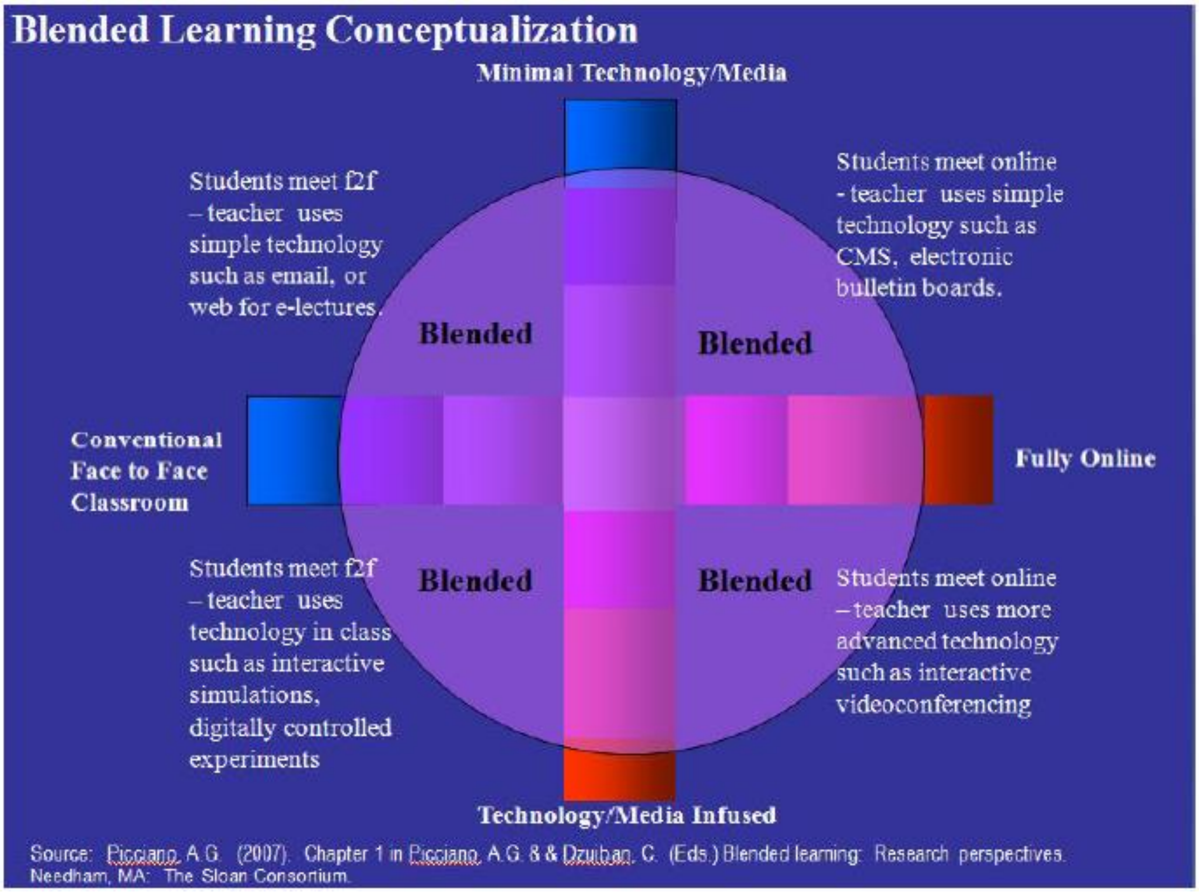
**Table 1** *Course Classification (Allen & Seaman, 2010, p. 5)*

| Proportion of Content Delivered Online | Type of Course | Typical Description |
|---|---|---|
| 0% | Traditional | Course with no online technology used — content is delivered in writing or orally. |
| 1 to 29% | Web Facilitated | Course that uses web-based technology to facilitate what is essentially a face-to-face course. May use a course management system (CMS) or web pages to post the syllabus and assignments. |
| 30 to 79% | Blended/Hybrid | Course that blends online and face-to-face delivery. Substantial proportion of the content is delivered online, typically uses online discussions, and typically has a reduced number of face-to-face meetings. |
| 80+% | Online | A course where most or all of the content is delivered online. Typically have no face-to-face meetings. |

Zhao et al. (2005) argued that the factors that affect distance learning effectiveness also affect the efficiency of face-to-face learning. One factor that notably distinguishes distance learning is technology, which is used to eliminate the effects of distance. This difference becomes blurred as face-to-face learning increasingly uses technology to support teaching and learning. When distance learning is seen as the same as face-to-face training, we are encouraged to consider the richness of the theoretical, analytical, and conceptual frameworks for understanding education.

Blended learning is becoming a frequently used teaching model in HE (Halverson et al., 2014). However, “Blending is about the effective integration, fusion even, of face-to-face and online learning depending on the educational need and purpose. As such, there is virtually an infinite range of possibilities” (Garrison, 2009, p. 200). Picciano's (2009) broad conceptualisation of blended learning presents a range of these possibilities on a spectrum, highlighting the dimensions of technology and the synchronous and asynchronous use of media, as shown in Figure 1.

**Figure 1** *Broad Conceptualisation of Blended Learning (Picciano, 2009, p. 11)*



## 2.1 Theoretical Foundations of Blended Learning

Valverde-Berrocoso and Fernández-Sánchez (2020) divided the theoretical foundations of blended learning into (1) theoretical-explanatory models, (2) theoretical-applied models, (3) generic models of instructional design, (4) models using educational standards for online education, and (5) models specifically for blended learning environments.

Valverde-Berrocoso and Fernández-Sánchez (2020) assigned community of inquiry (CoI) and TPACK to the category of theoretical-explanatory models. The TPACK model is presented in detail in the chapter on Technological Pedagogical Content Knowledge and is one of the most important theoretical foundations of blended learning. The CoI model (Garrison et al., 1999) describes the success factors for online supported learning processes. These are social presence, teaching presence, and cognitive presence. Social presence extends to how participants experience each other, communicate with one another and develop interpersonal relationships. The teachers' degree of support and guidance is referred to as teaching presence, and cognitive presence is the degree of shared knowledge construction through communication between the participants (Shea & Bidjerano, 2009). According to the CoI model (Garrison et al., 1999), learning for a group of individuals arises through the educational experience created by the intersection of social, cognitive and teaching presence.

The second category defined by Valverde-Berrocoso and Fernández-Sánchez (2020) in the theoretical foundations of blended learning is theoretical-applied models. This class includes UDL and the ARCS model. The universal design for learning (UDL) model (Tobin & Behling, 2018) applies the approach of barrier-free access in the sense of an inclusive education system to the design of learning environments. The aim is to reduce barriers to enable equal participation in education for all learners. Three design principles are applied, namely, (1) representation - information should be presented in multiple forms, (2) action and expression - learners should encounter various ways to interact with the material and express their learning outcomes, and (3) engagement – learners can be motivated in multiple ways.

The ARCS model (Keller, 1987) addresses the motivational issues of learners through appropriate instructional design. It consists of four components of motivation and a four-step design process. The design process is intended to support the creation of motivational elements for learning, which are define, design, develop, and evaluate (Keller, 1987). The parts of the model are (1) attention as a precondition for learning, (2) relevance of the subject matter to the learner, (3) confidence of the learners in their learning success, and (4) satisfaction of the learners with the learning outcome (Liao & Wang, 2008).

Valverde-Berrocoso and Fernández-Sánchez (2020) identified theoretical-explanatory models and theoretical-applied models based on their experience and a literature review. In contrast, Hew et al. (2019) analysed 503 empirical studies on educational technology to identify the most frequently cited theories in this area. The eight theories they identified as most frequently cited are presented in the chapter on Specific Theories for Educational Technology.

The third category defined by Valverde-Berrocoso and Fernández-Sánchez (2020) in the theoretical foundations of blended learning is generic models of instructional design. They mention ADDIE, ASSURE, MRK and DDD-E. According to Chen (2016), ADDIE is one of the most frequently cited traditional instructional design models. This model is prevalent in business and organisational environments. It comprises five course design principles (Molenda, 2003), which form the acronym ADDIE: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. The model is linear and focuses on implementation and evaluation.

The ASSURE model supports educators in selecting technologies, resources and materials for teaching and integrating them into the classroom (Smaldino et al., 2019). It is considered particularly useful for blended learning settings (Çetinkaya, 2016). The model consists of six phases (Smaldino et al., 2019), which form the acronym ASSURE: (1) analyse learner characteristics, (2) state objectives, (3) select, modify, or design materials, (4) utilise materials, (5) require learner response, and (6) evaluate.

Ross and Kemp's model (MRK) consists of nine elements that are part of a cyclical sequence of planning, revision, formative evaluation and project management (Morrison et al., 2019). These are (1) instructional problems, (2) learner characteristics, (3) task analysis, (4) instructional objectives, (5) content sequencing, (6) instructional strategies, (7) designing the message, (8) development of instructions, and (9) evaluation instruments. The model has no clearly defined starting point; the elements are independent of each other and can be carried out simultaneously.

The DDD-E model (Ivers & Barron, 2006) focuses on the design of multimedia teaching and the management and development of multimedia projects. It consists of three phases corresponding to the three “Ds”, which are (1) decide, (2) design, and (3) develop. The “E” stands for evaluating.

The fourth category defined by Valverde-Berrocoso and Fernández-Sánchez (2020) in the theoretical foundations of blended learning includes models that use educational standards for online education. They list iNACOL and Quality Matters for this category. The International Association for K-12 Online Learning (iNACOL) provides national standards for quality online courses developed in the USA and used worldwide. With these standards, online courses can be reviewed in depth (Adelstein & Barbour, 2016).

Quality Matters is a quality standard model developed for HE (Brown et al., 2018). The model is mainly used in the USA to develop and evaluate online courses. The 43 items of Quality Matters are divided into the following eight categories: (1) course overview and introduction, (2) learning objectives, (3) assessments, (4) instructional materials, (5) learner interactions, (6) course technology, (7) learner support, and (8) accessibility.

Valverde-Berrocoso and Fernández-Sánchez's (2020) fifth and final category for their theoretical foundations of blended learning includes models specifically for blended learning environments. They refer to the BLC design model and the IDM-BHE. The blended learning curriculum (BLC) design model (Huang et al., 2008) consists of three elements: (1) pre-analysis, (2) activity and resource design, and (3) instructional assessment. Each part includes several subareas. The model's core is the activity and resource design (Newbury, 2013). The BLC provides a conceptual framework and a guide for designing blended learning environments.

The instructional design model for blended HE (IDM-BHE) is characterised by a pyramid structure (Hack, 2016). The model consists of four levels: The first level includes the following tasks: assess needs, analyse learners, state goals and analyse resources. The second level has three components: develop objectives, blend and sequence, and design learning activities. The third level comprises two elements: develop assessment strategies and deliver and get feedback. The tasks at the fourth level are to analyse and revise. IDM-BHE was created for use in HE, for example, to design blended learning college courses.

This section presents the most important theoretical models for blended learning from Valverde-Berrocoso and Fernández-Sánchez's (2020) perspective. However, there are different views on which theoretical models are vital for blended learning. Halverson et al. (2014) analysed which blended learning models are most frequently cited. They divided the models into four categories: “a framework to guide design”, “an evaluation tool”, “a design process model”, and “an instructional model”. According to them, most authors of the articles that dealt with blended learning models developed their own models. Bower and Vlachopoulos (2018) also identified many technological learning design models, but they differ widely in their type and quality. It is necessary to consolidate the understanding of the different learning design processes, tools and models.

McGee and Reis (2012) conducted a meta-analysis to explore the principles for designing blended learning courses. According to them, design strategies start with defining course objectives and then creating course activities, assignments and assessments. Course objectives are particularly relevant as they influence online and offline content delivery, pedagogy and the number of meetings and types of interaction. After defining the goals, a course outline should be created, including the course activities and descriptions of the tasks and assessments. The structuring and detailed description of activities, tasks and assessments are essential for a blended learning course as it communicates when, where and how learning takes place. Overall, the whole process of design is also a process of re-design. According to McGee and Reis (2012), the possibilities and range of conceptions and approaches for designing blended courses are as diverse as the teaching methods.

Alammary et al. (2014) identified three different design approaches for blended learning in HE, differentiated according to the processes of designing blended learning courses. These are (1) low-impact blend by adding activities to an already existing course, (2) medium-impact blend by replacing activities on an already existing course, and (3) high-impact blend by creating a blended course starting from scratch.

## 2.2 Synchronous and Asynchronous Activities in Blended Learning

In addition to face-to-face elements, both synchronous and asynchronous activities are essential for blended learning arrangements (Bower et al., 2015; Ho, 2017; Picciano, 2009; Smits & Voogt, 2016).

Bower et al. (2015) defined blended synchronous learning as “learning and teaching where remote students participate in face-to-face classes through rich-media synchronous technologies such as video conferencing, web conferencing, or virtual worlds” (p. 1).

According to Ho (2017), blended synchronous learning's main benefits are more flexibility and comfort for students and improved self-efficacy, while teachers can benefit from more flexibility in teaching. Organisations can also better meet a growing student population's needs and provide alternative ways of delivering courses. As a result, classes can continue even when students cannot attend physically. On the other hand, students must have discipline and responsibility to accomplish the tasks assigned, and teachers must help reduce their perception of complexity (Ho, 2017).

In addition to synchronous and face-to-face learning, asynchronous learning is also practised in blended learning settings: “Asynchronous environments provide students with readily available material in the form of audio/video lectures, handouts, articles and PowerPoint presentations. This material is accessible anytime anywhere” (Perveen, 2016, p. 22). Smits and Voogt (2016) emphasise the importance of behavioural components, especially for student satisfaction, in their study of HE regarding the elements of good asynchronous online teacher behaviour. These are (1) addressing the group, (2) neutral acknowledgement, (3) specific praise, (4) elaboration, (5) content, and (6) online personality.

Yamagata-Lynch (2014) identified different requirements necessary for successfully combining synchronous and asynchronous learning. According to her, it is essential that (1) students are familiar with the tools for synchronous meetings, (2) ground rules are enforced, and (3) a structure and course objectives are clear. Furthermore, she derives three recommendations for designing any course combining synchronous and asynchronous activities. According to Yamagata-Lynch (2014), participants come to class with different previous experiences, and many have no experience with participatory online collaboration. Therefore, first, it is necessary to give the participants time and structure, e.g. through common rules, to find a new identity as online learners. Synchronous activities create a stronger sense of connectedness between participants and presenter. Second, combining synchronous and asynchronous activities helps participants develop a more robust social presence. Third, participants' experiences are strongly influenced by the extent to which the teacher brings a sense of cohesion and structure to the synchronous learning environment.

Hrastinski (2008) presented in his overview when, why, and how to use asynchronous or synchronous elements, as seen in Table 2.

**Table 2** *When, Why, and How to Use Asynchronous vs Synchronous E-Learning (Hrastinski, 2008, p. 52)*

| | Asynchronous E-Learning | Synchronous E-Learning |
|---|---|---|
| When? | Reflecting on complex issues<br>When synchronous meetings cannot be scheduled because of work, family, and other commitments. | Discussing less complex issues<br>Getting acquainted<br>Planning tasks |
| Why? | Students have more time to reflect because the sender does not expect an immediate answer. | Students become more committed and motivated because a quick response is expected. |
| How? | Use asynchronous means such as e-mail, discussion boards, and blogs. | Use synchronous means such as videoconferencing, instant messaging and chat, and complement with face-to-face meetings. |
| Examples | Students expected to reflect individually on course topics may be asked to maintain a blog.<br>Students expected to share reflections regarding course topics and critically assess their peer's ideas may be asked to participate in online discussions on a discussion board. | Students expected to work in groups may be advised to use instant messaging as support for getting to know each other, exchanging ideas, and planning tasks.<br>A teacher who wants to present concepts from the literature in a simplified way might favour an online lecture by videoconferencing. |

## 2.3 Blended Learning Research

Five literature reviews on blended learning (Drysdale et al., 2013; Halverson et al., 2014; Nortvig et al., 2018; Pima et al., 2018; Zhang & Zhu, 2017) were analysed in more detail to identify essential themes in blended learning research. The keywords used were "blended learning" and "literature review". Search engines and databases such as ProQuest and Google Scholar were used to identify publications on literature reviews about blended learning. References included in the reviewed articles were perused to identify other relevant studies. The search was further refined by selecting literature reviews that included the category "instructional design" or "course design". This reduction allowed better comparability and a more detailed analysis of the main categories of the analysed literature. Table 3 shows a comparison of the studies.

**Table 3** *Comparison of Literature Reviews on Blended Learning*

| | Authors | Year | N | Statistics | Qualitative | Combined |
|---|---|---|---|---|---|---|
| 1 | Drysdale, J. S., Graham, C. R., Spring, K. J., & Halverson, L. R. | 2013 | 205 | 34% (123) | 20% (122) | 26% |
| 2 | Halverson, L. R., Graham, C. R., Spring, K. J., Drysdale, J. S., & Henrie, C. R. | 2014 | 85 | 61 | 32 | 47 |
| 3 | Nortvig, A. M., Petersen, A. K., & Balle, S. H. | 2018 | 44 | N/A | N/A | N/A |
| 4 | Pima, J.M., Odetayo, M., Iqbal, R., & Sedoyeka, E. | 2018 | 210 | N/A | N/A | N/A |
| 5 | Zhang, W. & Zhu, C. | 2017 | 103 | N/A | N/A | N/A |

Two of the studies were published in 2018 (Nortvig et al., 2018; Pima et al., 2018), one literature review in 2017 (Zhang & Zhu, 2017) and one each in 2014 (Halverson et al., 2014) and 2013 (Drysdale et al., 2013); the literature reviews covered between 44 and 210 studies. If the number of empirical methods used was stated in the literature reviews, most studies used statistics, followed by combined methods and only then qualitative methods.

Drysdale et al. (2013) analysed 205 dissertations and theses studying blended learning. They summarise the trends regarding the growth and context of this topic. Their literature review's essential focus was on describing methodological trends in qualitative, inferential statistics, descriptive statistics, and combined approaches to data analysis. Their research questions addressed demographic trends (changes in the number of theses, contexts, and organisational level), methodological trends (data analysis techniques) and topical trends (theories, range and frequency of topics). Drysdale et al. (2013) collected all doctoral dissertations and masters' theses submitted to ProQuest on or before April 2012 that contained “blend*”, “hybrid”, or “mixed-mode” in the title or abstract. Then they refined their search to connect the search terms with educational terms. The open coding by Drysdale et al. (2013) was based on the open-coding patterns suggested by Emerson, Fretz and Shaw (1995) and resulted in nine main categories and several subcategories. It was possible to assign individual studies to more than one category so that the total number was more than 100%; the largest category, with more than half of the studies, covered learner outcomes. A third of the studies concerned instructional design. Drysdale et al.

(2013) found that one-third of the manuscripts dealt with classroom design issues, including sub-themes such as design process, implementation and course structure. Sub-theme: models, strategies and best practices were researched most frequently (38 times). Drysdale et al. (2013) coded the category models along with strategies and best practices and found that 18.5% of the graduate research manuscripts fell into this category.

The work of Halverson et al. (2014) was based on a previous study by Halverson et al. (2012) in which they analysed the most impactful scholarship and research on blended learning measured by citations. In that previous study, they searched the top 50 articles, 25 book chapters, and ten books on blended learning. The study (Halverson et al., 2014) identified where the most blended learning articles were published and the most influential authors. Halverson et al. (2014) analysed the research to provide a detailed thematic analysis of the top-cited articles and book chapters' contents. For their analysis, they used the 60 articles and 25 edited book chapters most cited in the domain of blended learning. Halverson et al. (2014) used the pre-existing coding system developed by Drysdale et al. (2013), making slight changes to the categorisation schemes to match their present findings. As the most cited articles and chapters, 41%, Halverson et al. (2014) identified research questions on instructional design, with models, strategies and best practices, design process, implementation, environment, and course structure as subcategories.

Nortvig et al. (2018) focused on factors influencing learning experiences in e-learning, online learning and blended learning. To find studies that deal with these factors, the authors searched using “e-learning”, “online learning”, “blended learning” or “hybrid learning” combined with one of the following keywords: “innovation”, “teacher education”, “learning outcome”, “collaboration” or “satisfaction”. Of the articles found, 93 were selected and divided into 13 categories. Only the five most common categories, including 44 items, were evaluated. Nortvig et al. (2018) studied the overall course design and the elements and activities that researchers considered relevant and essential when designing a successful blended learning course at a university. One focus was on the online part of a blended learning course design in professional education. They did not do a quantitative evaluation but described the category in detail. The main elements Nortvig et al. (2018) found were related to interactions, links and frameworks between online and offline activities, between campus-related and practical activities, and between students, teachers and content.

In contrast to Halverson et al. (2014) and Drysdale et al. (2013), Pima et al. (2018) used a comprehensive approach and expanded the sources and search strategies. They used the three keywords “blended learning”, “blended learning framework”, and “higher education”. The period searched was limited to 2000 to 2016, and they only looked for title words. The 210 papers they identified were analysed to answer questions concerning the development of the publications, frequently published themes and emerging subcategories. Pima et al. (2018) identified ten themes. Their premise for their themes came from Drysdale et al. (2013) and Halverson et al. (2014). As in these studies, individual papers were assigned to various categories. Most publications, 30%, focused on the topic of instructional design. Pima et al.'s review (2018) showed that the subject of disposition is now in second place in terms of publications, most of which, 58%, had learning and teaching styles as subtopics.

Zhang and Zhu (2017) reviewed 103 journal articles. Their literature review explored blended learning research status and identified the most important themes and categories. They identified the research papers by searching for “blended learning” in Science Direct. Zhang and Zhu (2017) followed Hemingway and Brereton's (2009) theoretical procedure for literature review. They identified 12 key themes that they integrated into six general categories. The largest category, with 38 studies, was “evaluation”, of which 20 deal with the effectiveness of blended learning, and all the studies concluded that blended learning is effective. Twenty-nine research articles dealt with blended learning design in the study by Zhang and Zhu (2017). Seven articles focused on the online component, mainly the online tools used. Three papers dealt with the use of Moodle as an online tool for blended learning, while four focused on online components. Twenty-two articles suggest blended learning models; each has created its own model or programme.

Table 4 displays the five literature reviews with their titles and categories.

**Table 4** *Titles and Categories of Literature Reviews on Blended Learning*

| | Title | Categories |
|---|---|---|
| 1 | Analysis of research trends in dissertations and theses studying blended learning | learner outcomes (51.7%), dispositions (38.5%), instructional design (34.6%), interaction (29.3%), comparison (21.5%), demographics (14.1%), technology (13.7%), professional development (7.3%), and other. |
| 2 | A thematic analysis of the most highly cited scholarship in the first decade of blended learning research | instructional design (35, 41.2%), disposition (27, 31.8%), exploration (25, 29.4%), learner outcomes (24, 28.2%), comparison (15, 17.6%), technology (15, 17.6%), interaction (12, 14.1%), demographics (4, 4.7%), professional development (3, 3.5%) and other (4, 4.7%). |
| 3 | A Literature Review of the Factors Influencing E-Learning and Blended Learning in Relation to Learning Outcome, Student Satisfaction and Engagement | spaces, learning community and student identity, course design and educator role |
| 4 | A Thematic Review of Blended Learning in Higher Education | instructional design (62, 29.52%), disposition (33, 15.71%), exploration (31, 14.76%), learner outcomes (27, 12.86%), comparison (17, 8.10%), technology (21, 10.00%), interactions (12, 5.71%), professional development (3, 1.43%), demographic (2, 0.95%) , and others (2, 0.95%). |
| 5 | Review on Blended Learning: Identifying the Key Themes and Categories | design (29), strategy (21), factors (13), evaluation (38), methodology (25) and review (10) |

In the five literature reviews on blended learning, recommendations for further research are given. Drysdale et al. (2013) and Pima et al. (2018) share the observation that, so far, few publications deal with institutional adoption and guiding frameworks. According to Drysdale et al. (2013), “Additional research on design subtopics such as implementation, evaluation, and environment could be beneficial” (p. 94). Halverson et al. (2014) stated that “Less attention is being given to demographics (especially faculty demographics) and professional development—gaps which may indicate a failure to consider the support needs fully, shifting roles, and other concerns of a vital part in the blended learning ecosystem: the instructors” (p. 31). From their thematic review of blended learning in HE, Pima et al. (2018) concluded that there are few publications on the original mix and use of blended learning, professional development and best practice. Zhang and Zhu (2017) found that most factors studied that influence blended learning affect students. From their perspective, more factors, such as teacher, administrator, policy, and cultural factors, should be considered.

Several other literature reviews carried out came to similar conclusions. For example, Mozelius and Hettiarachchi (2017) found, based on their meta-study, that it would be interesting to investigate the role and the perspective of lecturers on the introduction of blended learning in HE. From their perspective, it could be helpful to investigate bottlenecks and the potential need for training and support. Caravias (2015) concludes that further research is needed to achieve a broader understanding of the attitudes and problems teachers face when they integrate pedagogical and content-related knowledge into blended learning environments, the strategies they apply to address these problems, and how they use blended learning tools to address these challenges.

## 2.4 Blended Learning in Higher Education

Blended learning can be a particular challenge for successful implementation by HE institutions (Dziuban et al., 2011; Owston, 2013). Graham et al. (2013) explored critical issues for introducing blended learning in HE by examining different cases of institutional introduction of blended learning. Their framework allocates the institutions to three different levels grounded in the five stages of Rogers' process model for organisational innovation (Rogers, 2003). These are (1) agenda-setting, (2) matching, (3) redefining/restructuring, (4) clarifying, and (5) routinising.

Level 1 institutions (awareness/exploration) focused on blended learning to solve one or more major institutional problems, including rapid development, desire to give access to more students, limited physical infrastructure, demand for more flexibility for faculty and students, and others (Graham et al., 2013). Many institutional managers see blended learning as a way to address growth, cost or flexibility challenges and at the same time respond with the faculty as potentially conducive to learning.

Level 2 institutions (adoption/early implementation) chose blended learning and are trying to change the innovation and organisational structures to succeed. These institutions experience difficulties developing suitable institutional arrangements for the blended initiatives and adapting the HE systems (Graham et al., 2013). Level 2 institutions spend a considerable amount of money on establishing suitable course development processes and pedagogical training and incentives for the teaching staff to make the initiatives a success.

Level 3 institutions (mature implementation/growth) established blended learning as a standard characteristic of their HE and are working on constant enhancement through more attention to evaluation and data-driven decision making (Graham et al., 2013). They use their findings for critical managerial decisions and disseminate their results to institutionalise blended learning for other organisations.

Mozelius and Hettiarachchi (2017) listed critical factors for implementing blended learning in HE, grouping them into ten categories and four blended learning perspectives. For them, the most prominent finding is the unexpected complexity of blended learning. The factors affecting blended learning implementation are (Mozelius & Hettiarachchi, 2017): (1) technology – virtual learning environments and media integration, (2) didactics – pedagogy, instructional design and teacher role, (3) course outcome – learning outcomes and learner satisfaction, (4) collaboration and social presence, (5) course design, (6) synchronicity vs asynchronicity, (7) the heritage of technology-enhanced distance courses, (8) multi-/modal overloading, (9) trends and hypes and (10) economy. The perspectives that influence blended learning and should be achieved with a multi-stakeholder approach when implementing are the university perspective, the learner perspective, the teacher perspective and the global perspective.

Kintu et al. (2017) identified learner satisfaction, achievement, knowledge development, intrinsic motivation and inherent motivation as predictors of the effectiveness of blended learning. Learner satisfaction is predicted by design features, technology quality, online tools and personal support. Features of self-regulation and learners' attitude are indicators of achievement. Social support and learner background allow predictions for knowledge development. Technology quality and interactions are the only aspects that can forecast learners' knowledge development. Inherent motivation is predicted by technology quality, online tools and interactions. Intrinsic motivation is only anticipated by self-regulation (Kintuet et al., 2017).

Nortvig et al. (2018) analysed which factors influenced blended learning and e-learning in learning outcomes, student satisfaction, and HE engagement. They developed the following categories in their meta-study: (1) spaces, learning community and student identity; (2) course design; (3) educator roles; and (4) relations. Nortvig et al. (2018) conclude that “research shows that teaching and learning are complex and are influenced by more than just the teaching format. For this reason, we should look into the many different factors that influence teaching and learning in different formats and in different contexts" (p. 53).

# 3 Educational Technology

This chapter is dedicated to the broader theoretical field of educational technology to which this thesis belongs. The focus is initially on reviewing the theoretical foundations in the form of learning theories and specific theories of educational technology. Since the empirical part of the work deals with UAS, educational technology in HE is then considered. Following the main aspects of the research questions, the difficulties in educational technology use in HE and faculty development in educational technology in HE are described.

"Educational technology" is an umbrella term that applies to scientific knowledge in education (Spencer, 2017). Spencer (2017) described it as composed of five components: (1) methods of learning, (2) objectives for learners, (3) evaluation of teaching and learning, (4) environments and (5) media for learning. Following Stosic (2015), educational technology has three areas of use: as a tutor, as a teaching tool, and as a learning tool.

According to the widespread definition of the Definitions and Terminology Committee of the Association for Educational Communications and Technology (AECT), "Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources" (Januszewski & Molenda, 2008, p. 1). The AECT definition consists of four elements (Hlynka & Jacobsen, 2010). It goes beyond a tool focus from the very beginning and places its emphasis on "study and ethical practice". Therefore, educational technology is not merely a tool but a study and ethical practice. Second, according to the definition of the AECT (Januszewski & Molenda, 2008), it has a clear purpose, namely, "facilitating learning and improving performance", so it puts learning and performance in the foreground. The third part of the definition focuses on how it is used "by creating, using and managing". It emphasises that these three activities can be performed by a person using educational technology, in contrast to earlier times, where each of these activities was carried out by a different person. Therefore, this part of the definition refers to the convergence of technology, which gives the users more power and control as they can simultaneously be creators, managers, and end-users. Therefore, the teacher's role is changing to that of a designer and facilitator of learning. The fourth part of the definition explains that we are working with "technological processes and resources". In this definition of educational technology, the tool concept comes last, so the primary focus is on learning and performance, and the secondary focus is on technological processes and resources.

Spector (2016) described educational technology as the overlap between technology and education; for him, “Educational Technology involves the disciplined application of knowledge for the purpose of improving learning, instruction, and/or performance” (p. 10). By “disciplined application”, Spector intended to express those principles based on theory, experience and empirical evidence to define educational technology. The term is used synonymously with Internet and Communication Technologies (ICT) in Education, Instructional Education, Instructional Design or E-Learning in Anglo-American countries (Mayrberger & Kumar, 2014).

The term “media didactics” is a similar concept used in German-speaking countries. In the German-language understanding, media-didactic skills are considered a central aspect of competence, describing the knowledge and skills of teachers for the purposeful and learning-oriented use of digital media in classrooms (Blömeke, 2017). The term and the underlying idea of “didactics” are typically German, and the expression “didactics” is hardly used in the Anglo-American educational literature (Grafe, 2011).

Educational technology is institutionalised in the USA, for example, in schools and colleges and in the standards of the International Society for Technology in Education (ISTE). In contrast, in German-speaking countries, media didactics is not widely institutionalised, i.e. for teacher education (Mayrberger & Kumar, 2014). In German-speaking countries and Anglo-American regions, the academic discourse about the skills teachers should acquire in the usage of digital media is intensive (Blömeke, 2003; Crompton, 2017; Herzig, 2007; Herzig, Martin et al., 2015; Mayrberger, 2012). However, the overlap between the two discourses and research approaches in both countries is minimal (Endberg, 2019).

The historical development of educational technology can be described based on published articles. Bozkurt (2020) identified thematic trends in educational technology publications from 1993 to 2019, evaluated 666 articles published in peer-reviewed journals, analysed the most cited articles with social network analysis, and visualised the results with concept maps. The outcome was a grouping of five chronologically thematic areas. Bozkurt classified the period from 1993 to 1999 as the first and assigned it the topics multimedia learning and instructional design. Two other topics replaced these in the years 2000 to 2004, namely, the convergence of educational technology, distance education and online learning environments, and the integration of educational technology in traditional learning settings. In the phase from 2005 to 2009, three areas played an important role (1) the revision of the curriculum for educational technology, (2) educational technology in HE and distance education, and (3) the differences in educational technology research. From 2010 to 2014, online teaching at HE institutions was relevant again, and the integration of ICT and the full potential of educational technology. In the last phase identified by Bozkurt (2020), from 2015 to 2019, the focus was on data-driven, smart educational technologies, big data and learning analytics. Bozkurt (2020) concluded that the research field of educational technology has grown enormously since the introduction of the internet and is moving more toward a data-driven technology-centred area.

The most frequently mentioned trends and keywords since 2015 represent another current view of educational technology. Kimmons (2020) analysed 7708 Journal articles published between 2015 and 2019 to identify educational technology trends. The most researched field covered the keywords “online” with the related terms “online learning” and “online teaching”. They were followed by “mobile” with a range of terms used for this topic such as “e-learning”, “blended”, and “distance”. The most common subject area was “language learning” and “foreign language”, and the most researched topics were “social network”, “learning analytics”, and “social media”.

## 3.1 Theories of Teaching with Educational Technology

Various theories can be considered when using educational technologies, especially in the online part of blended learning. Learning theories describe learning in a general way. In addition, the question arises as to which specific theories educational technology research is based on. According to Hew et al. (2019), about 35% of empirical studies on educational technology (174 out of 503) made explicit reference to theories in the field of educational technology. Therefore, they concluded that educational technology lacks a theoretical foundation. They identified 183 theories; however, only 35 (19%) were specific educational technology theories. This is consistent with Jones and Czerniewicz (2011), who stated that the theoretical work in learning technology is mainly from social sciences. Hew et al. (2019) identified the eight most-used theories of educational technology in empirical studies. These are (1) the cognitive load theory, (2) the technology acceptance model, (3) the cognitive theory of multimedia learning, (4) the social development theory, (5) the self-determination theory, (6) the self-regulated learning theory, (7) technological, pedagogical and content knowledge and (8) the cognitive-affective theory of learning with media. In the following chapter, the learning theories are described first. In their in-depth analysis of 503 empirical studies on educational technology, Hew et al. (2019) focused on and analysed the theories that were examined in detail, and thereafter described eight theories. They are divided into three sections: (1) the cognitive load theory and theories based on it, (2) theories that describe human learning, which are the social development theory, the self-determination theory, and self-regulated learning; and (3) models to describe and measure the acceptance and implementation of educational technology, whereby only the technology acceptance model (TAM) is described in detail, the TPACK model being discussed in a separate chapter.

#### *3.1.1 Learning Theories*

Learning theories describe how learning generally works. Behaviourism, cognitivism and constructivism are examples of established learning theories. They are often mentioned when textbooks on educational technology refer to the theoretical foundations of teaching and learning with educational technology (Meier, 2011; Schaumburg & Issing, 2004).

Behaviourism assumes that people learn from the environment through repetition in response to positive and negative stimuli (Niegemann et al., 2004). The focus is on the relationship between stimuli and response and the changes in behaviour observed. A number of the basic assumptions of behaviourism are used to design lessons that use educational technology (Deubel, 2003). One example is early audiovisual material implemented as computer-aided instruction and mastery learning. According to this theory, lessons should be structured to focus on the stimuli and opportunities for the learner to practice the correct reactions (Ertmer & Newby, 2013).

In contrast to behaviourism, cognitivism explains human behaviour by cognitive processes rather than environmental conditions (Yilmaz, 2011). In this theory, learning is a process in which information is processed; the learner is seen as more active in achieving their learning outcomes. Elements supposed to influence this process are processes of perception, thinking and memory, and the learners' thoughts, opinions, attitudes, and values (Ertmer & Newby, 2013). Cognitive theories assume that transfer depends on how information is stored in memory, and transfer is successful when the learner understands how to apply the knowledge in different contexts (Schunk, 2020). According to this theory, the teaching material should be presented in a form that allows the learner's interaction process with the subject to be controlled and processed by the teacher (Ertmer & Newby, 2013). Similar to behaviourism, in cognitivism, educational technology is seen as a tool from which learners learn (Rushby & Surry, 2016).

Both behaviourism and cognitivism assume an objectively measurable real world for the learner; however, this does not apply to constructivism. Constructivists believe that the mind filters input from the world to create its reality (Jonassen, 1991). Loyens and Gijbels (2008) define constructivism as an approach to learning that views learners as self-responsible, active in their knowledge acquisition. According to them, constructivist learning environments should include several characteristics that support the learning process: knowledge construction, cooperative learning, self-regulation, and authentic learning situations. This assumes that knowledge transfer is enhanced by authentic tasks presented in meaningful contexts (Ertmer & Newby, 2013). From a constructivist perspective, educational technology is a tool for learning and can be seen as a cognitive partner that enables learners to think in new ways. The term “technology-enabled learning” reflects this view and incorporates the shift from teaching about technology to learning with technology (Rushby & Surry, 2016).

Connectivism is a less widely accepted learning theory, which emphasises educational technology and is known as the learning theory of the digital age (Siemens, 2005). The concept of connectivism implies that knowledge and learning are distributed through both human and non-human resources. Siemens views people not as isolated individuals but as interconnected with other people and non-human resources. This results in a linked network out of which people learn. Connectivism was initially based on self-organised learning and developed towards network organised learning (Harasim, 2017). The “top-down” approach implies that participants learn in a networked environment without teachers and course structure. This involves first establishing a hypothesis and then testing it by collecting data from a networked environment. From a learning design perspective, this leads to the integration of digital network components to design technology-supported learning environments (Kizito, 2016) in which learners access a network of nodes and learn through interaction. Banihashem and Aliabadi (2017) indicated that connectivism is not always seen as a learning theory compared with the established learning theories, as shown in Table 5.

**Table 5** *Comparison of Learning Theories (Banihashem & Aliabadi, 2017, p. 2)*

| Property | Behaviourism | Cognitivism | Constructivism | Connectivism |
|---|---|---|---|---|
| How learning occurs | Black box, observable behaviour main focus | Structured, computational | Social, meaning created by each learner (personal) | Distributed within a network, social, technologically enhanced, recognising, and interpreting patterns |
| Influencing factors | Nature of reward, punishment, stimuli | Existing schema, previous experiences | Engagement participation, social, cultural | Diversity of network, strength of ties |
| Role of memory | Memory is the hardwiring of repeated experiences, where reward and punishment are most influential. | Encoding, storage, retrieval | Prior knowledge remixed to current context | Adaptive patterns, representative of current state, existing in networks |
| How transfer occurs | Stimulus, response | Duplicating knowledge constructs of "knower" | Socialisation | Connecting to (adding) nodes |
| Types of learning best explained | Task-based learning | Reasoning clear objectives, problem solving | Social, vague (ill defined) | Complex learning, rapid changing core, diverse knowledge sources |

### *3.1.2 Cognitive Load Theory and Theories Based on It*

Three of the eight specific educational technology theories (Hew et al., 2019) are related to the cognitive load theory (CLT). The theory of multimedia learning (CTML) and the cognitive-affective theory of learning with media (CATLM) build on CLT, and CATLM is also based on CTML.

CLT is one of the most influential theories in educational technology and instructional design and a widespread instructional, explanatory psychological approach (Gerjets et al., 2009). The theory addresses the cognitive load that happens during the learning process. It assumes that the media used for learning correspond to the learners' limited cognitive capacities. The theory consists of several ideas about cognitive demands and their connection to learning outcomes. This involves the differentiation between working memory, where information is first processed, and long-term memory, to which the information is transferred and stored (Sweller, 1988). It is assumed that the working memory of humans is the major limitation in the acquisition of knowledge, while long-term memory is considered unlimited in its capacity (Cowan, 2014). Since it is assumed that the working memory can only store a small amount of information at once, it is essential to keep the load on the working memory as low as possible (Baddeley, 2010). New information is learned when it is transferred to long-term memory. Working memory capacity can be expanded if the knowledge is presented in organised schemas (Sweller, 2016). CLT postulates three types of cognitive loads which, when added together, make up cognitive load (Merriënboer & Ayres, 2005): intrinsic cognitive load (ICL), extraneous cognitive load (ECL) and germane cognitive load (GCL). Learning opportunities should be designed to minimise the overall cognitive load to promote learning. ICL is the load that derives from the difficulty of the learning material; the more related the content is, the more complicated it is. ECL is defined as an unnecessary cognitive load that prevents learning. GCL is the learner's effort to understand the material and build a cognitive schemata (de Jong, 2010). CLT develops recommendations for lesson designs and questionnaires to assess cognitive load.

The cognitive theory of multimedia learning (CTML) aims to design and present multimedia learning content and assumes that content should be designed according to the supposed functioning of the human brain to support learning (Mayer, 2014). It draws on CLT. CTML involves three basic assumptions: (1) the information processing system has two channels, (2) working time memory has a limited capacity, and (3) knowledge is actively constructed by the learner (Mayer, 2014). According to CTML, the two channels, visual/pictorial and auditory/verbal, are available to receive information. Learning material design aims to activate both channels while information is being processed. Learning materials should also be designed in such way that learners are not cognitively overloaded by too much information due to the assumed limited capacity of working time memory (Stiller et al., 2020).

CTML differentiates between five cognitive processes that can occur when learning in a multimedia learning environment (Rudolph, 2017). The first process is the selection of relevant words within multimedia learning material that serves to create a first representation within the working memory. Additionally, the learning material should enable the learner to actively engage with it to construct a coherent mental representation of their existing experiences (Sorden, 2012). Second, the selection of relevant images from existing graphics aims to do the same. Third, the organisation of words builds connections between them to form and integrate them into a coherent verbal model in the working memory. Fourth, in the organisation of images, a linking between selected images generates a coherent pictorial model. The fifth and last process involves integrating the learner's verbal and pictorial models and prior knowledge from long-term memory (Rudolph, 2017). CTML distinguishes the memory used in these processes into sensory memory, working memory and long-term memory (Sorden, 2012). Sensory memory collects information in the form of words and pictures with the eyes and ears. In working time memory, information is temporarily stored and intentionally processed; it is of central importance for CTML. Long-term memory holds all the previous knowledge and can store a large amount of information (Mayer, 2014).

CATLM builds on CTML and, like it, makes the same three basic assumptions (Park et al., 2014). These are the two channels of information processing, the limited capacity of the working time memory and the active information processing of the learner (Moreno, 2006). CATLM makes four additional assumptions (Moreno & Mayer, 2007): The first is the subdivision of long-term memory into semantic memory, in which factual knowledge and episodic memory about events with personal reference are stored. Second and third are the importance of motivational factors for learner engagement and metacognitive factors for learning success. The last assumption relates to the differences between learners and their learning characteristics in existing knowledge and skills (Moreno & Mayer, 2007). According to Morrison et al. (2015), CATLM also differentiates between tactile, olfactory and gustatory information input to CTLM.

### *3.1.3 Theories That Describe Human Learning*

Hew et al. (2019) described eight educational theories frequently referred to in educational research. Three of them describe human learning in general: social development theory, self-determination theory, and self-regulated learning.

In social development theory (Vygotsky, 1978), also called a sociocultural theory, social interaction plays a central role in learning. The theory played a significant role in the foundations of constructivism. It stated that every child's development occurs first between people (inter-mental level) and then on the individual mental level (intra-mental level). Therefore, a child needs interaction with other people to learn. This process is accompanied by a more knowledgeable other (MKO), for example, a teacher or a peer. Learning takes place in the zone of proximal development (ZPD). This is the zone between a child's ability to perform a task under supervision and the child's ability to solve a problem independently (Eun, 2018). According to social development theory, learning environments should be designed so that teachers and students work together to construct meaning within the learner.

Self-determination theory (SDT) is a motivation theory that describes the individual's adaptation to the environment in terms of basic psychological needs (Deci & Ryan, 1993). It consists of five mini-theories (Reeve, 2012): (I) basic need SDT theory, (II) organismic integration theory, (III) cognitive evaluation theory, (IV) causality orientations theory and (V) self-determination theory.

(I) The basic need theory identifies three different needs: (1) The need for autonomy means that people feel that they can make their own decisions. If individuals feel that they have mastered an activity, (2) their need for competence is addressed. (3) The need for relatedness refers to people's desire to experience themselves in context with others and to be part of a community (Reeve, 2012). The theory divides motivation into amotivation, extrinsic and intrinsic motivation (Noour & Hubbard, 2015). Intrinsic motivation is present when people do something for their own sake. When people are extrinsically motivated, they carry out things as a means to an end and not for themselves. Amotivation means that the person has no intention to act, either because the action has no value or does not lead to a result, or the individual lacks the competence to complete it (D’Annunzio-Green & Ramdhony, 2019).

(II) The organismic integration theory describes four types of extrinsic motivation (Wasserkampf & Kleinert, 2016). (1) In the case of external regulation, people act based on external pressure. (2) Introjected regulation is action based on internal pressure. (3) If people act based on identified regulation, they act somewhat autonomously because they see the value of external regulation. (4) Integrated regulation is the most autonomous form of extrinsic motivation and occurs when the required action is seen as significant and among one's values. It is close to intrinsic motivation, whereas the latter is spontaneously guided by interest. The theory tries to answer why people participate in activities even if they are uninteresting (Malhotra et al., 2008). In this theory, extrinsic goals are somewhat associated with diminished well-being and greater discomfort. In contrast, intrinsic goals are intended to support psychological needs and well-being.

(III) The cognitive evaluation theory describes how external events affect intrinsic motivation (Reeve, 2012). It focuses on how the social context in terms of reward, control and ego-involvement affects intrinsic motivation. In this context, competence and the support of autonomy are emphasised.

(IV) The causality orientations theory describes an individual's pattern of motivation and engagement. People can react based on three different types of orientation: autonomy orientation, control orientation and impersonal or amotivated orientation (Núñez & León, 2015).

(V) The self-determination theory emphasises the instructor's task to create a motivating learning environment; technology-based teaching can support this task (Noour & Hubbard, 2015).

In self-regulated learning (SRL), learners are seen as active participants who control the learning activities themselves (Cleary, 2018). They determine what, when and how they learn and monitor themselves. Cognitive aspects of learners, especially their motivation, play an essential role in this process. The model distinguishes three central learning strategies: cognitive, metacognitive, and resource management. Cognitive strategies are strategies for organising, critical review and repetition. Metacognitive strategies are used to guide, control and regulate learning strategies. Resource management strategies refer to external and internal learning conditions (Cleary, 2018). There are several models for self-directed learning, for example, Zimmerman (1989), Boekaerts (1991) and Hadwin (2011). One of the most widespread SRL models is the so-called Zimmerman model, which describes the cyclical phases of SRL (Zimmerman, 2000). The model is organised in three phases in which students learn. It begins with the forethought phase, which consists of task analysis, goal setting, strategic planning and how self-motivation beliefs influence them. Second, the performance phase in which the job is carried out is accompanied by self-control and self-observation, and after completion of the task, in the self-reflection phase, students evaluate how they have carried out the task.

### *3.1.4 Technology Acceptance Model*

Two of the eight educational theories that are most often thoroughly examined in empirical studies of educational technology research (Hew et al., 2019) are models describing and measuring the acceptance and implementation of educational technology. These are the TAM and the TPACK model. Since TPACK is explained extensively in a separate chapter, only a description of TAM follows.

TAM aims to measure the acceptance of new technology from the user's point of view. The model builds on the theory of reasoned action (TRA) of Ajzen and Fishbein (1975) and is based on the same theoretical foundation. In both cases, it is assumed that the actual use is directly dependent on users' intentions. This is influenced by attitudes towards use. In addition to TRA, Davis et al. (1989) introduced two new predictors for their TAM: perceived usefulness and perceived ease of use. Perceived usefulness directly affects the attitude towards use and the behavioural intention to use. Perceived ease of use directly influences the attitude towards use and indirectly affects the behavioural intention to use via the perceived usefulness. The TAM has been revised twice. The first revision is TAM2, in which Venkatesh and Davis (2000) described why users find a particular system useful. The second revision,TAM3, followed in 2008. Venkatesh and Bala (2008) extended the model with constructs that affect trust and perceived risk in using the system. Granić and Marangunić (2019) analysed 71 studies published between 2003 and 2018 in the educational context regarding the TAM. They concluded in their literature review that TAM, together with its different versions, is a leading theoretical model for assessing technological applications in education. From their perspective, the core variables of TAM, perceived usefulness and perceived ease of use, have been shown to influence the uptake of learning with technology in education.

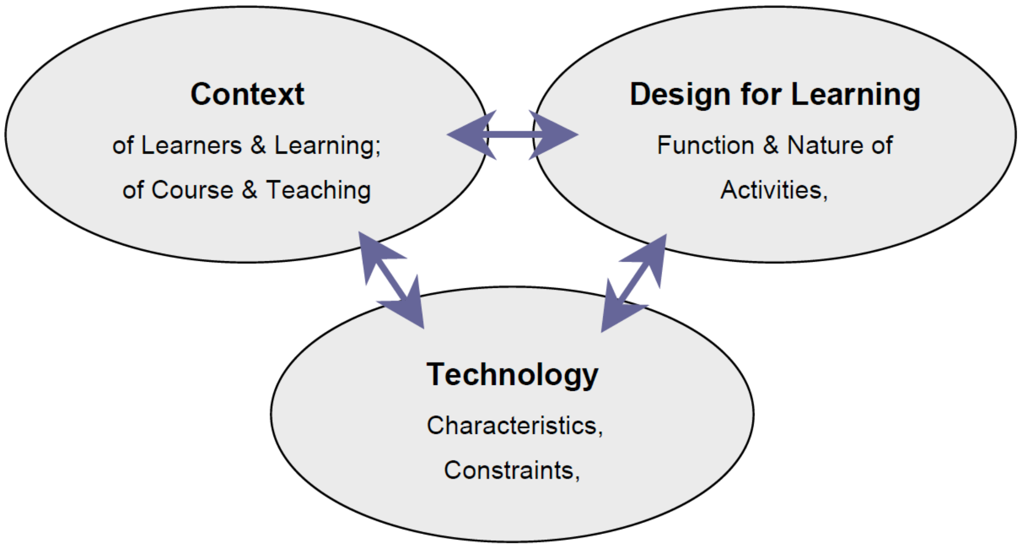
Koehler and Mishra (2005) developed the TPACK model, which is based on Shulman's pedagogical content knowledge (PCK) model (1986). TPACK represents the knowledge necessary to use digital tools effectively in teaching (Harris et al., 2017). It consists of three dimensions: technology, pedagogy, and content, and the intersections between them. The model is presented in detail in the chapter focused on TPACK.

This section presented the eight most frequently cited theories from educational technology research articles. However, De Castell et al. (2002) argued that an educational theory of technology examining technologies from the perspective of educational values and purposes is lacking.

### 3.2 Educational Technology in Higher Education

The application of educational technology in HE institutions affects many different stakeholders. Kirkwood (2015) described the individual factors that influence educational technology in HE; these factors are illustrated in Figure 2. The first is access to technology, which varies across HE institutions. The necessary investment includes equipment, maintaining the system, and acquiring the skills needed to achieve the desired results. Equally important as technology is the context of the learners, how they learn, their courses and the lecturers. In this context, the design for learning and the functions and nature of the activities are of particular significance.

**Figure 2** *Factors that influence teaching with technology in HE (Kirkwood, 2015, p. 6)*




Several models describe the introduction and assessment of educational technology in HE, ranging from process models to best practice models and student satisfaction models (Cronje, 2016). Badenhorst (2015) compared six of these models, namely, SILSTI, ACODE, eMM, Pick&Mix, Dimensions and HELAM. Table 6 illustrates the different dimensions or categories of the models.

**Table 6** *Dimensions or Categories Used for Benchmarking (Badenhorst, 2015, p.13)*

| Combined perspective (SILSTI) | ACODE Benchmark (ACODE) | eMM process categories (Marshall) | Pick & Mix Adopted from MIT90s (Bacsich) | Dimensions (Sun et al.) | HELAM (Ozkan, et al.) |
|---|---|---|---|---|---|
| Student Dimension | Institution policy and governance for technology supported learning and teaching | Learning | Organisational Strategy | Student dimension | System quality |
| Instructor Dimension | Planning for, and quality improvement of the integration of technologies for learning and teaching | Development | Structure | Instructor dimension | Service Quality |
| Learning Design Dimension | Information technology infrastructure | Coordination/ Support | Processes | Course dimension | Content Quality |
| Support Dimension | Pedagogical application of information and communication technology | Evaluation | People and their roles | Technology dimension | Learner perspective issues |
| Technology environment Dimension | Professional/staff development | Organisation | Technology | Design dimension | Instructor Attitudes |
| Institutional Dimension | Staff support | | | Environment dimension | Supportive Issues |
| | Student training | | | | |
| | Student support | | | | |
| Approach | Processes Approach | Processes Approach | Best practices / processes Approach | Student satisfaction Approach | Student Satisfaction Approach |

*Note.* The colour codes for the dimensions are student (yellow), instructor (red), learning design (orange), support (cyan), technology environment (blue) and institutional (green).

The combined perspective model (SILSTI) specifies six dimensions to evaluate the e-learning status of a HE institution; these are (1) student, (2) instructor, (3) learning design, (4) support, (5) technology environment, and (6) institutional dimension (Badenhorst, 2015). Badenhorst developed this model based on a comparison with other models. With the SILSTI model, he assessed and compared the status of e-learning at technical universities in South Africa. The comparison is presented in Table 6.

Krause et al. (2009) developed a framework to introduce first-year students to e-learning. Their ACODE (Australasian Council on Open, Distance and E-learning) benchmarking model supports the introduction of educational technology. The ACODE benchmark areas are: "(1) institution policy and governance for technology-supported learning and teaching, (2) planning for, and quality improvement of the integration of technologies for learning and teaching, (3) information technology infrastructure to support learning and teaching, (4) pedagogical application of information and communication technology, (5) professional/staff development for the effective use of technologies for learning and teaching, (6) staff support for the use of technologies for learning and teaching, (7) student training for the effective use of technologies for learning, and (8) student support for the use of technologies for learning" (Krause et al., 2009, p. 3). The ACODE framework was applied in Australia, New Zealand, the United Kingdom, and the USA.

Marshall (2012) developed the e-Learning Maturity Model (eMM) to assess the maturity of the implementation of e-learning at various universities in New Zealand. The eMM includes five areas necessary to introduce e-learning. These are (1) learning: processes that directly impact pedagogical aspects of e-learning, including 11 processes; (2) development: processes around the creation and maintenance of e-learning resources, including seven processes; (3) support: processes surrounding the support and management of e-learning, including six processes; (4) evaluation: processes associated with the evaluation and quality control of e-learning through its lifecycle, including three processes; and (5) organisation: processes related to institutional planning and management, including nine processes (Marshall, 2012). These five categories of processes are measured by assigning different levels of achievement, namely, (1) not practised/not adequate, (2) partially adequate, (3) largely adequate, (4) fully adequate, and (5) not assessed (Marshall, 2012). The results of the eMM for a HE institution are visualised in the form of a coloured matrix.

The Pick&Mix model (Bacsich, 2009) has been applied in different phases, and a total of 24 universities in the UK have undertaken 82 benchmarks with it. The model aims to benchmark e-learning with other institutions. Pick&Mix consists of 99 criteria grouped into six categories (Badenhorst, 2015), namely, external environment, individuals (both staff and students), processes, organisation (structure), strategy, and technology. The achievement of each criterion is measured on a scale of six levels (Bacsich, 2009).

Sun et al. (2008) identified 17 factors influencing student satisfaction with e-learning and classified them into six dimensions. These six dimensions, which consist of 17 factors, are: (1) the learner dimension, classified into the attitude toward computers, learner anxiety related to computers, and learner efficacy related to the internet; (2) the instructor dimension, classified into instructor response timeliness and instructor attitude toward e-Learning; (3) the course dimension, classified into e-Learning course flexibility and e-Learning course quality; (4) the technology dimension, classified into technology quality and internet quality; (5) the design dimension, with perceived usefulness and perceived ease of use; and (6) the environment dimension, classified into diversity in assessment and learner perceived interaction with others (Sun et al., 2008). Among the factors listed, "course quality" was the most important single factor. Except for the technology dimension, all other dimensions influenced the perceived learner satisfaction. The study was conducted in a high-tech study environment in universities in Taiwan.

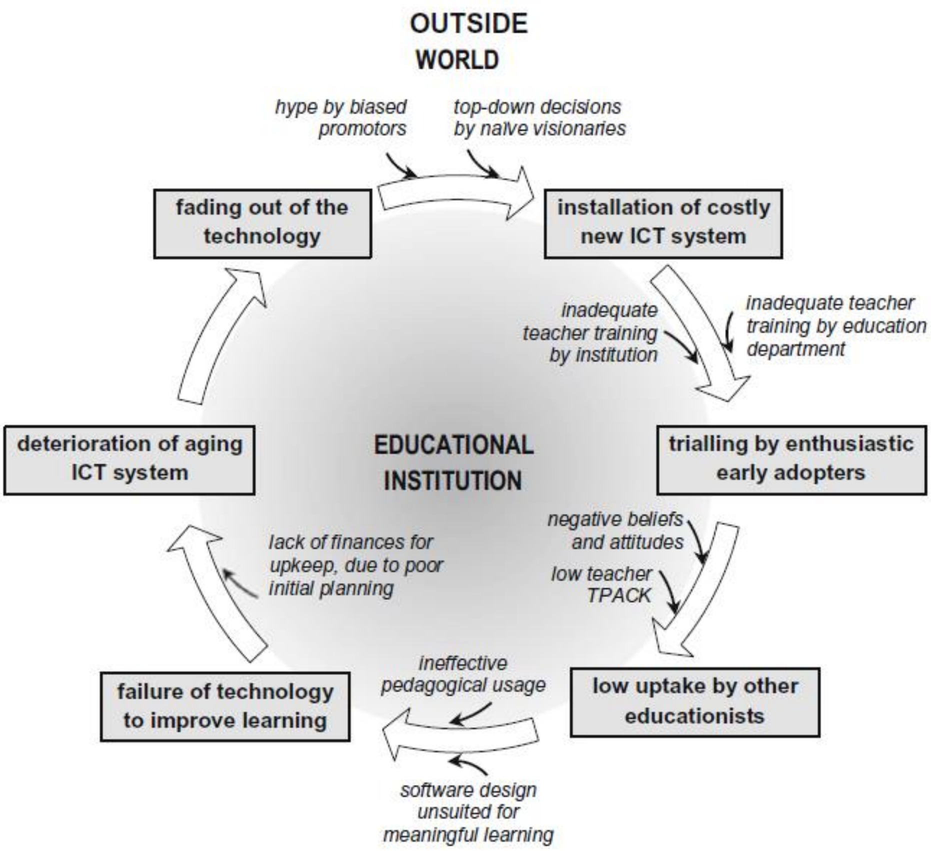
Ozkan and Koseler (2009) developed an e-learning assessment model. Their HELAM (Hexagonal e-Learning Assessment Model) focuses on evaluating learners' perspectives on learning management systems. The model has six dimensions, which are system quality, service quality, content quality, learner perspective, instructor attitudes, and supportive issues (Ozkan & Koseler, 2009). HELAM was applied at a Turkish university.

## 3.3 Difficulties in the Use of Educational Technology in Higher Education

The previous section presented different approaches to implementing and evaluating educational technology. According to Bokzkurt (2020), the research field of educational technology tends to be novelty-driven with new educational technology. It describes every new educational technology as innovative and exciting and the next big thing to save and change education. Bozkurt (2020) believes that more technology adaptation, as a smooth and natural process, is needed and less technology implementation, which involves combining two things and is a planned sequence.

Sanders and George (2017) derived seven recommendations for the critical consideration and introduction of educational technology in their review paper. According to their advice, first, one should be careful about the hype generated by biased ICT proponents. Educational technology is not a universal solution, does not solve educational problems, and is often introduced to address non-educational issues. Second, caution should be exercised about the claimed benefits of introducing educational technology, as these are usually not met. Third, universities should be aware of the unforeseen negative consequences of introducing educational technology. Fourth, implementing educational technology requires planning for one-time and recurring, long-term expenses. Fifth, it is important to remember that the introduction of educational technology does not automatically lead to better learning because that depends on how educational technology is used. Sixth, this also applies to the further training of lecturers because in-service training for lecturers tended to be insufficient. However, some strategies were nevertheless promising, which leads to the seventh and final recommendation that educational technology cannot be used all the time and in all situations. According to Sanders and George (2017), an essential lesson from decades of research is that the success of the use of educational technology depends on different contextual factors. They also depicted this critical view on introducing ICT in educational institutions through a technology innovation cycle and critical factors that influence it, as seen in Figure 3.

**Figure 3** *Stages of the Technology Innovation Cycle (Sanders & George, 2017, p. 2919)*



Sanders and Georg (2017) considered the introduction of educational technology from a critical point of view. Anderson and Rivera-Vargas (2020) took a similar approach to educational technology from a distance education perspective. They identified five particularly notable shortcomings in educational technology for distance education. Firstly, the attrition rate could be very high in distance education systems with low student support, low use of interactive methods, and weak didactic learning design. Second, student-content interaction was also not sufficiently pronounced in many scenarios, which led to high drop-out rates. Third, threaded discussions were often used, although the hope that this tool would support the understanding and generation of new knowledge was usually not fulfilled. Fourth, a further problem was copyright confusion, as the handling of copyrights in the digital space was not conclusively clarified from a legal point of view in many countries. The fifth and last issue of criticism by Anderson and Rivera-Vargas (2020) was the obsessive, overly optimistic view that educational technology solves educational problems or problems of education in general.

The problems outlined by Sanders and George (2017) and Anderson und Rivera-Vargas (2020) are confirmed by several empirical studies on the difficulties of introducing educational technology in HE. In addition to the publications on the difficulties with educational technology at HE institutions, there are more studies on educational technology challenges at schools. One example is the second survey of schools implemented by the European Commission (2019). The differences between the difficulties schools and universities experience with educational technology are rarely studied.

Amemado (2014) conducted 24 interviews at 15 universities in Canada. He investigated why universities use new technologies in education and focused mainly on online collaboration. His interview partners were academics, technology specialists and experts from teaching support centres. The reasons for introducing new online technologies were primarily external causes such as conformity, student pressure, competition in the educational market and other economic reasons. Only 25% of interviewees mentioned internal motivations such as collaborative working, distance learning or other educational reasons. As a result, the technologies used are not always pedagogically oriented and interactive. The tools applied were LMS, wireless, Web 2.0 technologies, video and mobile devices. In 2014, Amemado (2014) claimed that these were not the latest technologies and postulated a digital gap between universities and the rest of society.

Over the last 15 years, the Universities and Colleges Information Systems Association (UCISA) has conducted eight surveys in the United Kingdom HE sector (Walker et al., 2017). A key topic was the investment, adoption and embedding of technology-enhanced learning (TEL). Of the more than 160 institutions, 69% participated in the survey. According to Walker et al. (2017), the drivers for institutional investment in TEL in UK HE were enhancing the quality of learning and teaching in general, meeting student expectations in the use of technology, improving student satisfaction, e.g. Narrative Scoring Scheme (NSS) scores, helping create a common user experience and improving access to online and blended learning for campus-based students. From 2012 to 2016, the HE institutions made large investments in educational technology, mainly in virtual learning environments, e-assessment and lecture capture systems.

In contrast, there is little evidence that these investments had a significant transformative impact on educational practice or innovation in course delivery. Walker et al. (2017) argued that they were driven by the need to expand and manage key learning processes and introduce inter-institutional teaching and assessment processes and are therefore focused on institutional flexibility. According to them, the main barriers to the development of educational technology tools are lack of time, department or school culture, lack of internal sources to support development, lack of money and lack of academic staff commitment.

Shelton (2017) conducted a qualitative study to determine why 11 lecturers of three universities in the United Kingdom stopped using technology. He found three recurring themes when the lecturers stopped using technology. Firstly, when newer technologies replaced older ones, it was necessary to learn new skills to handle the new technology. Secondly, negative experiences in using technology were an additional theme, and thirdly, changes in a primarily social context influenced the lecturers.

Mercader and Gairín (2020) conducted a multiple case study with 527 lecturers. This survey of lecturers from four Spanish universities aimed to better understand the barriers to use of digital technologies. They divided these barriers into personal, professional, institutional and contextual. The most frequently cited barriers were (1) lack of training, (2) lack of knowledge about teaching approaches to digital technologies, (3) lack of planning, (4) excessive workload, (5) lack of time, (6) generational differences, (7) technophobia, (8) lack of assessment, and (9) lack of incentives. Mercader and Gairín (2020) found that the Arts and Humanities faculty faced the most obstacles in incorporating digital technologies into their teaching, in contrast to lecturers in science and technology, who face the fewest obstacles. As far as institutional barriers were concerned, they did not find any difference between the disciplines. On the other hand, professional barriers scored higher than other barriers. Mercader and Gairín (2020) argued that a person's professional characteristics are more relevant than the skills to improve the integration of digital technologies. Training can enhance lecturers' professional development by strengthening their digital competencies.

### 3.4 Faculty Development in Educational Technology in Higher Education

Meyer and Murrell (2014) explored learning theories that form the base for staff development in online teaching at HE institutions. They conducted a study of 39 institutions of HE in the USA that were members of the Online Learning Consortium. The theories mentioned were learning styles (72%), adult Learning – Merriam (69%), self-directed learning – Knowles (69%), experiential learning – Kolb (64%), andragogy – Knowles (59%), instructional design model (54%), critical reflection – Schön (46%), multiple intelligence – Gardner (38%), cognitive development – Perry (38%), individual development – Kegan (31%), transformational learning – Mezirow (31%), CoI – Anderson/Garrison (28%), connectivism – Siemens (18%) and TPACK (13%). More than half of the participating institutions (21 of 39) indicated their specific instructional design model (Meyer & Murrell, 2014). These were ADDIE- analysis, design, development, implementation and evaluation (9 mentions), Quality Matters (3 mentions), CSU Chico rubric (2 mentions), ASSURE (2 mentions), Dick and Carey (1 mention), Backward Design (1 mention), Bloom's Taxonomy (1 mention) and Sloan-C (1 mention) (Meyer & Murrell, 2014).

Several frameworks have been developed for the initial and in-service training of teachers. In German-speaking countries, models such as the Model of Media Education Competence (Blömeke, 2000), the Competence Structure Model from the M³K study (Herzig & Martin, 2017) and Digital Competencies for Educators - digi.komP (Brandhofer et al., 2016) are common. In Europe, the following models are widely used (Schmid & Petko, 2020): The European Framework for Digital Competence of Educators – DigCompEdu (Redecker & Punie, 2017), the UNESCO ICT Competency Framework for Teachers (UNESCO, 2018) and the ISTE Standards for Educators (Crompton, 2017).

All these frameworks focus on the education of teachers. They were not developed for lecturers in HE, although they are helpful for the development of continuing education for lecturers. Schoolteachers receive pedagogical training before they teach pupils. Typically, lecturers at HE institutions have not completed a university degree in education; they begin teaching after gaining expertise in a particular subject. For this reason, further training in the fields of pedagogical and technological pedagogical knowledge is crucial. The focus should not only be on learning necessary pedagogical and technological skills but on educational media. As this is continually developing, dealing with it requires continuous training.

Sanders and Georg (2017) compiled studies on the efficiency and inefficiency of further educational technology training for teachers. According to their research, the following were considered inefficient: (1) the overload of training with information, (2) training that focused solely on technological skills rather than combining them with aspects of pedagogical design, (3) the consideration of technological skills or pedagogical design in isolation rather than combining technological knowledge, pedagogy and subject teaching, and (4) one-size-fits-all programmes. Factors that have led to more effective training (Sanders & George, 2017) were (1) needs-based programmes, (2) a focus on pedagogy and design theory, (3) subject-related focus, (4) the use of technology for teaching technology, (5) discussion among teachers about aspects of their design in communities of practice, (6), returning for more training, (7) the use of role models, and (8) online mentoring of teachers in the use of educational technology.

Kirkwood and Price (2013) argued that professional staff development activities in HE should not focus on using educational technology but on why and for what reason. Therefore, they question a technical focus that, in their view, does not sufficiently address pedagogical issues and models of learning with educational technology. Educational technology should not have a higher priority than pedagogy. However, they argue that even if pedagogical topics are considered in continuing education, little changes in the way students are taught. From their perspective (Kirkwood & Price, 2013), the essential points are whether the lecturers provide a teaching-focused (transmission of knowledge) or a learning-focused (developing the learner) approach and how they use educational technology for this purpose because the change in education does not take place through educational technology, but the lecturers.

# 4 Technological Pedagogical Content Knowledge

This chapter outlines the TPACK model. It forms one of the core theoretical concepts for both educational technology and blended learning and is prominent in the research questions. In this chapter, the model is introduced by outlining the state of research on TPACK. A closer look is taken at surveys, influencing factors and research in German-speaking countries, including publications on lecturer TPACK in online HE.

Technological Pedagogical Content Knowledge (TPCK) was introduced in educational research as a theoretical framework to understand the teacher knowledge required for effective technology integration (Mishra & Koehler, 2006). It further develops Shulman's (1986) Pedagogical Content Knowledge Model (PCK).

In the original model, Shulman (1986) emphasised the importance of integrating content knowledge with teachers' pedagogical knowledge. He defined PCK as the second kind of content knowledge “which goes beyond knowledge of subject matter per se to the dimension of subject matter knowledge for teaching” (Shulman, 1986, p. 9). PCK is the knowledge of how to teach a particular subject.

Koehler and Mishra (2005) have expanded the model to include technological knowledge, which is knowledge about the handling and application of technical resources. The framework not only focuses on the individual components, content, pedagogical and technological knowledge, but it also highlights the interaction between them.

Until 2008 the framework was called “TPCK” in the literature, after which some members of the research community suggested the use of the more pronounceable term TPACK (Thompson & Mishra, 2007). The term has been defined in many different ways. Harris et al. (2017, p. i) define TPACK as “the interdependent, situated knowledge that is needed to integrate the use of digital tools and resources effectively in curriculum-based teaching” (2017, p. i).

## 4.1 Technological Pedagogical Content Knowledge Framework

The TPACK framework defines three main dimensions of training and four intersections among them. The three main dimensions of training are Content Knowledge (CK), Pedagogical Knowledge (PK) and Technological Knowledge (TK), which form the basis of lecturers' knowledge. The connections among these three types of knowledge result in the four intersections Pedagogical Content Knowledge (PCK), Technological Content

Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and TPACK. According to the TPACK concept, lecturers' teaching improves if they connect the three main dimensions and form the intersections between them. These seven aspects of TPACK are described below.

CK is knowledge of the content without considering the pedagogical aspects of teaching. It covers areas that students need to be taught, including concepts, theories, facts and procedures, and describes the teachers' knowledge about the content, e.g., chemistry or history.

PK refers to the teachers' knowledge of different educational theories, pedagogical activities, processes, practices and teaching methods. It includes knowledge about students' learning and the experience of teaching a topic without reference to content. An example is knowledge about how to use project-based learning in teaching.

TK is the knowledge of standard and advanced technologies. It addresses the teachers' understanding of various technologies to develop teaching practice. This dimension is always in a state of transformation (Koehler & Mishra, 2009). According to Graham (2011), Mishra and Koehler (2006) did not differentiate between the types of technology covered within TK. They include both older technologies such as pencil and blackboard and newer digital technologies such as blogs and Facebook. From this perspective, any educational setting would require TPACK since teaching is typically not done without tools.

PCK is knowledge of the teaching methods about the subject content. This also means that the teacher knows which teaching approaches and strategies are better suited to the content and how various content elements can be developed for effective teaching. PCK is similar to Shulman's idea of PK related to teaching specific content (Koehler & Mishra, 2009). An example is the knowledge of analogies to teach theoretical concepts such as implicit and explicit knowledge.

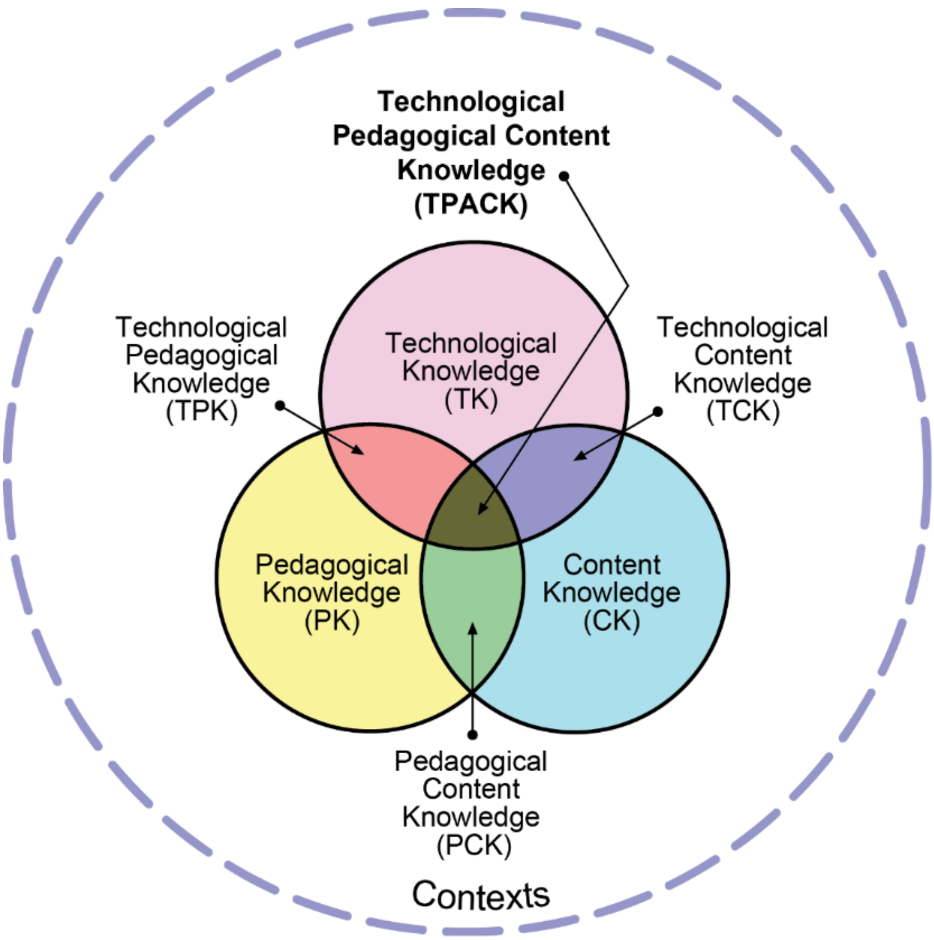
TCK covers how technology and discipline are interlinked. Teachers need to know how the use of technologies influences their areas' content; it is the knowledge of how to use technology to research and present specific content in different ways, regardless of pedagogical considerations. An example is knowledge of mathematical software such as Microsoft Mathematics, Math Editor or Photomath.

TPK is knowledge about different technologies' existence and possible applications to implement teaching approaches independent of the subject area. It relates to the understanding of general pedagogical strategies achieved using technology. This also involves the knowledge of which tools can be used for what educational task.

TPACK refers to the knowledge of how to develop didactic strategies for specific topics to support learning by using technology. An example is knowledge about using a peer feedback module within a learning management system to promote learning to write in English. Therefore, TPACK goes beyond the three components: content, pedagogy and technology.

A Venn diagram with three overlapping circles, each displaying a different form of knowledge, most often illustrates the TPACK framework, as displayed in Figure 4.

**Figure 4** *The Technological Pedagogical Content Knowledge Model (TPACK)*




*Note.* Reproduced with permission from the publisher © 2012 by tpack.org

Mishra (2019) argued that there is a semantic inconsistency in this frequently quoted image of TPACK. This inconsistency relates to the meaning of the outer dashed circle within the diagram, referred to as “Contexts”. Since TPACK is a framework for teachers' knowledge, each closed space represents a form of teachers' knowledge. This applies to all seven dimensions of TPACK, and that should also apply to the outer dashed circle. Mishra (2019) suggests a simple solution to solve this problem, namely, renaming this circle “Contextual Knowledge”.

## 4.2 TPACK Research

The TPACK framework is widely used in educational contexts and research. The TPACK newsletter (Harris & Wildman, 2019) lists 1170 articles, 291 chapters, 28 books and 394 dissertations that are TPACK-focused.

Researchers used qualitative, quantitative and mixed methods to study TPACK. Qualitative studies focused on TPACK often used lesson plan evaluation tools, evaluation of design tasks or learning activities, and case-based scenarios and case analysis. Other methods used were interviews as part of qualitative methods or to validate instruments and observation tools to analyse technology integration (Archambault, 2016). Chai, Koh and Tsai (2016) identified three kinds of quantitative measures of TPACK: surveys, lesson design measurement rubrics and quantitative content analysis of teachers' design processes.

In 2013, two literature reviews examining TPACK research carried out before 2011 (Chai, Koh et al., 2013; Voogt et al., 2013) were published. Further TPACK meta-studies followed: in 2015 by Rosenberg and Koehler, in 2016 by Chai et al., in 2018 by Wang et al. and Willermark, in 2019 by Rodríguez Monroe et al., and in 2020 by Sauber et al.

The study by Chai et al. (2013) covered 74 journal papers published up to May 2011. They concluded that TPACK was used more frequently in North America. The TPACK research included various research methods and suggested different directions for further research.

Voogt et al. (2013) studied 55 peer-reviewed journal articles published between 2005 and 2011. The review investigated the theoretical basis and the practical application of TPACK. The results displayed three different interpretations of TPACK and TK: T(PCK) as advanced PCK, TPCK as an autonomous domain of knowledge, and TP(A)CK as an interaction of three areas of knowledge and their intersections.

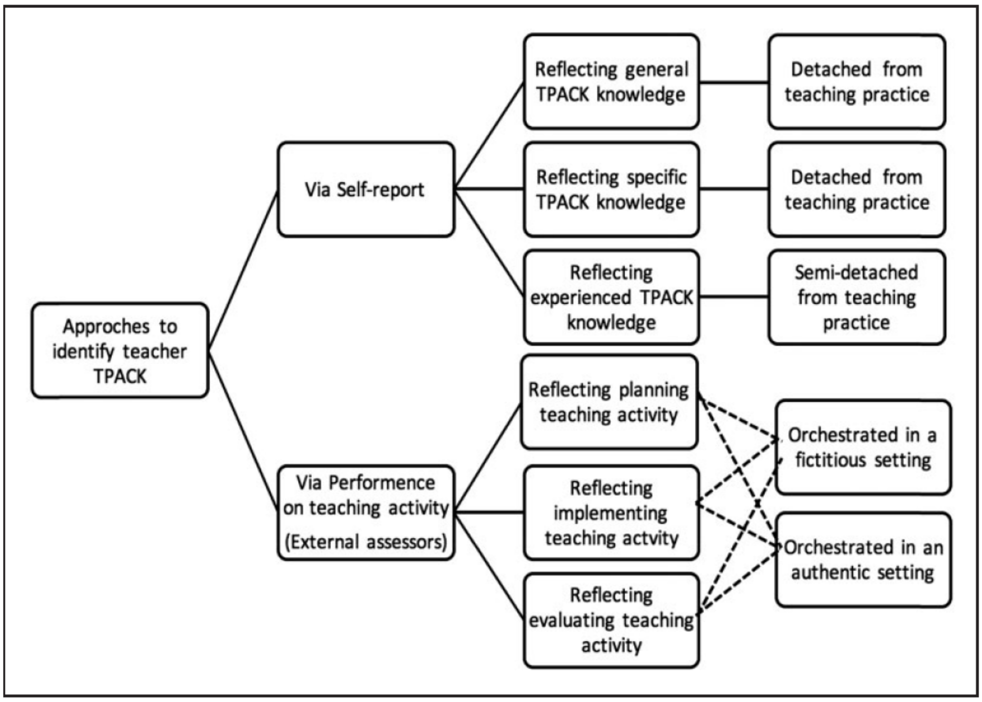
Rosenberg and Koehler (2015) reviewed 193 empirical journal articles on TPACK, 70 of which dealt with the topic context. Among these were factors most commonly covered, such as classroom factors (84%), followed by school factors (61%), teacher factors (57%), student factors (44%) and societal factors (14%).

Chai, Koh and Tsai (2016) reviewed 45 journal articles that covered quantitative measures of TPACK. They classified the different TPACK surveys into general TPACK surveys, TPACK surveys for a specific technology, TPACK surveys for specific pedagogy and TPACK surveys for specific content. A future direction for TPACK surveys is to create surveys for specific contexts.

Wang, Schmidt-Crawford, and Yi (2018) researched 88 studies that measured teachers' development of TPACK with participants who were preservice teachers. The research method categories identified were self-report measures (42), open-ended questionnaires (8), performance assessments (35), interviews (12) and observations (13). They identified three major themes from self-reported questionnaires: Effective modelling in teacher education can improve teacher TPACK development, teaching experience can impact the development of preservice teacher TPACK, and TK has a strong correlation with the growth of TPACK.

Willermark (2018) conducted a systematic literature review of 107 peer-reviewed journal articles published between 2011 and 2016. She concludes that several approaches and instruments measure teachers' TPACK, as illustrated in Figure 5. In most cases, teachers' TPACK is identified based on self-reports, and evaluations of teaching performance are rare.

**Figure 5** *Approaches to Identify Teacher TPACK (Willermark, 2018, p. 322)*




Rodríguez Moreno et al. (2019) analysed 37 empirical studies on the TPACK model published between 2014 and 2017 focusing on teacher training. The designs most often used are quantitative, followed by qualitative and mixed-method studies. Most of the samples are focused on students of higher and primary education.

Saubern et al. (2020) reviewed 22 TPACK papers published in the *Australasian Journal of Educational Technology* between 2015 and 2020. They were guided by the two questions raised by Herris et al. (2017): “What do teachers need to know in order to integrate technology effectively in the classroom?” and “How can they best develop that knowledge?” The central part of the articles focused on examining, criticising, and validating the structure of TPACK and its seven constructs. Based on this analysis, they called for a fundamental change in the direction of TPACK research. Saubern et al. (2020) suggest that more attention should be paid to understanding the knowledge lecturers need to use technology for teaching and learning effectively.

### *4.2.1 TPACK Surveys*

The first researchers who used a survey instrument to measure TPACK were Koehler and Mishra (2005). They developed and carried out a survey that addressed the requirements for the design of online learning activities for their master's students. The questionnaire consisted of 33 items, rated on a seven-point Likert scale with two open questions.

Schmidt et al. (2009) created the first and the most frequently used TPACK survey with items to measure self-perception of the seven factors of TPACK. They designed the study for preservice teachers in elementary or early childhood education (Survey of Preservice Teachers' Knowledge of Teaching and Technology). Their final survey listed 47 questions and was rated on a five-point Likert scale. Several researchers revised and adapted this survey.

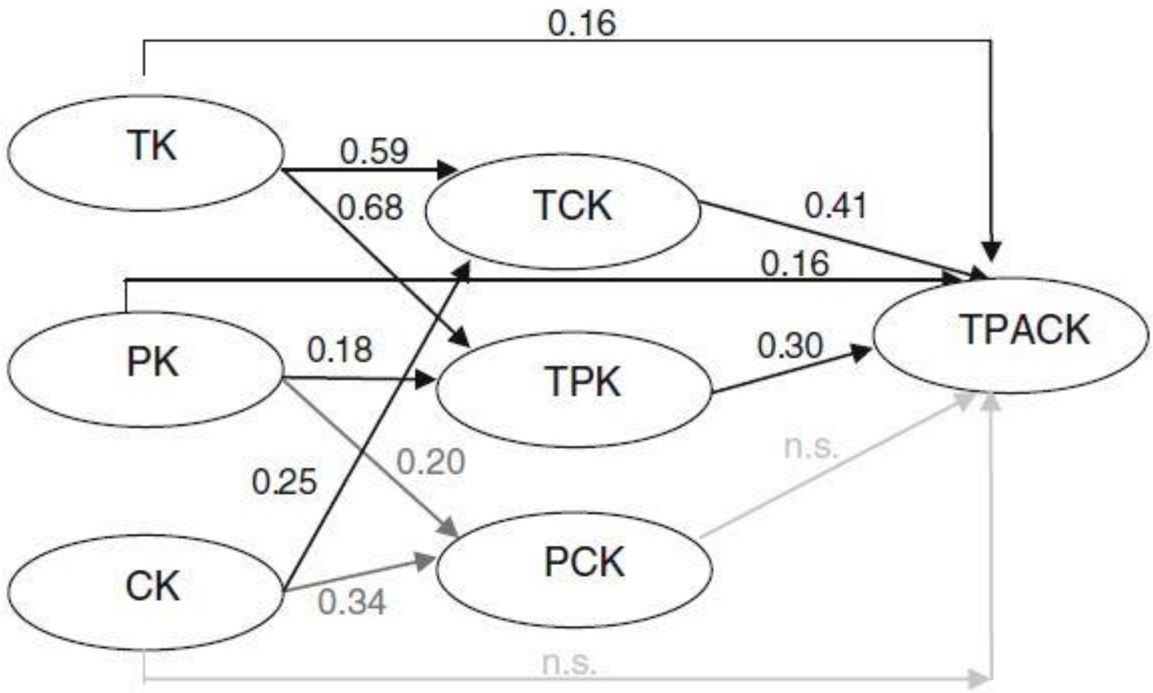
Chai and Koh developed many different TPACK questionnaires together with other authors. First, Koh et al. (2010) modified Schmidt et al.'s (2009) survey and used a seven-point Likert scale. They also changed the content knowledge-related items to meet the needs of Singapore's preservice teachers.

Examples of content-specific TPACK surveys were a TPACK survey focusing on the Web (TPACK-W) to assess the attitudes towards Web-based teaching of primary to secondary school teachers in Taiwan (Lee & Tsai, 2010). Another example is Jang and Tsai's (2012) TPACK survey with elementary mathematics and science teachers in Taiwan, focusing on interactive whiteboards. A further example was a survey for science teachers in Singapore (Lin et al., 2013) on a questionnaire to measure game-based TPACK for Taiwanese preschool teachers (Hsu et al., 2013).

In much of the TPACK research by Koh and Chai, a constructivist-oriented view is reflected in different models and questionnaires, e.g., meaningful learning highlighting the role of students in monitoring their learning, their cooperation, and reflective thinking. The development of TPACK for a meaningful learning survey started with initial work in 2011 (Chai et al., 2011), based on Koh et al. (2010), and included an enhancement of the PK items and the TK items to address Web technologies. The instrument has since been validated and refined several times to improve the differentiation between the constructs (Chai et al., 2016), and further improvements have revised TPACK items to describe meaningful learning pedagogies (Chai et al., 2013).

Koh et al. (2013) used a slightly modified survey and generated a path model. They tested the influence of the different TPACK constructs on TPACK. TK, PK, TCK, and TPK directly influenced TPACK, as illustrated in Figure 6. TK and PK also influenced TPACK indirectly through the effects on TPK and TCK. CK and PCK did not directly have a significant influence on TPACK.

**Figure 6** *Paths to TPACK (Koh et al. 2013, p. 803)*




Koh et al.'s (2013) research impacted the development of TPACK surveys. Chai and Koh (2017) developed questionnaires that do not include survey items for all seven TPACK constructs based on these results. This resulted in fewer items necessary for measuring TPACK and allowed the combination of other topics with TPACK in a questionnaire without requiring too many survey items.

Chai and Koh (2017) applied the TPACK questionnaire with a reduced number of items in their study on the Scaffolded TPACK lesson design model (STLDM). They synthesized models of learning by design for TPACK and developed and validated a questionnaire to measure teachers' design beliefs and TPACK. For this instrument, Web-TK, TCK, TPK and TPACK were taken from earlier validated TPACK surveys (Chai et al., 2013; Chai et al., 2017). The items for the other three parts are based on the same source (Chai et al., 2017). This includes Design Disposition (DD), Teacher as Designer (TAD) and Beliefs about New Culture of Learning (BNCL). The instrument was validated and is reliable (Chai & Koh, 2017). Chai and Koh's (2017) research documented significant changes in teachers' design beliefs and their development of TPACK through a course design based on the STLDM. Chai and Koh (2017) also found that all factors except Web-TK and DD predicted TPACK significantly.

The same or similar factors have been used for different surveys, e.g., Koh et al. (2017) measured the ICT development process for developing TPACK for twenty-first-century learning. They used TK, TPK, TCK, TPACK and LDP (lesson design practice) in their questionnaire.

Chai, Koh, and Teo (2019) also developed the TPACK-21st model to address twenty-first-century learning in fields reflecting learning with ICT (RL), authentic learning with ICT (AUL), collaborative learning with ICT (COL), active learning with ICT (ACTL), BNCL, design thinking (DT) efficacy and TAD. The study is based on previous questionnaires by Chai and Koh, especially the STLDM (Chai & Koh, 2017).

There are several other TPACK surveys. Graham et al. (2009) designed a survey to measure the TPACK of science teachers in the U.S. state of Utah. Archambault and Barnett (2010) developed a questionnaire to measure the TPACK of K-12 online teachers in the United States. Yurdakul et al. (2012) developed a TPACK questionnaire for Turkish preservice mathematics teachers. Bilici et al.'s (2013) survey discovered preservice science teachers' self-efficacy expectations towards TPACK Methods at universities in Turkey. The TPACK questionnaire from Valtonen et al. (2015) measured the twenty-first-century skills of preservice teachers at universities in Finland. The survey of Bostancıoğlu and Handley (2018) measured the TPACK for English as a foreign language (EFL-TPACK) of English language teachers in different countries. Above and beyond these new or primarily further developments of existing questionnaires, many researchers adapted and applied the existing questionnaires in most parts of the world (Harris & Wildman, 2019).

### *4.2.2 Factors Influencing TPACK*

Several quantitative studies examined the relationship between TPACK and its adoption factors. According to Chai et al. (2016), results varied regarding demographic factors. Other factors also varied widely, depending mainly on the context. Therefore, the following overview focuses on the widespread TPACK studies on service and in-service teachers, especially on four TPACK studies from HE, focusing on factors influencing TPACK adoption. Voithofer et al. (2019) conducted a TPACK survey with 842 teacher educators at 541 institutions across the USA. Fabian et al. (2019) based their TPACK study on a survey of 112 lecturers from a multi-campus university in the United Kingdom. Cubeles and Riu's (2018) questionnaire from three different universities in Spain was completed by 113 lecturers. Castéra et al.'s (2020) study included 574 teacher educators from eight institutions across six European and Asian countries.

Castéra et al. (2020) perceived a difference in lecturer's TPACK in six different countries and concluded that “country context” is the only significant factor explaining differences. A common trend, however, was that technology factors were typically rated lower. This was also reflected in Jang and Tsai's (2012) study, where TK was the lowest. Even in Fabian et al.'s (2019) study, TK scores were lowest and highest for PCK and TCK, and several studies confirmed this finding (Cubeles & Riu, 2018; Kushner Benson & Ward, 2013). According to Cubeles and Riu (2018), lecturers would most probably score PK/PCK highest because they gained extensive experience in their field of expertise before starting to teach. TPACK constructs that incorporate technology (TK, TCK, TPK and TPCK) got lower ratings. However, they found differences between lecturers who had taught online and those who had not (Cubeles & Riu, 2018).

Several studies found gender differences in TPACK, but this did not apply to all. Koh et al. (2010), Jang and Tsai (2013), and Scherer et al. (2017) found that male teachers reported stronger ratings for the technological constructs of TPACK. Lin et al. (2013) reported that female teachers reported lower TK, while their results also showed higher PK. In contrast, Castéra et al. (2020) did not find a gender difference in the TPACK perception of lecturers who train teachers.

The factors of age and teaching experience are strongly dependent. The majority of the teachers with a lot of teaching experience are also the oldest. Many studies found a negative correlation between age or teaching experience and the technological constructs of TPACK (Alzahrani, 2014; Blackburn, 2014; Cheng & Xie, 2018; Koh et al., 2010; Lee & Tsai, 2010; Lin et al., 2013) or the entire TPACK construct (Lee & Tsai, 2010; Yaghi, 2001). Castéra et al. (2020) reported differences between the global comparisons of age groups and TPACK, except for PK; however, multiple pairwise comparisons were insignificant. In Jang and Tsai's (2012) study, TK did not differ concerning years of teaching experience; Guo et al. (2008)

reported the same for different age groups. Also, Voithofer et al. (2019) found no relationship between TPACK and years of service as a teacher educator.

Many studies found no relation between lecturers' fields of expertise and their TPACK level. This applies to teachers (Alzahrani, 2014; Lye, 2013; Rienties et al., 2013), teacher educators (Voithofer et al., 2019), and lecturers (Fabian et al., 2019). However, Cubeles and Riu (2018) found that TPACK differed by subject area.

There were also differences between TPACK and teaching qualifications in HE (Fabian et al., 2019) but not between those who attended further training in the last year and others. Also, Castéra et al. (2020) reported no differences between lecturers' initial levels of training.

Further differences were determined between full-time and part-time lecturers concerning their TPACK (Fabian et al., 2019). The same applies to TPACK and the more frequent use of digital media in the classroom (Endberg, 2019).

#### *4.2.3 TPACK Research in German-Speaking Countries*

TPACK has, so far, only played a minor role in research carried out in German-speaking countries (Delere, 2020; Endberg, 2019). Studies conducted included research done by Krauskopf et al. (2018), Mirau (2020) and Lorenz et al. (2017), the PhD theses of Endberg (2019) and Brandhofer (2015) and the master's theses of Strobl (2020) and Hoch (2020). Several articles about TPACK were also published in German. Most of these articles compare TPACK with other models (Delere, 2020; Heinen & Kerres, 2015; Petko & Döbeli Honegger, 2011; Schmid & Petko, 2020; Schmidt-Hertha et al., 2020).

Krauskopf et al. (2018) conducted a study on the Graphic Assessment of TPACK Instrument (GATI). GATI includes a process to enhance the meta-conceptual awareness of TPACK using visualisation and reflection activities for teachers. The research is a proof-of-concept study for the GATI model that they developed. Two German teachers took part in the mixed-method study, the research for which was carried out in a three-stage process. First, information on the teachers' framework conditions and the TPACK self-assessment were collected using a model adapted by Schmidt et al. (2009). Then the two participants were asked to create their own GATI model and explain it orally. Afterwards, they created another GATI model that reflected their TPACK objectives. The third step explained how teachers could achieve their TPACK goals (Krauskopf et al., 2018). This research aimed to determine how GATI can support professional development.

Based on the TPACK model, Mierau (2020) illustrated the implementation of a media-didactic concept for teacher training in the subject of sport. She called her model S.P.O.R.T.S. (Student-Produced Online Resources for Teaching in Schools) within this framework. Teachers' TPACK profiles were created in the form of network diagrams.

The national indicator 2017 (Lorenz et al., 2017) for secondary school level I in Germany covered the state of media education and developments and trends in schools. The focus was on school equipment with digital media, the use of digital media in schools, the support of computer and information-related competencies of children, and the self-evaluated media-related competencies of teachers. The national indicator is based on a representative survey of 1218 teachers. In some cases, the same indicators are used as in other surveys, allowing comparability. As part of the study, the questionnaire by Schmidt et al. (2009) was translated and adapted into German for the first time, and TPACK was surveyed and analysed for teachers throughout Germany and in the individual federal states. The national indicator (Lorenz et al., 2017) summarised the results in the form of five indicators or statements, making it possible to evaluate teachers' knowledge in the field of TPACK.

The statement "I can choose digital media that can be used to teach the subject matter better in class" received the most approval with 76.6%, followed by "I can design lessons in such a way that the contents of the reference subject, the digital media used and teaching methods applied are appropriately combined" with 73.4% agreement, "I can choose digital media for my lessons that improve both what I teach and how I teach and what pupils learn" with 72.2% agreement, and "I have strategies in my teaching that combine subject content, digital media and teaching methods that I have learned about" with 64.3% agreement. There was much less support for the statement "I can guide other teachers in their teaching to match subject content, the use of digital media and appropriate teaching methods", with 43% agreement (Lorenz et al., 2017).

Endberg's PhD thesis (2019) covered data analysis from the national indicator 2017 (Lorenz et al., 2017) for the knowledge areas TK, PCK, TCK and TPK. She answered three research questions in her work. The first was how teachers in Germany assess their knowledge of the TPACK knowledge areas. On average, experience in the field of PCK was rated the highest. Endberg (2019) explained that this was because this knowledge component is the core area of the teaching profession in the self-image of German teachers. The rating for TCK was comparably high. However, only one individual item was queried for both TCK and PCK. The second research question was whether different types of teachers could be identified in terms of self-assessment of the TPACK knowledge areas in Germany. Endberg (2019) identified four types that differ into very high, high, medium and low TPACK self-assessment. The majority of teachers in lower secondary education described themselves as very highly (25.0%) or highly (44.2%) competent in terms of TPACK. Only 10.0% stated that they had low TPACK knowledge, most of them were women who were over 50 years old. The third research question was whether the level of TPACK knowledge influenced the frequency of use of digital media in the classroom. Endberg (2019) concluded that a higher TPACK self-assessment was related to the more frequent use of digital media in the classroom.

For his PhD thesis, Brandhofer (2015) conducted a quantitative survey of 6264 teachers and students of lower secondary education in Austria. The questionnaire was based on a TPACK-A model that he developed. “A” represents the connection to pupils' Austrian framework of reference. It covered the TPACK sectors CK, PK, TK and TPCK. Brandhofer (2015) designed the survey to answer his three research questions. The first question asked if there are interactions between the theoretical teaching perspective of teachers in schools and the use of digital media in the classroom. Brandhofer (2015) discovered a significant correlation between the use of digital media and a constructivist view of teaching. However, he could not identify a directed causal relationship. In answering the second question, he concluded that knowledge of information technology and the use of social media is not widespread among teachers. The third question related to teaching experience and its relationship to media usage and the rating of obstacles. An analysis of teachers' age groups and media use showed significant differences in their teaching experience, especially those with 0-10 years of teaching experience, which differed from the other groups (Brandhofer, 2015). However, the differences in the mean values between the groups were not very large, and no trend was evident. The group with 0-10 years of teaching experience also differed in assessing obstacles to using digital media in teaching. With increasing teaching experience, teachers rated the barriers to using digital media as decreasing. An exception was the group with 0-10 years of teaching experience.

Strobl's work (2020) focused on how digital storytelling can be used in English as a foreign language teaching to introduce grammar to develop the TPACK model of teachers. The quantitative study involved 49 middle school teachers who taught English in Innsbruck. The questionnaire was based on Schmidt et al. (2009) and was adapted and extended with further questions. Strobl (2020) concluded that digital storytelling helps to create a TPACK based teaching model.

Hoch (2020) researched the development of TPACK for student teachers at the primary level bachelor's degree at the University College of Teacher Education in Vienna. She focused on the question of which TPACK areas students in the eighth semester of their studies change their knowledge in comparison to students in the second semester. The quantitative survey participants consisted of 211 students: 42% of the 497 students in the second and fourth semesters. The questionnaire was based on Schmidt et al. (2009) and Bostancıoğlu and Handley (2018). Hoch (2020) concluded an increase in knowledge among student teachers in all TPACK areas during their studies. However, students' TK in the second semester was more developed than their PK and CK.

### 4.3 TPACK of Lecturers in Online Higher Education

The publications on the use of the TPACK framework are numerous and compared in different reviews. Based on this, the conclusion can be drawn that most research on TPACK is conducted to measure the TPACK of preservice and in-service teachers. According to Rodríguez Moreno (2019), the predominant sample of TPACK studies are students studying to become teachers in HE or primary education. Less research is concerned with HE lecturers and non-educational faculties. According to Chai et al. (2016), university lecturers were rarely asked about their TPACK. Herring et al. (2016) also share this view in their analysis of TPACK in HE. Nevertheless, several studies examined the TPACK knowledge of lecturers in the online HE context (Ouyang & Scharber, 2018). The following section presents studies covering the TPACK of lecturers teaching online in HE.

Scott (2009) explored how two professors with different online teaching experiences integrated TPACK into their online courses. Scott (2009) concluded in his case study of professors' experiences in teaching online that extensive online teaching experience is not necessary for achieving TPACK, but the lecturers' understanding of how to use technology to support their content online is.

Kushner et al. (2013) used TPACK to create individual TPACK profiles for three professors who taught online courses. They concluded that lecturers who can verbally express their understanding and application of PK are more likely to achieve an integrated TPACK profile. On the other hand, achieving an integrated and balanced TPACK profile was unlikely if TK was defined only as the ability to use different technical tools.

Anderson et al. (2013) used TPACK as a framework for analysing qualitative interviews to identify elements of lecturers' knowledge in online teaching. The interpretive, qualitative case study approach with 15 lecturers was focused on the how and why of online teaching concerning TPACK. They concluded that PK was most common among online lecturers, expressed in statements about student and lecturer's engagement and focusing on the learning activities and the learning outcomes of the course. TK was also an important topic, reflected in statements on selecting appropriate technological tools and the adequate level of the online part of teaching. CK was less strongly represented, although there were comments on the subject.

Meyer and Murell (2014) conducted a national study with 39 HE institutions in the USA. They collected information on their practices of faculty development for online teaching. The lecturers' TPACK was not queried, but the percentage of institutions using the TPACK as a learning theory was. The survey lasted from 2011 to 2012, and five out of 39 institutions used TPACK as a learning theory. Kennedy (2015) studied inexperienced online instructors to discover if TPCK is evident in their online environment. He identified the TPACK constructs CK, PK, PCK and TPCK in the online course and presented a scheme to evaluate online teaching practice. Ouyang and Scharber (2018) adapted the TPACK constructs for online lecturers in HE. Based on this, they described the TPACK profile of an experienced online instructor within an online course. The results present an approach to analysing the TPACK of online lecturers.

The TPACK development of lecturers has rarely been researched outside teacher training programmes (Herring et al., 2016; Kushner Benson & Ward, 2013). Nevertheless, there are some studies on TPACK with lecturers in online HE; most of them use qualitative research. So far, there is no quantitative study with HE lecturers in blended learning. Ouyang and Scharber (2018) conclude that “there continue to be obstacles in accurately assessing and effectively applying TPACK for use within online higher education contexts”

(p. 42) and that there is a need for further modification of the TPACK instruments to make them more suitable for online learning in HE.

# 5 Educational Media

This chapter is dedicated to another central part of the research topic, educational media. A description of media use in HE is central to the research questions. Different forms of media are presented, and various educational media classifications that are also relevant to the research questions are compared.

Educational technology for Spencer (2017) consists of the components (1) methods of learning, (2) objectives for learners, (3) evaluation of teaching and learning, (4) environments, and (5) media for learning. According to Reeves (1998), media concerning education "are the symbol systems that teachers and students use to represent knowledge; technologies are the tools that allow them to share their knowledge representation with others" (p. 2). Educational technology describes the general adoption of technology in education. However, when it comes to lecturers' specific use of technology, the research usually focuses on the extent to which they use certain media.

Amemado (2014) distinguishes four phases of media that influence distance education. Print media marked the first phase, used to send out course materials. The second phase in the 1960s was the multimedia age in which print, radio, television and video were used in education. The third phase followed in the late 1980s and early 1990s with micro-computing and subsequent communication technology. According to Amemado (2014), the emergence of the Web characterises the fourth, current phase.

## 5.1 Media Forms

Laurillard (2002) dealt with the various teaching media characteristics that support the learner in performing the tasks. She grouped them into narrative, interactive, adaptive, communicative and productive media and assigned these media forms to the types of learning and technologies they support. Table 7 shows the resulting taxonomy.

**Table 7** *Five Principal Media Forms with the Learning Experiences They Support and the Methods Used to Deliver them (Laurillard, 2002, p. 90)*

| Learning experience | Methods/technologies | Media forms |
|---|---|---|
| Attending, apprehending | Print, TV, video, DVD | Narrative |
| Investigating, exploring | Library, CD, DVD, Web resources | Interactive |
| Discussion, debating | Seminar, online conference | Communicative |
| Experimenting, practising | Laboratory, field trip, simulation | Adaptive |
| Articulation, expressing | Essay, product, animation, model | Productive |

Laurillard's (2002) framework is designed to define each formal learning encounter, and the appropriate media technologies she identifies are both traditional and digital. She places the educational process of the technologies and, therefore, the pedagogical actions at the centre and uses the term “media forms”.

With narrative media, a story can be told in the process of attending and apprehending (Laurillard, 2002). The narrative consists of one person communicating with many others in most cases; examples are print, TV, video and DVD. According to Hinkelman (2018), the ideal blended approach consists of a teacher mixing face-to-face narratives and online narratives. For example, he suggests that several live lectures can be recorded and made available online along with supplementary texts or books.

When using interactive media, learners navigate and select the content themselves (Laurillard, 2002) in the process of investigating and exploring. Interactive and narrative activities differ in that they are dynamic and non-linear and in that the learning process and content change as the learner interacts with it (Hinkelman, 2018). Media such as a library, CD, DVD and Web resources can be used. For Laurillard (2002), the focus is on questioning on the lecturer's part and inquiry on the learner's part.

Communicative media forms enable learners to interact with each other (Laurillard, 2002). For example, this can be done in pairs or small discussion groups in seminars or online meetings. The learning experience is created through discussion and debate.

Adaptive activities can be adapted to the learners' needs and usually allow for practical application (Laurillard, 2002). The learning experience comes from experimenting and practising. Teachers model the training field for students to practise and simulate. The technologies used include simulations, field trips, role-plays and games.

Productive media forms enable students to create and publish their content for an audience (Laurillard, 2002). Examples are essays, animations, wikis and blogs. According to Laurillard (2002), the lecturer's main activity is coaching and that of the learner is performance.

## 5.2 Classifications of Educational Media

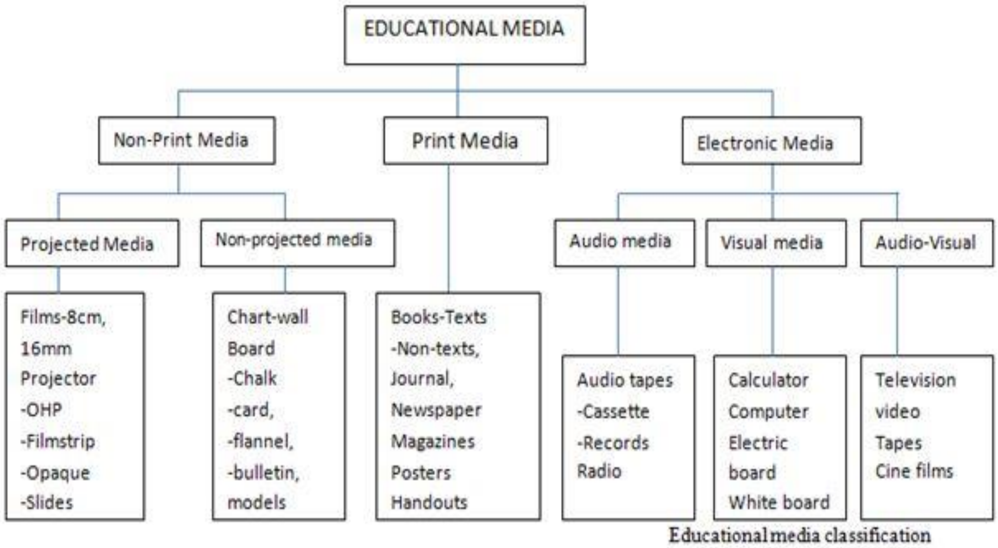
Several classifications were developed to classify media used in teaching. These are presented below and then combined into a new classification. Churchill (2007) presented six different types of learning objects: (1) presentation, (2) practice, (3) simulation, (4) conceptual models, (5) information, and (6) contextual representation objects, described in Table 8. For Churchill (2007), a learning object is “a representation designed to afford uses in different educational contexts” (p. 484).

**Table 8** *Types of Learning Objects (Churchill, 2007, p. 482)*

| LO-Type | Explanation | Simple example |
|---|---|---|
| Presentation object | Direct instruction and presentation resources designed with the intention to transmit specific subject matter | An instructional sequence on the classification of triangles |
| Practice object | Drill and practise with feedback, educational game or representation that allows practice and learning of certain procedures | Quiz question requiring a learner to use representation of a protractor to measure angles and answer a question regarding ratio between base and height of the right-angled triangle |
| Simulation object | Representation of some real-life system or process | Simulation of a compass allowing a learner to draw a geometric shape (e.g., equilateral triangle) |
| Conceptual model | Representation of a key concept or related concepts of subject matter | Representation that allows manipulation of parameters of a triangle, which in turn changes displayed modalities such as visual representation of a triangle, and numerical values of sizes of its angles and sides, and displays a graph showing changes in relationship between sides or angles |
| Information object | Display of information organised and represented with modalities | Representation that allows learners to change angles and sizes of a triangle and, based on configuration, to obtain information such as the type of triangle illustrated, a picture showing it in real-life and a short description of its properties |
| Contextual representation | Data displayed as it emerges from represented authentic scenario | Representation that shows real-life examples of triangles (e.g., roof of a building) and allows a learner to use representation of a tool (e.g., tape measure) to collect data about dimensions of these triangles |

Omodara and Adu (2014) differentiated three educational media types: print media, non-print media and electronic media. Examples of print media are books, journals, magazines, newspapers, workbooks, and textbooks. For non-print media, two categories apply: (1) Projected media require light sources for projection, such as film projector slides or PowerPoint slides, and (2) non-projected media include two-dimensional and three-dimensional objects such as prints, charts or models. Electronic media can be divided into three parts: (1) audio media, (2) visual media and (3) audiovisual media. Examples of audio media are audiotapes and record players. Examples of visual media are television, computers and whiteboards. Audiovisual media offer hearing and seeing simultaneously, such as television and videos (Omodara & Adu, 2014). Figure 7 illustrates the educational media classification.

**Figure 7** *Educational Media Classification (Omodara & Adu, 2014, p. 50)*




Kaplan and Haenlein (2010) developed a social media classification and distinguished six social media types: (1) collaborative projects, (2) blogs, (3) content communities, (4) social networking sites, (5) virtual game worlds, and (6) virtual social worlds. The facets used for classification are social presence and media richness, with the values low, medium and high; self-presentation; and self-disclosure, with the levels low and high, as illustrated in Table 9.

**Table 9** *Classification of Social Media by Social Presence/Media Richness and Self-Presentation / Self-Disclosure (Kaplan & Haenlein, 2010, p. 62)*

| | | *Social Presence / Media Richness* | | |
|---|---|---|---|---|
| | | **Low** | **Medium** | **High** |
| ***Self- Presentation/ Self-Disclosure*** | **High** | Blogs | Social networking sites (e.g., Facebook) | Virtual social worlds (e.g., Second Life) |
| | **Low** | Collaborative projects (e.g., Wikipedia) | Content communities (e.g., YouTube) | Virtual game worlds (e.g., World of Warcraft) |

Based on Kaplan and Haenlein's (2010) classification displayed in Table 9, Dao (2015) developed a classification scheme of social media sites for educators concerning the social presence and media richness, presented in Table 10. He added the characteristics of participation, openness, conversations, community and connectedness. Also, he listed general classroom applications and potential classroom functions.

**Table 10** *The Social Media Classification Scheme for Educators (Dao, 2015, p. 92)*

| | Social Media Types | | | | | |
|---|---|---|---|---|---|---|
| | Collaborative Projects | Blogs | Content Communities | Social Networking Sites | Virtual Game Worlds | Virtual Social Worlds |
| **Classification Elements** | | | | | | |
| **1. Social Presence/ Media richness** | Low | Low | Medium | Medium | High | High |
| **2. Selfpresentation/ Self- Disclosure** | Low | High | Low | High | Low | High |
| **Characteristics** | | | | | | |
| **1. Participation** | √ | √ | √ | √ | √ | √ |
| **2. Openness** | √ | √ | √ | √ | | |
| **3. Conversations** | √ | √ | √ | √ | √ | √ |
| **4. Community** | √ | √ | √ | √ | √ | √ |
| **5. Connectedness** | √ | √ | √ | √ | | |
| **Prevalent Classroom Applications** | PBworks | WordPress or Blogger | YouTube, SlideShare, Flikr, or Skype | Facebook | World of Warcraft | Second Life |

The previously presented classifications of media used in teaching cover a considerable part of the different media types. The classification proposed in Table 11 summarises and extends the classifications presented so far.

**Table 11** *Classification of Educational Media*

| Print Media | Visual and Audio Media | Web-based Activities | Social Networking Sites and Messenger |
|---|---|---|---|
| Books | Audio devices (e.g. CD player, MP3 player) | Blogs (e.g., Blogger, WordPress) | Facebook |
| Journals and Articles | Beamer and Presentations | Cloud-Services (e.g. One Drive, Google Drive, Dropbox) | FB-Messenger |
| Magazines | Blackboard and chalk | Collaborative projects (e.g., Wikipedia) | Instagram |
| News papers | Digital books (e-books) | Content communities (e.g., Slide Share, Vimeo) | Snapchat |
| Textbooks | Flipchart | Digital tasks submission | Twitter |
| Work books | Interactive media, e.g. simulations with feedback | Digital feedback on tasks | WhatsApp |
| | Podcasts (e.g. iTunes) | Discussion forums | YouTube |
| | Recorded lecture (Video or Audio) | Email to students | |
| | Screen capture (e.g. Camtasia, Jing, Screencastomatic, Captivate) | ePortfolios (e.g. Mahara) | |
| | Subject-specific software | Online surveys | |
| | TV / DVD | Peer review (e.g. Moodle) | |
| | Video | Smartphones | |
| | Whiteboard | Tablet-PC | |
| | | Tests, Quizzes, E-Assessments | |
| | | Video/web conferencing (e.g. WebEx, Adobe Connect, Skype) | |
| | | Virtual social worlds (e.g. Second Life) | |
| | | Virtual game world (e.g., World of Warcraft) | |
| | | Web pages/resources | |

### 5.3 Media Use in Higher Education

Several studies analyse which media are used by lecturers in HE institutions. Bond et al. (2018) studied digital tools used in face-to-face teaching by 381 lecturers and 200 students at the University of Oldenburg, Germany. Lecturers from six faculties evaluated the perceived usefulness of the tools and the frequency of their use. The majority of the lecturers (80%) used the LMS in every course. However, they did not use most integrated tools, except forums and, to a lesser degree, wikis. Compared to the use of the tools, the lecturers' assessment of their usefulness is somewhat higher, with 93% of the lecturers rating the LMS as “very” or “quite useful”. Other tools rated as applicable were institutional cloud storage (62%), collaborative reference management software (61%), collaborative annotation tools (57%), forums (53%), collaborative mind maps (53%) and video records of lectures (52%). The study (Bond et al., 2018) also found remarkable differences in the perception of individual tools' usefulness between students and lecturers. There were opposing ratings for the perceived usefulness of three tools: 27% of the lecturers rated lecture recordings as “not useful at all” compared to the students, of whom 57% said they found the tool “very useful”. The other two tools assessed very differently are instant messaging and institutional cloud storage; students considered them more valuable than lecturers. In summary, the results (Bond et al., 2018) show that both lecturers and students use a limited number of tools, with the LMS being rated as the most helpful tool.

According to Watson and Watson's (2007) definition, an LMS “is the framework that handles all aspects of the learning process. An LMS is the infrastructure that delivers and manages instructional content, identifies and assesses individual and organisational learning or training goals, tracks the progress towards meeting those goals, and collects and presents data for supervising the learning process of an organisation as a whole” (p. 28).

Sinclair and Aho (2018) interviewed Moodle administrators at one Finnish and one British university about the functions used in the LMS. They found that most university staff use LMS only for essential functions. The primary benefit is better communication with students, but it is less used for improved teaching and learning.

Rahrough et al. (2018) conducted a quantitative and qualitative study on LMS use with 81 instructors from five Al Ain Campus colleges in the United Arab Emirates. They concluded that the number of years instructors have been using the LMS explains some variation in the number of activities used. The majority of instructors used only three of the

12 Moodle activities offered. According to Rahrouh et al. (2018), the most frequently used Moodle functions were uploading teaching materials (98%), announcements (74%), and assignments (70%), followed by online exams (51%) and grade checking (36%). The other functions were used by less than 20% of the lecturers; these were feedback (20%), Turnitin assignment (17%), forum (17%), learning outcome assessment (15%), attendance (11%), chatting (4%) and wiki (2%).

In addition to LMS tools, other media are also used at HE institutions. Kimmons (2020) analysed the most frequently used tools from 51,496 school websites and 1317 university websites in the USA in 2019 by analysing the links that refer to tools. According to Kimmons (2020), schools and HE institutions linked mostly freely available, non-educational tools like social media sites (e.g. Facebook, Twitter, LinkedIn and Instagram), media sharing sites (e.g. YouTube), Google tools (e.g. Google Docs, Gmail, Google Sites and Google Translate) and various tools that support school management (e.g. SchoolMessenger and virtual campus tour).

Manca and Ranieri (2016) found that while there is much research on students' use and expectations of social media, there is very little on their use in teaching. They surveyed 6139 lecturers at Italian HE institutions, and their results show low usage of social media in HE courses. At least one tool was used monthly by less than 40% of the lecturers, and less than 40% indicated that they considered social media useful for teaching purposes. Gender did not influence the use of social media, but age did. Younger instructors were more likely to use social media in the lesson, with older faculty using Twitter more often than younger ones. In Manca and Ranieri's (2016) study, scientific discipline was the factor that best predicted social media use. Faculty from the Arts and Humanities and Social Sciences used social media more frequently than those from other disciplines. Also, the types of social media usage varied by profession.

Amhag et al. (2019) undertook a study with 105 teacher educators to determine how they use information technology. They distinguished four areas of use: teaching, communication, administration, and research. Only one of these areas of use was related to education. Information technology in teaching was mainly used to establish a digital classroom. Amemado (2014) also concluded that HE institutions do not implement technology primarily for pedagogical reasons and that teaching and learning task-related aspects play a more critical role later.

Marcelo et al. (2015) surveyed 941 Andalusian lecturers from ten universities to determine which digital technologies they use and how. They concluded that teachers teach with limited integration of information technologies. The applications that scored highest were those that support instructor-centred teaching and are easy to implement. Technologies that are advanced and specific were used less. Marcelo et al. (2015) concluded that “technology alone does not change the learning environment. It requires a more intense intervention in which technology accompanies teaching and learning strategies that not only prioritise the acquisition of knowledge based on digital resources but that are based on the appropriation processing of this knowledge by students through productive, experiential or communicative learning activities” (p. 122).

# 6 Digital Pedagogy

Pedagogy is guiding the learner to learn. The focus is always on pedagogy, even if it guides the use of technology. However, pedagogy is closely related to the technologies of learning. Consequently, the scope and style of pedagogy are changing with technological change. Digital technologies change the relationship between lecturers, learners and what they learn. For this reason, the style and scope of pedagogy must be constantly reconsidered and adapted to the digital age and its challenges (Beetham & Sharpe, 2013).

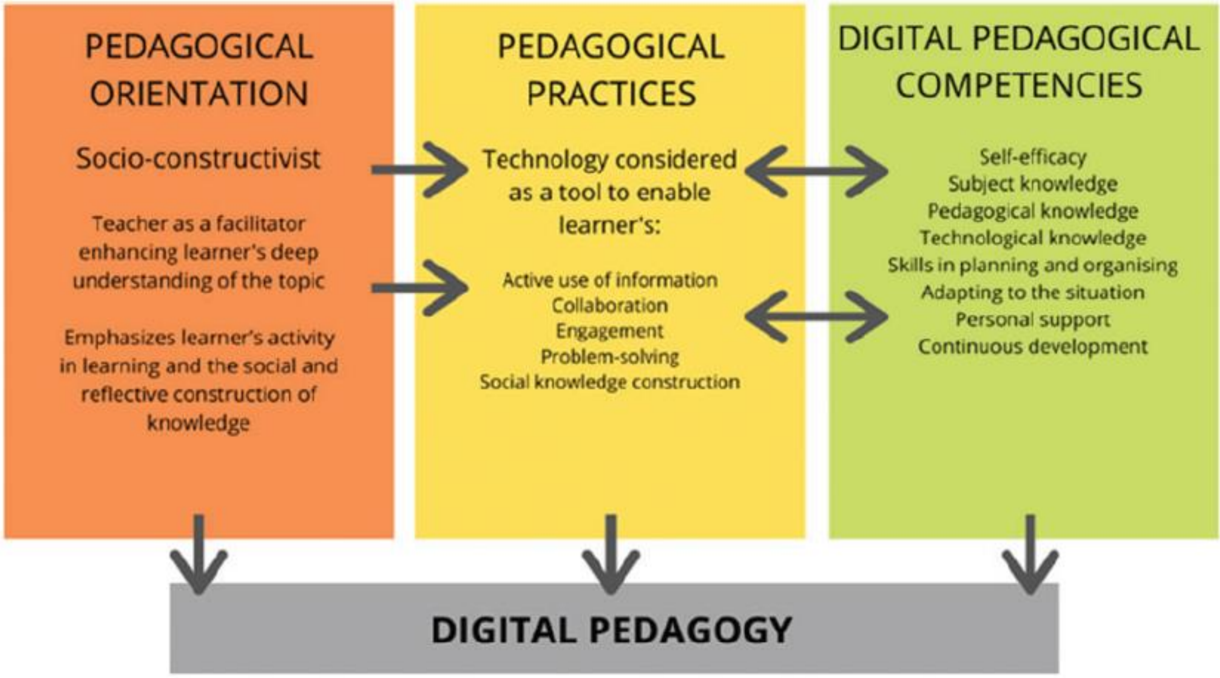
According to Howell (2012), digital pedagogy is "the study of how to teach using digital technologies" (p. 5). For Croxall (2013), digital pedagogy enhances the educational experience through electronic elements. According to a current definition, "digital pedagogy can be fundamentally defined as the pedagogical use of digital technologies" (Väätäjä & Ruokamo, 2021, p. 6).

Spence and Brandao (2020) stated that digital pedagogy could cover topics as diverse as blended learning, open educational resource, MOOCs, network learning, and new literacy studies. It ranges from using simple to more advanced methods. It can be about content and processes and the tools and platforms used (Spence & Brandao, 2020). Kivunja (2013) believed that adopting a technically-oriented pedagogy and content knowledge strategies is necessary. For him (Kivunja, 2013), digital pedagogy specifically involves using and implementing Mishra and Koehler's (2006) TPACK model.

## 6.1 Dimensions and a Model for Digital Pedagogy

Väätäjä and Ruokamo (2021) conducted a literature review on digital pedagogy. It was based on 12 peer-reviewed articles published in English between 2014 and 2019 and included empirical or theoretical research on digital pedagogy. The theoretical framework most frequently discussed in the articles was the TPACK model by Mishra and Koehler (2006). Based on the literature research, Väätäjä and Ruokamo (2021) derived a model with three dimensions of digital pedagogy: (1) pedagogical orientation, (2) pedagogical practice and (3) digital pedagogical competencies. Figure 8 shows this model for digital pedagogy.

**Figure 8** *Conceptualisation of Dimensions and a Model for Digital Pedagogy (Väätäja & Ruokamo, 2021, p. 7)*




According to Väätäjä and Ruokamo (2021), Tondeur et al.'s (2017) concept of pedagogical beliefs is similar to their pedagogical orientation. Tondeur et al. (2017) understand this to mean teachers' beliefs about teaching and learning. This pedagogical belief system is complex and multi-layered. Butler et al. (2017) reported a change in the pedagogical orientation of teachers when they use digital tools. This referred to the design of a more student-centred learning environment and had positive effects for the learners on active control over their learning and a higher level of engagement and collaboration. Law (2009) describes three aspects that constitute the pedagogical orientation of teachers. These are the curriculum goals, the role of the teacher related to the teaching practice and the role of the students related to their learning practice. These aspects are measured in traditionally important, lifelong learning and connectedness. Law's (2009) study showed that the traditionally important orientation is the most popular and the connectedness orientation the least. Väätäjä and Ruokamo (2021) distinguish between two types of pedagogical orientation: constructivist and traditional. The traditional pedagogical orientation is teacher-led. Here, technology supports teacher-centred activities. In contrast, the constructivist pedagogical orientation is based on student-centred activities and the student's participation. Thus, technology is a tool that helps students learn. The pedagogical orientation is reflected in the pedagogical practice.

Following Wadmany and Kliachko (2014), this pedagogical practice encompasses digital pedagogy in an information and technology-based learning environment. In most cases, however, using information and communication tools will not result in teachers rethinking their teaching and learning processes. In contrast, teachers who apply constructivist teaching methods that focus on students tend to adapt digital media to teaching and learning purposes (Wadmany & Kliachko, 2014). Prestridge (2012) describes which teachers' beliefs influence their pedagogical practice and how they use ICT. For Prestridge (2012), this includes four factors: (1) foundational ICT practice, (2) developing ICT practice, (3) skill-based ICT practice, and (4) digital pedagogical practice. In detail, the digital pedagogical practice encompasses three different beliefs of teachers, namely, that digital media are tools but not the focus of instruction, that the role of the teacher is changing to a facilitator of self-directed learning, and that teachers should enable students to solve authentic problem-oriented tasks.

The third part of the digital pedagogy model of Väätäjä and Ruokamo (2021) covers digital pedagogical competencies. This includes the skills teachers need to integrate digital technologies into their teaching. The competencies in Väätäjä and Ruokamo's model refer, on the one hand, to how self-efficacy and personal knowledge are related to the integration of digital technologies, and on the other hand, to personal support and continuous development as part of the working environment.

### 6.2 Changes in Digital Pedagogy during the COVID-19 Distance Learning Phase

The COVID-19 pandemic affected learning on all continents, involving almost 1.6 billion learners in more than 190 countries (United Nations, 2020). Crawford et al. (2020) analysed the reactions of the HE sectors of 20 countries to the COVID-19 pandemic. Responses ranged from universities that reacted somewhat limitedly to universities that stopped attendance and switched entirely to distance learning. According to Crawford et al. (2019), universities that had already offered blended or online programmes before the COVID-19 pandemic had an easier time with this change.

In Germany, one reaction to the COVID-19 pandemic was the complete lockdown of universities and the switch to full distance learning (Ahrens & Zascerinska, 2021). In Austria, universities also switched to full distance learning after the semester had already started (Ebner et al., 2020). For this reason, HE institutions had to implement in just a few months a learning strategy that usually takes ten years to implement (Anderson, V., 2020). As a result, emergency remote teaching (ERT) became a global phenomenon (Hodges et al., 2020). In contrast to distance learning, which is planned and designed as such from the start, ERT is a temporary change of delivery mode due to a crisis. It involves complete distance learning for content that the lecturers would otherwise have taught face-to-face, blended learning or hybrid courses. According to Hodges et al. (2020), ERT aims to provide learning infrastructure for a limited time to enable educational continuity. Consequently, the differences between planned, conventional online teaching and ERT are significant.

Stewart (2021) conducted a literature review of 101 articles on ERT published between January and October 2020. The articles often discussed the difficulties, challenges and significant socio-economic inequalities. However, they also highlighted the potential for change in education in the future. Teachers were forced to use and adopt educational technologies to unprecedented levels. The pandemic has also shown the importance of distance learning in teacher training to prepare for emergencies. Stewart (2021) believes that the knowledge base for distance learning is not new, but it is new to a large proportion of teachers worldwide.

In German-speaking countries, universities used digital media only to a minimal extent before the COVID-19 crisis. The resulting Distance Learning Phase required the lecturers and students to use digital formats (Vallaster & Sageder, 2020). Due to the Distance Learning Phase, many lecturers had to deal with online teaching for the first time. They also learned its advantages, such as flexibility in terms of time for the participants and easier integration of experts from distant locations (Schubert et al., 2021). Other advantages such as easier access to education for learners in remote areas or for people who cannot attend traditional face-to-face classes for personal or financial reasons (Murphy, 2020) also became apparent. During this time, many lecturers put much effort into digitising their teaching formats and would like to continue using these digital media. In addition, HE institutions also made investments in their technical infrastructure to support distance learning. This experience has led to expectations about digital teaching (Zawacki-Richter, 2021). On the other hand, it has presented excessive demands, especially on vocational students who were also professionally challenged by COVID-19 (Limarutti et al., 2021).

Suppose teaching with digital media remains permanently anchored in HE institutions. In that case, strategic decisions and infrastructure are needed for HE institutions and know-how in digital media and engagement for teachers and students (Vallaster & Sageder, 2020). However, we should remember that learning with new media is not new. Therefore we should not talk about the "new" online learning but rather "what we should be talking about is effective, efficient and enjoyable learning that is facilitated and/or enhanced by the technologies available to the teacher, the learner and the school" (Kirschner, 2015, p. 313).

# 7 Digital Literacy and Digital Competences

Digital literacy and digital competencies are two frequently mentioned concepts in teacher education and training. This chapter looks at these terms and presents different frameworks for digital competencies. It focuses on HE and describes different perspectives and models in the USA, the European Union and the German-speaking countries specifically.

Spante et al. (2018) conducted a literature review to determine how the concepts of digital literacy and digital competence are defined and used in HE research. Their literature review includes 107 peer-reviewed publications in HE published between 1997 and 2017. According to them, digital literacy has been used more often and for a more extended period in HE research than digital competencies. Furthermore, most of the studies on digital literacy were published in English-speaking countries, i.e. the USA and the UK. On the other hand, publications on digital competencies are more likely to originate from European countries, excluding the United Kingdom, such as Spain, Italy and Scandinavia (Spante et al., 2018). The two concepts are usually mentioned in most publications but not explained further. Once the terms were defined, publications on digital literacy mostly referred to research and publications, whereas research on digital competence mostly referred to research and policy.

For Gilster (1997), “digital literacy is the ability to understand and use information in various formats from a variety of sources when presented on computers” (p.1). His definition was influential for the further discourse on digital literacy. Compared to the definition of “digital literacy”, the term “digital competence” is mainly defined based on policy documents of the European Union (Spante et al., 2018). According to the definition of the European Commission (2006), “Digital competence means the confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is underpinned by basic ICT skills: the use of computers to retrieve, evaluate, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet” (p. 15). In Ferrari's (2012) technical report on digital competences for the European Commission, “Digital Competence is the set of knowledge, skills, attitudes (thus including abilities, strategies, values and awareness) that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socialising, consuming, and empowerment" (p. 3-4).

## 7.1 "Medienkompetenz" in German-speaking Countries

In German-speaking countries, "Medienkompetenz" is often used instead of "digital literacy" and "digital competencies". According to Tiede (2020a), "Medienkompetenz" is an umbrella term. It translates into English as digital literacy, media literacy, digital competence, or media competence. The discourse on "Medienkompetenz" in Germany is based on the work of two authors (Blömeke, 2017): Baaker (1999) and Tulodziecki (1998). Baaker's (1999) work was decisive for media use outside of school and the theoretical discourse on "Medienkompetenz" and media education. Tulodziecki, on the other hand, influenced the discourse on media education in schools in Germany (Endberg, 2019).

Baaker (1999) defines "Medienkompetenz" as a special communicative competence. Media-literate persons are skilled in the use of all types of media for communication purposes and activities. Baacke (1999) divides the term "Medienkompetenz" into four areas: (1) media criticism, (2) media studies, (3) media use and (4) media design. Media criticism covers the identification of problematic social conditions. Media studies are related to the knowledge of what is available and operating the appropriate equipment. Media use includes the skills to apply and run programmes. Media design refers to the further development of the media system and creative applications.

Tulodziecki (1998) defines "Medienkompetenz" as acting appropriately, self-determinedly, creatively and socially responsibly in media contexts. Tulodziecki (1998) describes tasks and competences in dealing with media in the context of school media education. These are (1) selecting and using media offers while considering alternative actions, (2) designing and distributing media, (3) understanding and evaluating the design of media, (4) identifying and analysing media influences, and (5) understanding and assessing the conditions of media production and distribution.

## 7.2 Models of Digital Competencies

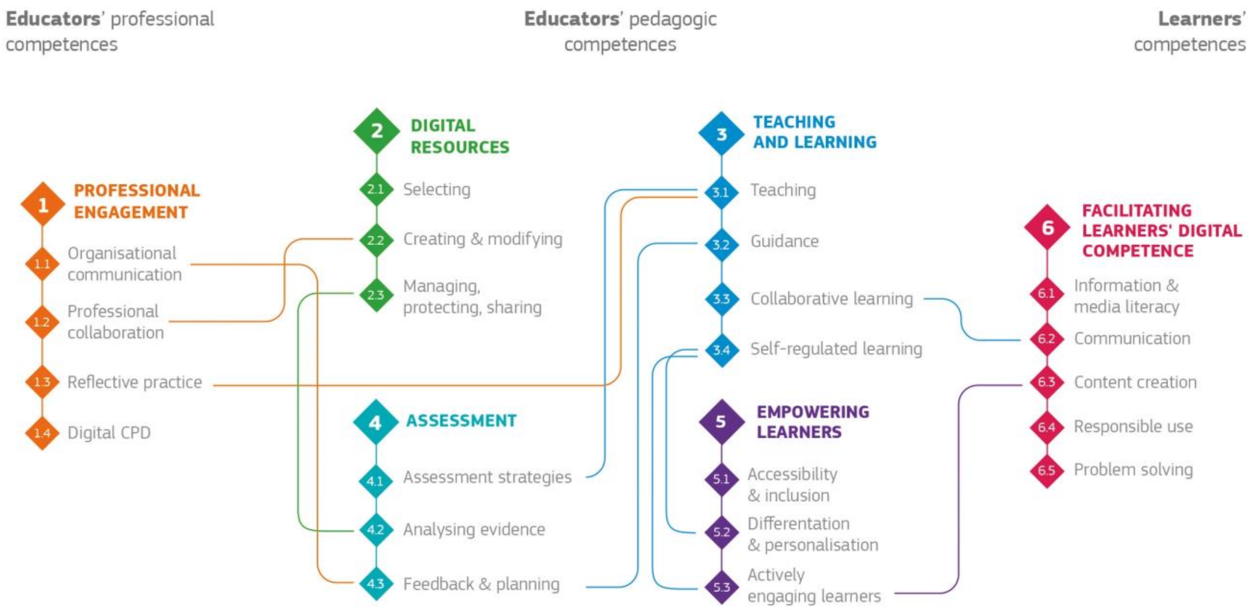
There are various models for mapping the digital competencies of teachers. Internationally, the TPACK model by Mishra and Koehler (2006) is often cited. According to Schmid and Petko (2020), the UNESCO ICT Competency Framework for Teachers (UNESCO, 2018), the ISTE Standards for Educators (Crompton, 2017) and the European Framework for Digital Competence of Educators - DigCompEdu (Redecker, 2017) are used particularly frequently internationally, but especially in Europe. In German-speaking countries, according to Blömeke (2000), the Model of Media Education Competence (Blömeke, 2000) and the Competence Structure Model from the M³K study (Herzig & Martin, 2017) are used in addition to the DigCompEdu model (Redecker, 2017).

Tiede (2020b) compared three models of media-related competencies, namely, the TPACK model, DigCompEdu and M³K. She justified her selection (Tiede, 2020b) with the criteria of innovative potential, impact, measurement instruments, and validation. The TPACK model distinguishes itself with an exceptionally high impact and a large number of measurements instruments. According to Tiede (2020b), the DigCompEdu has a high innovation potential and an extensive research background. Tiede (2020b) attributes an exceptionally high innovation potential to the M³K model because it summarises previous approaches, revises them and adds new ones. Following Tiede's (2020b) argument, these three models are used for the following comparison.

The TPACK model by Mishra and Koehler (2006) is described in a separate chapter in this thesis and therefore is not further elaborated on here. Still, it is considered to compare the three models for digital competencies.

The DigCompeEdu Framework is intended to support those responsible in European educational organisations to develop digital competencies among teachers. It assumes that educators need digital skills to use digital media in their teaching (Redecker, 2017). As shown in Figure 9, the DigCompEdu competence framework comprises 22 elementary competencies divided into six areas. The pedagogic competencies of educators are presented in Competencies 2 through 5. The second area includes skills to select, create and share digital resources. The third area is teaching and learning and thus the planning and design of digital media. The fourth area covers assessment, evaluating performance in the digital space. Finally, the fifth theme, empowering learners, highlights the potential of digital media for learning-centred teaching. With the DigCompEdu model, educators can assess their digital competencies in six areas at six stages (Redecker, 2017). The stages are Newcomer (A1), Explorer (A2), Integrator (B1), Expert (B2), Leader (C1) and Pioneer (C2).

**Figure 9** The *DigCompEdu Framework (Redecker, 2017, p. 8)*




In theoretical terms, the M³K structural competency model of "medienpädagogische Kompetenz" follows the work of Blömeke (2000), Gysberg (2008) and Tulodziecki et al. (2010). It was created within the framework of a funded study; the aim was to develop a competency structure model and a test for recording media-pedagogical competencies. As shown in Figure 10, the M³K model covers media didactics, media education and media-related school reform. The model also captures teachers' beliefs, self-efficacy, and technical knowledge (Herzig et al., 2015).

**Figure 10** *M³K Structural Competency Model of "Medienpädagogische Kompetenz" (Tiede, 2020b, p. 77; adopted from Herzig et al., 2015, p. 11)*

Schmid and Petko (2020) compared different media and digital literacy education models. They identified differences in subject area, concept of competencies, structure of the competence models, grading of competencies and theoretical connectivity and empirical validation. (1) Subject area: In DigCompEdu and M³K, the emphasis is on teachers' competencies to teach media-related skills to students. In comparison, TPACK focuses on using media for learning about a subject. (2) Concept of competencies: TPACK focuses on naming essential fields of competencies. DigCompEdu and M³K include a concrete, normative description of expected competencies. (3) Structure of the competence models: The M³K model includes a competence typology. Competencies are structured by combining competence dimensions. DigCompEdu and TPACK, on the other hand, are structural models; the structures of these facets are also represented graphically (Schmid & Petko, 2020). (4) Grading of competencies: Six competency levels are defined in the DigCompEdu Framework. Various requirement levels are also described in the M³K model. TPACK, in comparison, does not differentiate between any competence levels. (5) Theoretical connectivity and empirical validation: Both TPACK and M³K were developed and validated in the research context. However, the TPACK model is the most widely used in research and has various instruments to measure it. The DigCompEdu Framework was developed by a group of experts and has not yet been empirically fully verified.

# 8 Research Methods

The following chapter presents the research method of the thesis in detail. First, the overall design method and the explanatory sequential design are introduced. After that, the institutions and participants, the Austrian UAS and their lecturers are presented. The next part is devoted to the quantitative study. First, the research sample and the participants of the quantitative part, the participating lecturers of blended learning study programmes are described. The measures used in the survey are explained in detail, and the reliability of factors is presented. This description is followed by a description of the data analysis and the procedure for the quantitative data collection. After the description of the quantitative survey, the qualitative study is explained.

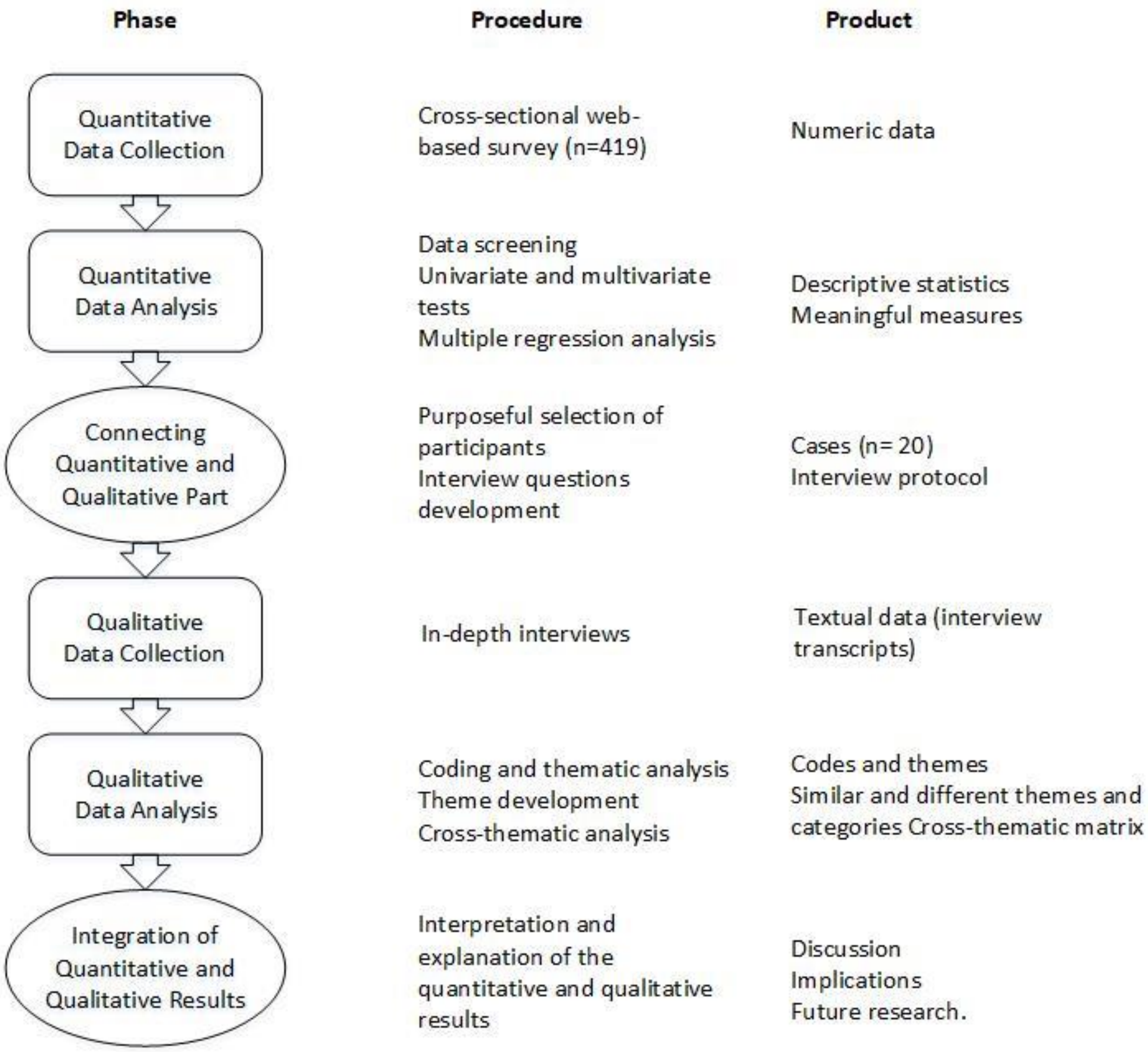
## 8.1 Overall Design Method

The research design is a mixed-method design. The quantitative survey describes the aspects of blended learning in UAS numerically and gives a general understanding of the topic. The following qualitative structured interviews explain the survey results by exploring the lecturer's perspective in more depth.

The quantitative survey comes first, and the qualitative structured interviews follow to explain the questionnaire results. Therefore, this is an explanatory sequential design (McMillan, 2016).

Subedi (2016) and Ivankova et al. (2006) defined a similar generic process to visualise the explanatory sequential design. Based on their examples, Figure 11 shows a visual model for the mixed-methods sequential explanatory design procedures of the study at hand. It consists of the following phases: quantitative data collection, quantitative data analysis, a connection of the quantitative and qualitative phases, qualitative data collection, qualitative data analysis and integration of the quantitative and qualitative results. Each step has an assigned procedure and product.

**Figure 11** *Visual Model for the Mixed-Methods Sequential Explanatory Design Procedure, adapted Figure based on Ivankova et al. (2006) and Subedi (2016)*




The quantitative data collection procedure is a cross-sectional Web-based survey (*n* = 419). The participants are lecturers teaching in a blended learning setting at Austrian UAS. The result of this phase is numeric data. The quantitative data analysis starts with data screening, followed by performing frequencies, univariate and multivariate tests, multiple regression analysis, and other analyses in SPSS. The products of this phase are descriptive statistics and other meaningful data to answer the research questions for the quantitative part. This is followed by connecting the quantitative and qualitative parts. The participants (*n* = 20) for the qualitative part are purposefully selected based on each group and the maximal variation principle. Along with this, the author develops the interview questions. The product of this phase is the interview protocol. The next step is qualitative data collection through the performance of structured interviews with 20 participants. The product of this phase is textual data in the form of transcripts of audio files. They are the basis for qualitative data analysis. This phase consists of coding and thematic research, theme development, and cross-thematic analysis. The products of this step are codes and themes, similar and different themes and categories, and a cross-thematic matrix. The last phase is integrating quantitative and qualitative results, which consists of the interpretation and explanation of the quantitative and qualitative findings. The resulting products are a discussion, implications and future research.

## 8.2 Institutions and Participants

The tertiary sector in Austria includes universities, UAS, teacher training colleges and private universities (Wadsack & Kasparovsky, 2007). In 2018, 278,052 students were studying at Austrian universities, 51,522 at UAS, 13,232 at teacher training colleges and 12,775 at private universities (Keplinger, 2018).

In most universities in Austria, e-learning courses are standard, and blended learning courses are most widely used (>50%). Some UAS and universities offer more than 50% of their classes in a blended learning format. At teacher training colleges, they are used only sporadically (Bratengeyer et al., 2016). From a legal point of view, the foundation and growth of the Austrian UAS became possible due to the 1993 Universities of Applied Sciences Law (Fachhochschul-Studiengesetz – FHStG, 1993). Section 3 (1) of the law contains the formulation that the university of applied sciences (UAS) are university-level degree programmes that provide scientifically founded vocational education and training (Mascha & Diem, 2012).

Part-time lecturers carry out a large part of the teaching at Austrian UAS, as stated in the answers to 21 parliamentary enquiries to the Austrian Federal Minister of Science, Research, and Economics in the 25th legislative period (Mahrer, 2017). In the academic year 2015/16, 2030 permanent staff and 12,645 part-time lecturers taught 48,100 students at the UAS (Mahrer, 2017). On average, full-time lecturers teach about 40% of the weekly semester hours. At almost half of the UAS, external lecturers conduct more than two-thirds of the teaching.

With this staffing structure, the UAS also face unique demands in lecturer training. According to Kiendl-Wendner et al. (2014), all full-time lecturers at most UAS are required to attend further education courses in university didactics. At the same time, so-called teaching awards or annual didactics days are impulses for professionalising teaching. All these activities are intended to help achieve the following goals: (1) provide all lecturers with well-founded didactic training that is adequate for HE institutions, (2) include quality assurance in teaching, (3) ensure a common basis of educational abilities and skills in teaching both for new and for more experienced working lecturers, (4) integrate existing e-learning services more quickly and increasingly into teaching, (5) encourage lecturers to reflect their own and new teaching methods, (6) support lecturers with the knowledge and experience of other lecturers, and (7) increase the attractiveness of the UAS as an employer for new lecturers (Kiendl-Wendner et al., 2014).

Twenty-one institutions offer courses of study at the Austrian UAS (Keplinger, 2018). The study programmes offered are also classified into training areas. They enrolled the following numbers of full-time students for the winter semester of 2017: Design and Art (890), Health Sciences (6,231), Military and Security Sciences (297), Social Sciences (3,966), Technology and Engineering Sciences (19,253) and Economics (20,102). Of these 51,522 students at Austrian UAS, 20,742 studied part-time (Keplinger, 2018).

Additionally, the courses of study are classified according to the ISCED fields of education of the International Standard Classification of Education (ISCED). “ISCED is designed to serve as a framework to classify educational activities as defined in programmes and the resulting qualifications into internationally agreed categories. Therefore, the basic concepts and definitions of ISCED are intended to be internationally valid and comprehensive of the full range of education systems” (UNESCO, 2012, p. 6).

The ISCED Fields of Education and Training 2013 (ISCED-F) domains (UNESCO, 2014) consist of the following categories: 00) Generic Programmes and Qualifications, 01) Education, 02) Arts and Humanities, 03) Social Sciences, Journalism and Information, 04) Business Administration and Law, 05) Natural Sciences, Mathematics and Statistics, 06) Information and Communication Technologies, 07) Engineering, Manufacturing and Construction, 08) Agriculture, Forestry, Fisheries and Veterinary, 09) Health and Welfare, 10) Services, and 11) Generic Programmes and Qualifications.

According to Kepplinger (2018), 40% of Austrian UAS students studied part-time, alongside their job. Petermandl (2009) identified three forms of part-time courses in Austria. The first model is the regular evening or weekend programme. This form is typical for Austrian UAS. During the semester, students attend face-to-face courses regularly in addition to their everyday professional activities. The second organisational model is the dual study programme. It is similar to the dual vocational training system typical for apprenticeship training. In Austria, there is only one example of a dual study organisation. In Germany, professional academies offer dual studies. The third model is the blended learning model. Face-to-face phases occur at intervals of two to six weeks during an extended weekend (e.g. Thursday to Saturday) or weekly blocks. Students do not work at their workplace but focus entirely on their studies during this time. During the time between the face-to-face phases, they study online in addition to their professional activities. This blended learning form of study organisation is typical for university training courses but is also offered more frequently by UAS now.

## 8.3 Quantitative Survey

In the quantitative part of the research methods chapter, the research sample, the participants of the quantitative part, the instrument, the data analysis, and the quantitative data collection procedure are presented. The research sample covers the description of lecturers at Austrian UAS. In the next chapter, the study participants are described in more detail. The survey instrument is presented in the measures section, which includes the reliability of factors. This section is followed by a description of the data analysis and the procedure for quantitative data collection.

### *8.3.1 The Research Sample*

The targeted population of this study consists of lecturers from Austrian UAS who are teaching in a blended learning study programme. The basis for this analysis is a statistic for the academic year 2018/19 provided by AQ Austria (Agency for Quality Assurance and Accreditation Austria). There are 476 degree programmes at Austrian UAS, of which 245 are conducted on a part-time basis. Since there are no statistics on the blended learning options of these degree programmes, the websites with the description of the teaching organisation of all degree programmes were reviewed. According to this survey, 48 study programmes at

UAS offer different forms of blended learning courses where many hours of face-to-face lesson time were replaced by distance learning. This number was determined based on the self-description of the degree programmes and can, therefore, vary over time.

Out of the 48 study programmes offered in the blended learning model, 18 are operated by the University of Applied Sciences Burgenland. The University of Applied Sciences Burgenland is the only university of applied sciences in Austria that implements the blended learning model in all part-time study programmes. At other UAS, only individual study programmes are offered in blended learning.

According to ISCED (UNESCO, 2014), of the 48 blended learning degree programmes at Austrian UAS, four study programmes belong to the category [03] Social Sciences, Journalism and Information, 15 to [04] Business, Administration and Law, nine to [06] Information and Communication Technologies, 15 to [07] Engineering, Manufacturing and Construction and five to [09] Health and Welfare. Within the research, different ISCED categories were compared among UAS that offer blended learning models.

### *8.3.2 Participants of the Quantitative Part*

The following section describes the demographic data of the survey participants. Table 12 covers gender, age and lecturers' education. The descriptive analysis of participants for didactic training and field of education is illustrated in Table 13.

Table 14 includes full-time or adjunct status, years in HE and years in blended learning of lecturers. The university sector and federal state are given in Table 15.

**Table 12** *Descriptive Analysis of Participants for Gender, Age and Lecturers' Education*

| | | N | Percent |
|---|---|---|---|
| Gender | Male | 250 | 59.7 |
| | Female | 146 | 39.1 |
| | Other | 5 | 1.2 |
| Age | up to and including 30 | 10 | 2.4 |
| | 31-40 | 69 | 16.5 |
| | 41-50 | 167 | 39.9 |
| | 51-60 | 139 | 33.2 |
| | 61 or higher | 34 | 8.1 |
| Education | Secondary School Certificate or equivalent | 6 | 1.4 |
| | Bachelor or equivalent | 17 | 4.1 |
| | Master or equivalent | 231 | 55.1 |
| | Doctoral or equivalent | 145 | 34.6 |
| | Habilitation or equivalent | 20 | 4.8 |

Among the lecturers who took part in the survey, 250 were male (59.7%), 164 were female (39.1%), with five others (1.2%), as seen in Table 12. The results match the official statistics (Radinger & Sommer-Binder, 2020). According to the official statistics, as of 31 December 2018, 5,078 male (62.5%) and 3,044 female (37.5%) lecturers were teaching at Austrian UAS. At the UAS, the two educational fields of business and technology are preferred (Radinger & Sommer-Binder, 2020). The assumption is that the number of male staff members in technical programmes is higher than in other programmes.

Most participants were aged ($M$ = 48.57, $SD$ = 9.00) between 41 and 50 (39.9%), followed by 51-60 (33.2%), 31-40 (16.5%), 61 or older (8.1%) and up to and including 30 (2.4%); these values are illustrated in Table 12. In the official statistics on all lecturers at Austrian UAS (Radinger & Sommer-Binder, 2020), 13.5% of the lecturers are up to 29 years old, 26.2% between 30 to 39 years old, 29.8% between 40 and 49 years old, 23.7% between 50 and 59 years old, 6.0% between 60-69 years old and 0.9% 70 years or older. Compared to the official statistics (Radinger & Sommer-Binder, 2020), more young and fewer middle-aged lecturers are measured. The reason could be that in the state statistics, the age of all lecturers is calculated as an average value for a full-time equivalent staff. In the blended learning survey at hand, the age range is analysed for all lecturers. There are more part-time than full-time lecturers, and a permanent position is usually only available with more professional and teaching experience, resulting in higher average age.

An overview of the lecturers' education levels is given in Table 12. More than half of the lecturers who participated in this survey hold a master's degree or equivalent as their highest academic degree. About one-third graduated with a doctorate. Over half (231 participants, or 55.1%) of the lecturers have a master's degree or equivalent as their highest degree. In comparison, only 34.6% (145 participants) hold a doctorate or equivalent. More lecturers have a habilitation (4.8%, 20 participants) than a bachelor's degree (4.1%, 17 participants). A secondary school certificate or equivalent as the highest degree is only reported by six people (1.4%).

Results illustrated in Table 13 show that 30.3% of the lecturers (127 persons) had participated in more than three didactic seminars. One-quarter (108 participants, or 25.8%) have a didactic education, 20.3% (85 participants) had attended one to three didactic seminars, and 15% (63 participants) completed a didactic seminar programme with a certificate of completion. Only 36 individuals (8.6%) have no didactic training. According to Kiendl-Wendner, Pöllinger and Egger (2014), all full-time lecturers at most Austrian UAS must attend further education courses in university didactics. The didactic seminars are offered individually and often as seminar programmes. These programmes can be mandatory for new lecturers. Many of these seminar programmes end with a certificate.

**Table 13** *Descriptive Analysis of Participants for Didactic Training and Field of Education*

| | | *N* | Percent |
|---|---|---|---|
| Didactic Training | No didactic training | 36 | 8.6 |
| | 1 to 3 didactic seminars | 85 | 20.3 |
| | More than 3 didactic seminars | 127 | 30.3 |
| | One didactic seminar programme with certificate of completion | 63 | 15.0 |
| | A didactic education | 108 | 25.8 |
| Field of Education | Education | 22 | 5.3 |
| | Arts and Humanities | 18 | 4.3 |
| | Social Sciences, Journalism and Information | 46 | 11.0 |
| | Business, Administration and Law | 124 | 29.6 |
| | Natural Sciences, Mathematics and Statistics | 22 | 5.3 |
| | Information and Communication Technologies | 73 | 17.4 |
| | Engineering, Manufacturing and Construction | 33 | 7.9 |
| | Agriculture, Forestry, Fisheries and Veterinary | 2 | 0.5 |
| | Health and Welfare | 54 | 12.9 |
| | Services | 7 | 1.7 |
| | Generic Programmes and Qualifications | 18 | 4.3 |

Table 13 shows that 29.6% (124 participants) of the lecturers taught in the field of Business, Administration and Law followed by Information and Communication Technologies with 17.4% (73 participants), Health and Welfare with 12.9% (54 participants) and Social Sciences, Journalism and Information with 11.0% (46 participants). Engineering, Manufacturing and Construction have 7.9%, with 33 answers. Under 30 mentions were received in the categories Education (5.3%, 22 participants), Natural Sciences, Mathematics and Statistics (5.3%, 22 participants), Arts and Humanities (4.3%, 18 participants), Generic Programmes and Qualifications (4.3%, 18 participants), Services (1.7%, seven participants) and Agriculture, Forestry, Fisheries and Veterinary (0.5%, two participants).

At Austrian UAS, preference is given to degree programmes in the fields of business and technology (Radinger & Sommer-Binder, 2020). This distribution also applied to lecturers who taught blended learning programmes at UAS.

Of all lecturers, 43.7%, or 183 people, worked full-time, while 56.3%, or 236 people, worked as adjuncts. The results of the employment status are given in Table 14. Part-time lecturers carry out a large part of the teaching at Austrian UAS. According to the answers to 21 parliamentary enquiries to the Austrian Federal Minister of Science, Research, and Economics in the 25th legislative period (Mahrer, 2017), in the academic year 2015/16, 2,030 permanent staff and 12,645 part-time lecturers taught 48,100 students at the UAS. On average, full-time lecturers taught around 40% of the weekly semester hours. At almost half of the UAS, external lecturers carried out more than two-thirds of the teaching. As of 31 December 2018, (Radinger & Sommer-Binder, 2020), 20,741 lecturers were teaching at UAS in Austria; when converted, that is the equivalent of 8,122 full-time lecturers. Therefore, the result showed that most lecturers who taught blended learning courses were adjunct staff.

**Table 14** *Descriptive Analysis of Participants for Full-time or Adjunct Status, Teaching Experience and Years in Blended Learning*

| | | *N* | Percent |
|---|---|---|---|
| Full-time or Adjunct | Full-time | 183 | 43.7 |
| | Adjunct | 236 | 56.3 |
| Teaching Experience | up to 5 | 81 | 19.3 |
| | 6-10 | 95 | 22.7 |
| | 11-15 | 91 | 21.7 |
| | 16-20 | 93 | 22.2 |
| | 21-25 | 34 | 8.1 |
| | 26 or more | 25 | 6.0 |
| Years in Blended Learning | 0 | 35 | 8.4 |
| | 1 | 112 | 26.7 |
| | 2-5 | 131 | 31.3 |
| | 6-10 | 86 | 20.5 |
| | 11-15 | 36 | 8.6 |
| | 16 or more | 19 | 4.5 |

The results concerning the number of years a lecturer has taught are illustrated in Table 14. The average was 13.46 years in HE ($M$ = 13.46, $SD$ = 8.59). Four of the items were indicated by about 20% of the participants: six to ten years (22.7%, 95 participants), 16 to 20 years (22.2%, 93 participants), 11 to 15 years (21.7%, 91 participants) and up to five years (19.3%, 81 participants). Only 21 to 25 years (8.1%, 34 participants) and over 26 years (6.0%, 25 participants) were mentioned less frequently. The groups with different teaching experiences were distributed similarly. These findings also match the result that 73.0% of all lecturers were between 41 and 60 years old. They have had many years or decades of teaching experience.

Table 14 summarises the results for the years the lecturers taught in blended learning settings: 8.4% or 35 participants had less than a year, and 26.7% (112 participants) had one year of experience in blended learning. A total of 131 participants (31.1%) had taught for 2-5 years, while 86 participants (20.5%) had been teaching for 6-10 years in blended learning mode. Thirty-six participants (8.6%) had 11-15 years of teaching experience in blended learning; 19 participants (4.5%) had taught for more than 16 years in the blended learning mode.

There are remarkable differences when comparing years in blended learning, which indicates the experience in blended learning teaching, with the number of years in HE. Lecturers have considerably more teaching experience than experience in teaching in blended learning settings. It seems that they frequently started with blended learning later in their academic development.

Table 15 summarises the results for the university sector. Since this study only analyses the data on lecturers who taught at UAS, the number of participants for this sector is 100% or 419 participants. Eighty-nine of the 419 lecturers had also taught at public universities, 39 at private universities and 25 at university colleges of teacher education. Nearly one in four lecturers (full-time equivalent) in HE in Austria is currently working at a UAS (Radinger & Sommer-Binder, 2020). There is mobility of lecturers between sectors as about a quarter of the staff members of UAS teaching in blended learning settings have taught in two or more sectors simultaneously.

**Table 15** *Descriptive Analysis of Participants for University Sector and Federal State*

| | | *N* |
|---|---|---|
| *University Sector* | Public university | 98 |
| | University of applied sciences | 419 |
| | University college of teacher education | 25 |
| | Private university | 39 |
| *Federal State* | Burgenland | 179 |
| | Carinthia | 23 |
| | Lower Austria | 110 |
| | Upper Austria | 89 |
| | Salzburg | 26 |
| | Styria | 34 |
| | Tyrol | 25 |
| | Vorarlberg | 27 |
| | Vienna | 164 |

*Note.* The question on both the university sector and the federal states allowed multiple answers. Therefore, only the absolute values and no percentages are stated.

The results given in Table 15 show that most participants were lecturers teaching in Burgenland (26.4%, 179 participants), followed by Vienna (24.2%, 164 participants), Lower Austria (16.2%, 110 participants) and Upper Austria (13.1%, 89 participants). The other federal states are mentioned relatively rarely. These are Styria (5.0%, 34 participants), Vorarlberg (4.0%, 27 participants), Salzburg (3.8%, 26 participants), Tyrol (3.7%, 25 participants) and Carinthia (3.4%, 23 participants).

### *8.3.3 Measures*

An instrument for self-reporting (survey) was used to collect the data on blended learning and media use at Austrian UAS. The survey was conducted via the Web using

“Unipark” software, and the participants were invited by email. The research design of this part of the study is a quantitative cross-sectional study, a static group comparison. It is a non-experimental design in which the participants are assigned by a convenience sampling method.

The questionnaire topics consisted of demography, HE institutions, media usage, TPACK, technology use and difficulties in technology use. For the questionnaire, see Appendix A: Questionnaire. The demographic questions covered gender, age, the highest completed degree, the level of didactic training and the fields of education. Age and gender are standard questions. The possible answers for the highest degree completed were based on the 2011 ISCED (UNESCO, 2012) and adapted for the questionnaire. They consisted of five responses ranging from secondary school certificate or equivalent, bachelor or equivalent, master's or equivalent, doctoral or equivalent, to habilitation or equivalent.

The levels of didactic training are based on the literature (Kiendl-Wendner et al., 2014) and experience in the field of further training at UAS. The levels ranged from no didactic training, one to three didactic seminars, more than three didactic seminars, one didactic seminar programme with a certificate of completion, to a didactic education.

The ISCED Fields of Education and Training 2013 (UNESCO, 2014) are mapped in the question on the fields of education. The possible answers covered 11 items: Education; Arts and Humanities; Social Sciences; Journalism and Information; Business, Administration and Law; Natural Sciences, Mathematics and Statistics; Information and Communication Technologies; Engineering, Manufacturing and Construction; Agriculture, Forestry, Fisheries and Veterinary; Health and Welfare; Services and Generic Programmes and Qualifications.

The next area covers the lecturers' connection to teaching in HE institutions. The first question in this section is whether the lecturers teach adjunct or part-time, the second is about the years teaching in HE and the third addresses the years teaching in blended learning mode.

The answer options for HE sectors are from the official categorisation of the Austrian HE system. They are divided into four areas (Wadsack & Kasparovsky, 2007): public universities, UAS, private universities, and university colleges of teacher education. The same applies to the list of Austrian federal states. This is the official state list of Statistics Austria (Radinger & Sommer-Binder, 2020), which is based on Article 2 (2) of the Federal Constitutional Law (Bundes-Verfassungsgesetz, 1999). The items for this question were:

Burgenland, Carinthia, Lower Austria, Upper Austria, Salzburg, Styria, Tyrol, Vorarlberg and Vienna.

For the questions on media usage, a summary of existing classifications in the form of a meta-classification of educational media was compiled based on the literature (see the chapter on Meta-Classification of Educational Media). Since this classification contains 44 elements, only the main categories are included, and a separation of the Web-based activities into asynchronous and synchronous activities is carried out. The importance of synchronous and asynchronous exercises for blended learning is repeatedly emphasised in the literature (Bower et al., 2015; Ho, 2017; Picciano, 2009; Smits & Voogt, 2016). Media usage was investigated by four statements referring to media with a scale ranging from 1 (every lesson), 2 (once a week), 3 (1-2 times a month), 4 (a few times per semester), 5 (once a semester) to 6 (never).

The questionnaire of Chai and Koh (2017) is the basis for the TPACK part of the survey. They developed and validated several versions of TPACK questionnaires (Chai & Koh, 2017; Koh et al., 2013; Koh et al., 2015). The author translated and adapted the questions for the demands of the context of the Austrian UAS. Two native speakers checked the quality of the translation. It consists of 15 statements on TPACK with a 7-point Likert scale ranging from 1 (strongly disagree), 2 (disagree), 3 (somewhat disagree), 4 (neither agree or disagree), 5 (somewhat agree), 6 (agree) to 7 (strongly agree). The items are grouped into four subscales: Web-based Technological Knowledge (Web-TK), Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK) and Technological Pedagogical Content Knowledge (TPACK).

Of the two subscales in technology use, the first examines the Use Behaviour (UB) of the most common LMS activities. The nine items ranged from 1 (every lesson), 2 (once a week), 3 (1-2 times a month), 4 (a few times per semester), 5 (once a semester), to 6 (never). The second subscale on technology use concerns the perceived ease of use (PEOU) and is based on the TAM of Venkatesh and Bala (2008), which is described in the chapter on TAM. The author translated and adapted the questions for the needs of the Austrian UAS context. In particular, “LMS” replaces the generic concept “system”. It consists of four PEOU statements with a 7-point Likert scale ranging from 1 (strongly disagree), 2 (moderately disagree), 3 (somewhat disagree), 4 (neutral - neither disagree nor agree), 5 (somewhat agree), 6 (moderately agree) to 7 (strongly agree).

The last part of the questionnaire examines the potential difficulties of technology use. It is based on the second survey of schools implemented by the European Commission (2019). The author translated and adapted the questions for reasons of time and the Austrian UAS context. Two native speakers checked the quality of the translation. Moreover, some wordings related to school systems were replaced to meet the needs of the HE system. The questionnaire contains four subscales: equipment-related obstacles, pedagogy-related obstacles, attitude-related obstacles and other obstacles. The 11 statements had a scale ranging from 1 (a lot), 2 (partially), 3 (a little), 4 (not at all) to 5 (don't know/prefer not to say). For the questionnaire, see Appendix A: Questionnaire.

The entire questionnaire was administered in English. It was translated several times into German by native speakers and English lecturers to identify and minimise inconsistencies in the translation. The questionnaire was then entered into the online survey tool and tested by several lecturers and experts in blended learning.

### *8.3.4 Reliability of Factors in the Quantitative Part*

The internal consistency of the subscales was calculated using Cronbach's alpha within the reliability analysis. The results were described according to Taber (2018), who reported that “So, alpha values were described as excellent (0.93–0.94), strong (0.91–0.93), reliable (0.84–0.90), robust (0.81), fairly high (0.76–0.95), high (0.73–0.95), good (0.71–0.91), relatively high (0.70–0.77), slightly low (0.68), reasonable (0.67–0.87), adequate (0.64–0.85), moderate (0.61–0.65), satisfactory (0.58–0.97), acceptable (0.45–0.98), sufficient (0.45–0.96), not satisfactory (0.4–0.55) and low (0.11)” (p. 1278).

The reliability of media use, which consists of five items measuring the frequency of use of different media types, is $\alpha = 0.52$, which is a sufficient (0.45-0.96) alpha value (Taber, 2018).

TPACK concepts with 15 items have the overall reliability of $\alpha = 0.93$; according to Taber (2018), this is an excellent (0.93-0.94) alpha value. The different subscales have the following reliability: Web-TK ($\alpha = 0.68$), TPK ($\alpha = 0.84$), TCK ($\alpha = 0.80$) and TPACK ($\alpha = 0.90$). This means that, according to Taber (2018), the alpha values are satisfactory for Web-TK (0.58-0.97), fairly high for TPK and TCK (0.76-0.95) and high for TPACK (0.73-0.95).

The items of UB, which consist of nine items measuring the frequency of use of different LMS tools, have the reliability α = 0.83, which is a high (0.73-0.95) alpha value (Taber, 2018).

The concept of PEOU consists of four items, and its reliability is α = 0.92; according to Taber (2018), this is a strong (0.91-0.93) alpha value.

Obstacles with 11 items have the overall reliability of α = 0.82, which is a fairly high (0.76-0.95) alpha value (Taber, 2018). The different subscales have the following reliability: equipment-related obstacles (α = 0.61), pedagogy-related obstacles (α = 0.77), other obstacles (α = 0.73) and attitude-related obstacles (α = 0.47). This means that, according to Taber (2018), equipment-related obstacles had satisfactory (0.58-0.97), pedagogy-related obstacles and other obstacles satisfactory (0.58-0.97) and attitude-related obstacles sufficient (0.45-0.96) alpha values.

In summary, all alpha values were acceptable (0.45-0.98), according to Taber (2018).

### *8.3.5 Data Analysis*

SPSS Version 26.0 (2019) was used for data analysis. It is essential to screen the data for completeness (e.g. missing data), validity of answers (e.g. inaccurate or invalid data) and extreme values (e.g. outliers) before conducting further analysis. Due to the design of the questionnaire and the fully automated survey and collection of the data, the first two sources of errors could be excluded. Outliers were handled sensitively, as inclusion can hamper further analysis, but overly rigorous removal may also adulterate the results. With this in mind, all data were included. Normal distribution, homogeneity of covariance matrices, and linearity are the basic assumptions for performing multivariate statistical analysis (Mertler & Reinhart, 2017). The data were assessed to ensure that these assumptions were met. In addition to descriptive statistics (mean, standard deviation, correlation and frequencies), data were analysed by performing one-way univariate analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA) tests (factorial ANOVA and factorial MANOVA). Multiple regression analysis was also applied. Cronbach's alpha was calculated with reliability analysis to calculate the subscales' internal consistency.

The influence of one independent variable on dependent variables was analysed with an ANOVA. The one-way MANOVA extends the one-way ANOVA. One-way MANOVA combines several independent variables into a new dependent variable. MANOVA tests for differences between the statistically significant groups among these newly created variables (Mertler & Reinhart, 2017).

One-way MANOVA was performed for testing Hypothesis 1 (independent variable field of education, dependent variables TPACK, TCK, TPK and Web-TK), Hypothesis 3 (independent variable lecturer's didactic education, dependent variable media use), Hypothesis 4 (independent variable lecturers' employment status, dependent variables TPACK, TCK, TPK and Web-TK), Hypothesis 6 (independent variable field of education, dependent variables synchronous or asynchronous media) and Hypothesis 8 (independent variable field of education, four dependent variables of difficulties of technology use).

The two-way MANOVA extends the one-way MANOVA. The main objective of the two-way MANOVA is to detect whether there is an interaction between the two independent variables on any of the two dependent variables (Mertler & Reinhart, 2017). Four- and five-way MANOVA are extensions of the same principle.

A four-way MANOVA was performed to test Hypothesis 2. The independent variables were highest degree (lecturers' education), gender, age and years in HE (years of service), while the dependent variables were TPACK, TCK, TPK and Web-TK. A five-way MANOVA was conducted for Hypothesis 5. The five independent variables for media infusion were (1) print media, (2) visual and audio media, (3) asynchronous Web-based activities, (4) synchronous Web-based activities and (5) social networking sites and messengers, while the dependent variables were TPACK, TCK, TPK and Web-TK.

Simple linear regression aims to predict a criterion variable (i.e. dependent variable) based on a predictor variable (i.e. independent variable). Multiple regression includes several independent variables. Standard multiple regression enables measuring the overall fit (variance) of the model and the relative contribution of each indicator to the overall variance (Mertler & Reinhart, 2017).

The influence of two or more independent variables on a single dependent variable was analysed with an ANOVA. Standard multiple regression analyses were performed for testing Hypothesis 7. The dependent variables were UB and PEOU; the independent variables were Web-TK, TPK, TCK, and TPACK.

#### *8.3.6 The Procedure for the Quantitative Data Collection*

The Unipark software was used for the implementation of the Web-based questionnaire. It was made available online from 31 May 2020 to 12 July 2020. In the end, the survey reached 1,395 people, had a net contribution of 730 participants and 495 people completed the entire questionnaire, of whom 419 are lecturers teaching at UAS.

Various recruitment techniques were used to ensure a sufficient number of participants in the survey. An invitation to participate in the survey was sent to personal contacts of lecturers and with the fnma newsletters. The fnma is a nationwide and inter-university e-learning network in Austria. As a next step, the managing director and the rector of the University of Applied Sciences Burgenland sent the invitation to their colleagues at all UAS in Austria. Based on this email, all lecturers of the University of Applied Sciences Burgenland and the University of Applied Sciences Upper Austria received a personal invitation. After that, the link to the survey was shared on the social networks LinkedIn, Twitter and Facebook within contacts of lecturers.

People responsible for e-learning and/or programme directors at UAS were identified based on records as further potential participants and disseminators of the survey. More than 500 personal e-mails were sent to individuals from these groups as a recruitment strategy. Some people forwarded the questionnaire to their lecturers, e.g. at the University of Applied Sciences BFI Vienna. In the last step, all programme directors of the University of Applied Sciences Burgenland were contacted by phone, kindly asking them to remind their lecturers to fill in the questionnaire.

### 8.4 Qualitative Study

This thesis is an explanatory mixed-method study, so the qualitative part explains the quantitative research results in more detail and develops them further. Structured interviews with the programme directors of blended learning study programmes at Austrian UAS were conducted to achieve this goal.

#### *8.4.1 The Research Sample for the Qualitative Study*

Every degree programme at an Austrian UAS is led by the head of the teaching and research staff, the so-called programme director. They are responsible for further developing the curricula and leading the teaching and research staff (Schweighofer, 2011).

The executive body ("Kollegium") is responsible for the implementation and organisation of teaching at UAS. It includes six programme directors, six representatives of teaching and research staff and four representatives of the students, in addition to the head of the Kollegium and their deputy (Hauser, 2019). From this, it follows that a proportionally large number of programme directors are involved in the implementation and organisation of teaching and assessment activities for the entire institution.

The operational tasks of the programme directors include coordinating the content of the individual courses, semester planning, coordinating the area of examinations, coordinating the educational focus defined in the particular UAS degree programme in accordance with the objectives defined in the accreditation application and tasks within the scope of personnel recruitment and degree programme-specific public relations work, and monitoring the academic and pedagogical quality of the particular programme (Hauser & Schweighofer, 2017).

Therefore, the programme directors are responsible for the study matters of their study programme. One of the central tasks is the selection of students and lecturers. Lecturers are either employed full-time at a UAS or recruited from academia and business on a part-time basis for a maximum of six teaching hours per week. Usually, the programme director also holds courses (Leitner, 2004).

The principle of freedom of teaching, which is anchored in the University of Applied Sciences Studies Act, obliges all bodies of UAS institutions, and thus also the programme directors, to respect the corresponding freedom of the lecturer in terms of content and methodology. For this reason, the programme directors have no right to give pedagogical directives (Hauser & Schweighofer, 2017). Thus, the programme directors are responsible for the lecturers and the quality of teaching but can only intervene to a limited extent under the freedom to teach.

### *8.4.2 Participants of the Qualitative Part*

The programme directors are responsible for the teaching staff in their study programmes and lecturers themselves. This position makes them particularly well suited and representative as interview partners to provide information about their lecturers.

The starting point for identifying blended learning programmes at Austrian UAS was a list of all current study programmes requested from the Fachhochschulkonferenz (FHK).

This list for the academic year 2018/2019 contained 476 degree programmes at UAS; 245 of these were conducted on a part-time basis. There are no statistics on the number of degree programmes in the blended learning format. Therefore, all websites of study programmes for the academic year 2019/2020 were searched manually for references to blended learning settings. As a result, 48 study programmes were identified that indicated in their self-description they offered blended learning; 18 were located at the University of Applied Sciences Burgenland. The other Austrian UAS that offered blended learning programmes were Campus Wien, Joanneum, Kufstein, Upper Austria, St. Pölten, Technikum, Health Professions Upper Austria and MCI. These 48 programmes are distributed across five ISCED fields of education (UNESCO, 2014), namely, (1) Social Sciences, Journalism and information; (2) Business, Administration and Law; (3) Information and Communication Technologies; (4) Engineering, Manufacturing and Construction and (5) Health and Welfare. For the qualitative study, 20 programme directors who led blended learning programmes in 2019 were interviewed. The participants are presented anonymously in Table 16.

**Table 16** *Participants of the Qualitative Study*

| Nr | Field of Education | Programme | University | Gender |
|---|---|---|---|---|
| P1 | Engineering, Manufacturing and Construction | Master | UAS1 | Male |
| P2 | Business, Administration and Law | Master | UAS1 | Female |
| P3 | Social Sciences, Journalism and Information | Bachelor | UAS1 | Male |
| P4 | Information and Communication Technologies (ICT) | Master | UAS3 | Male |
| P5 | Social Sciences, Journalism and Information | Master | UAS2 | Male |
| P6 | Information and Communication Technologies (ICT) | Master | UAS4 | Male |
| P7 | Information and Communication Technologies (ICT) | Bachelor | UAS1 | Male |
| P8 | Information and Communication Technologies (ICT) | Bachelor | UAS7 | Male |
| P9 | Social Sciences, Journalism and Information | Master | UAS1 | Male |
| P10 | Engineering, Manufacturing and Construction | Bachelor | UAS1 | Male |
| P11 | Health and Welfare | Bachelor | UAS5 | Female |
| P12 | Engineering, Manufacturing and Construction | Master | UAS5 | Male |
| P13 | Health and Welfare | Master | UAS1 | Male |
| P14 | Information and Communication Technologies (ICT) | Master | UAS6 | Male |
| P15 | Business, Administration and Law | Master | UAS2 | Male |
| P16 | Business, Administration and Law | Master | UAS7 | Male |
| P17 | Engineering, Manufacturing and Construction | Bachelor | UAS6 | Female |
| P18 | Health and Welfare | Master | UAS2 | Male |
| P19 | Business, Administration and Law | Master | UAS1 | Female |
| P20 | Business, Administration and Law | Bachelor | UAS7 | Female |

When selecting the interview partners, care was taken to create a heterogeneous group of interviewees. Austrian UAS degree programmes are assigned to five different fields of study. The interview partners came from all of these five fields; between three and five interview partners came from each field of study. In addition, the number of bachelor's programmes should correspond to the distribution in the area, with more master's than bachelor's courses being offered in the blended learning format. Ultimately, seven of the 20 programme directors interviewed managed bachelor's courses. Attempts were made to reach participants from all UAS that offer blended learning programmes. In the end, programme directors from seven out of nine UAS that offered blended learning programmes in 2019 participated. Women are underrepresented as programme directors at UAS, but five female programme directors participated in the qualitative study.

The interviews also provided information about how many years of experience the interviewed persons had as programme directors. To protect the anonymity of the participants, this information is not given in the overview table. Five persons were appointed as programme directors between 2000 to 2005. Eight interviewees took up the position between 2010 and 2015 and seven between 2015 and 2019.

### *8.4.3 Interview Protocol*

An interview protocol for structured interviews was developed based on the quantitative results and the literature. The connections between the interview protocol and the results of the tested hypotheses and the literature are described in detail in the qualitative results chapter at the beginning of each main category. The interviews with the course directors were conducted as guided interviews. In this procedure, the interviewer follows a list of questions and may deviate from the questions as needed to follow up on incidental findings (VanderStoep & Johnston, 2009). As VanderStoep and Johnston (2009) explained, an interview should include a setup, a report and a closing. Typically, it starts with questions about background information. The questions themselves should be open-ended and single-issued, avoiding “why” questions (VanderStoep & Johnston, 2009).

After developing the interview protocol, it was tested with two experts in blended learning to optimise the questions' comprehensibility and arrangement. The interview protocol for programme directors of Austrian blended learning courses is documented in Appendix B.

After two questions about background information, the first two introductory questions in the interview protocol were related to COVID-19 to find out what the interviewees had learned from the COVID-19 Distance Learning Phase and which changes they could imagine for the time afterwards. Later in the protocol, the respondents were asked how the COVID-19 Distance Learning Phase had changed the use of media by lecturers. In addition, several other questions about media use concerned the challenges for lecturers with low media use and two questions dealt with synchronous and asynchronous media use. Two questions examined in more detail the differences in the staff of the programme directors, including the differences between full-time and part-time teaching lecturers. Two questions covered the theme of advanced training and one question was on pedagogical support and pedagogical models.

### *8.4.4 The Procedure for Qualitative Data Collection*

Between 10 February 2021 and 22 March 2021, 20 interviews were conducted with programme directors of Austrian UAS who had already led blended learning courses before COVID-19. The contact details of the programme directors were found on the websites of the study programme, and the programme directors were contacted by email or telephone and asked if they would like to participate in the interview. Due to the situation caused by COVID-19, the interviews were not conducted in person but online with WebEx or MS Teams video conferencing software. After the participants were asked whether they agreed to the recording, the video was started. For documentation purposes, permission to record the interviews was asked again after recording. The 20 interviews lasted between 44 and 102 minutes, with an average length of 53 minutes.

The audio recordings were transcribed verbatim with minimal dialect smoothing and stuttering removal. In a further step, all transcripts were read back while listening to the interviews to check the transcription quality. Both the interviews and the transcripts were carried out in the mother tongue of the interviewees, which is German.

### *8.4.5 Data Analysis of the Qualitative Survey*

The transcripts were analysed according to qualitative content structuring analysis. This model is described in different variations in the literature, for example, by Lamnek and Krell (2016), Mayering (2015), and Kuckartz (2018).

The qualitative data analysis in this research follows the procedure of Kuckartz (2018). His process scheme consists of seven steps: (1) initial text work, which includes marking of important text and writing memos, (2) development of major thematic categories, (3) coding all material using the major categories, (4) compilation of all text passages coded with the same main category, (5) inductively determining subcategories on the text, (6) coding the complete text with the detailed category system, and (7) simple and complex analyses and visualisations (Kuckartz, 2018). MAXQDA 2020 (VERBI Software, 2019) was used for data analysis following this scheme.

The first phase of the analysis was initial text work (Kuckartz, 2018). This part involved marking significant text passages while the text was carefully read. Furthermore, remarks, comments and ideas for analysis were recorded. Major thematic categories were developed in the second phase of the analysis (Kuckartz, 2018). Since this study follows an explanatory research design, the qualitative interviews explain and further elaborate the quantitative study results. Therefore, the main thematic categories for the analysis of the transcripts were deductively derived from the results of the tested hypotheses, the literature section and current developments about COVID-19. In a first step, these were the following major categories: (1) lessons learned from the COVID-19 Distance Learning Phase, (2) changes from distance learning for blended learning, (3) changes for synchronous and asynchronous Web-based activities, (4) full-time and part-time lecturers, (5) differences in the group of lecturers, (6) further training requirements and demands for the future, (7) contents of further training, (8) types of further training, (9) models for media use, (10) changes in media use because of COVID-19, (11) reasons for synchronous and asynchronous media use, and (12) challenges for lecturers with low media use.

The transcripts were imported into the MAXQDA 2020 programme. Then the texts of three transcripts (P8, P10, P16) were assigned to the major categories to test the category system. This test showed that for some categories, there were very many, and for others, very few relevant text segments in the transcripts. In particular, the categories related to COVID-19 had disproportionately long replies from the respondents. Furthermore, a category system with 12 main categories is too broad to allow a quick overview. Therefore, the category system was reduced to five main categories: (1) pedagogical support for lecturers, (2) media use in teaching, (3) differences between lecturers in teaching, (4) lessons learned from the COVID-19 Distance Learning Phase and (5) changes after the COVID-19 Distance Learning Phase.

In the third phase of the analysis process, the entire material was coded with the major categories (Kuckartz, 2018). All texts were processed line by line in the first coding process, and main categories were assigned to the text passages by coding. The size of the text passages was chosen so that a coded segment could still be understood out of context. Since a text segment could contain various topics, assignment of multiple categories was possible.

The fourth phase involved the compilation of all text passages coded with the same main category (Kuckartz, 2018). This procedure was done with the help of text retrieval, which compiles all text passages belonging to one major category.

In the fifth step of the process, the subcategories were determined (Kuckartz, 2018). One major thematic category was selected at a time; each was then differentiated. The subcategories were first compiled as an unordered list and then ordered and systematised. These subcategories were formed deductively; they originate from the first version of the 12 main categories. Other subcategories, especially those related to COVID-19, were inductively formed from the material. The chapter on the qualitative results describes the formation of each subcategory. Figure 12 shows a graphic representation of the main categories and subcategories that served as the basis for coding all transcripts.

**Figure 12** *Graphical Overview of the Main Categories and Subcategories*

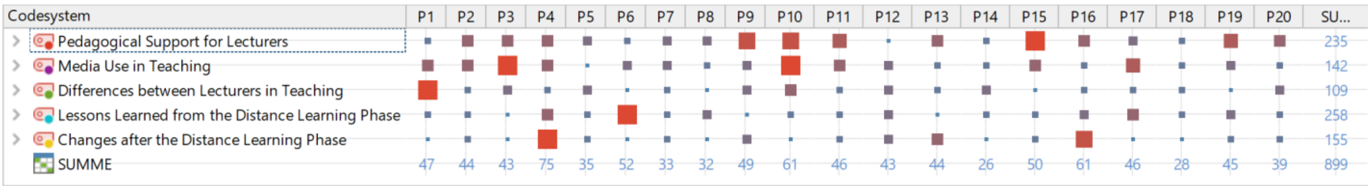

The definitions of the subcategories were recorded as code memos, then specific examples for the respective category were added. Table 43 shows an example from this process for the codes from the subcategory “Differences between full-time and part-time lecturers in teaching" with the corresponding definitions and examples. The result of this phase was a coding guide for the entire, now complete, classification system.

**Table 17** *Coding Guide for the Subcategory "Differences between full-time and part-time lecturers in teaching"*

| Code | Definition | Example |
|---|---|---|
| Differences in didactic competences | The programme directors who see differences between their part-time and full-time lecturers cite different didactic competence as a distinguishing feature. | "I would say that those who work full-time in teaching are better in terms of didactics, better in terms of the variety of teaching, and more flexible." (P1:28) |
| Differences in practical experience | The programme directors see differences between their part-time and full-time lecturers because external lecturers bring practical relevance to teaching. | "Because I want the part-time lecturer because of his practical experience and not because of his theoretical knowledge, which he taught himself at home in the evening. That is what the professor at the university of applied sciences is for." (P10:32) |
| Differences in the knowledge of internal processes | The programme directors believe that full-time lecturers have more internal processes and internal communication knowledge than part-time lecturers. | "We all know that the more I work digitally, the more programmes, tools and workflows I need. That means we have to brief the externals again and again very precisely about the processes, procedures and the tools and methods that are made available to them. That takes a lot more servicing with the externals than it does with the internals." (P12:80) |
| Differences in teaching areas | Full-time and part-time lecturers are assigned to different types of courses by the programme directors. | "I try, I have to say that now, to relocate basic subjects to the full-time professionals and to give what goes beyond that to the external, because that makes more sense." (P1:96) |

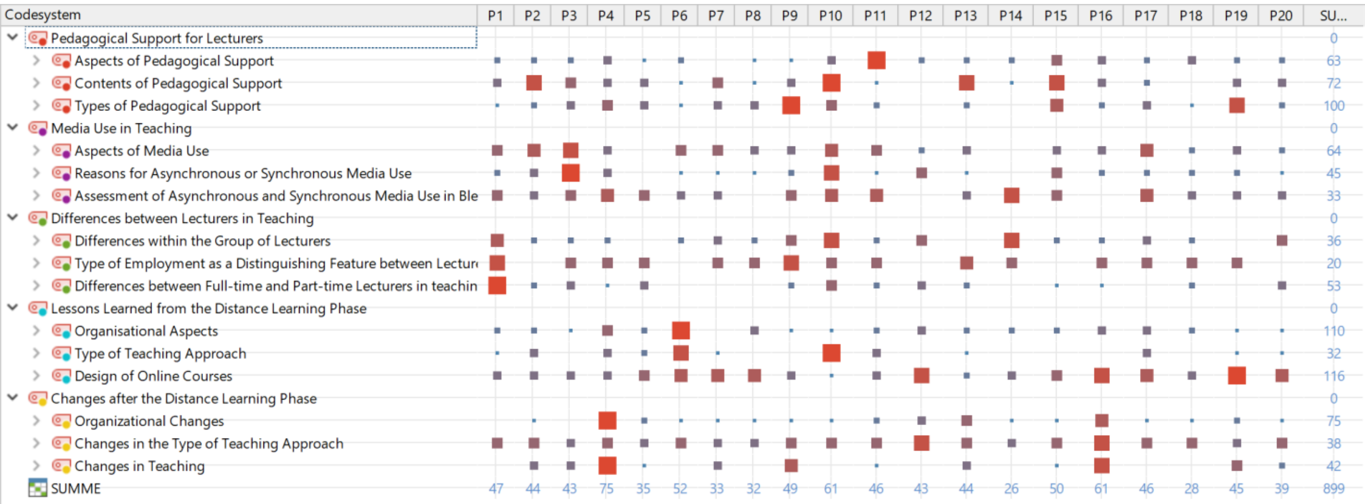
The sixth phase covered the second coding process. The entire transcripts were coded with the differentiated classification system (Kuckartz, 2018), shown in Figure 12, with the assistance of the coding guide, which is illustrated for one subcategory as an example in Table 43. In other words, the coding of the entire text was carried out with the main categories and the newly formed subcategories. The frequency of the coded segments per interview transcript varied. Figure 13 shows the distribution of the frequencies of the codes in the main categories according to the 20 interviews. The larger a square, the more codes were assigned to the category from that interview.

**Figure 13** *Distribution of the Frequencies of the Codes in the Main Categories*



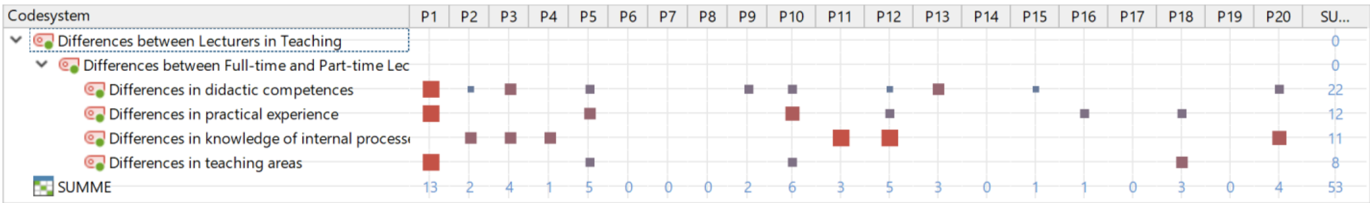

The distribution of the frequencies of the codes varied considerably in the individual subcategories, as shown in Figure 14.

**Figure 14** *Distribution of the Frequencies of the Codes in the Subcategories*




Some subcategories, such as “Changes in the Type of Teaching Approach”, included coded text passages from all qualitative interviews, as documented in Table 46 in the qualitative results section. Other subcategories did not contain coded segments from individual interview transcripts, for example, in the subcategory “Differences Between Full-time and Part-time Lecturers in Teaching”, presented in Table 43. The reason is that not all programme directors were able to identify differences between their staff. The distribution of the frequencies of the assigned codes for this example is shown in Figure 15.

**Figure 15** *Distribution of the Frequencies of the Codes in the Subcategory Differences Between Full-time and Part-time Lecturers*




Then, the allocation of the coded elements to the differentiated category scheme was rechecked for all 20 transcripts. As shown in Figure 1, the category scheme comprised five main categories with three subcategories each, or 15 subcategories. Each sub-class contained three to nine codes, for a total of 86 codes. Each code was assigned between four and 23 times. The qualitative results chapter gives a detailed overview of the coded elements for each main category.

The seventh and final phase of the data analysis included simple and complex analyses and visualisations (Kuckartz, 2018). First, the text passages per major category and subcategory were compiled. The frequencies of the subcategories and overlaps and connections between them were analysed. At the end of this process, the coded text passages and the notes written during the analysis were summarised and merged into the qualitative results chapters. The creation of Table 46 provided more in-depth insight into the interlinked relationships of “Changes in the Type of Teaching Approach”.

# 9 Quantitative Findings

The following chapter presents the results of the quantitative survey. First, the preliminary analysis is presented, including descriptive analysis, normality and reliability, and Pearson correlations among variables. Then the results of the eight hypotheses are presented.

## 9.1 Preliminary Analyses

The key features of the data are listed in Table 18. It summarises the means (M), standard deviations (SD), skewness, kurtosis and Cronbach alpha (α) values for all dependent variables. Concerning the skewness, all values except Web-TK, equipment-related obstacles and attitude-related obstacles ranged from -1 to +1 (Hair et al., 2019). Kurtosis was in the reasonable range from -1 and +1 (Hair et al., 2019) for all variables except Web-TK. All Cronbach alpha (α) values, except attitude-related obstacles, were above 0.50 (Taber, 2018). The variables with a lower Cronbach value measured the frequency of media use or the rating of obstacles.

**Table 18** *Descriptive Analysis, Normality and Reliability*

| Variables | *Mean* | *SD* | Skewness | Kurtosis | Cronbach's α |
|---|---|---|---|---|---|
| **Web-TK** | 5.87 | 1.17 | -1.30 | 1.68 | 0.68 |
| **TPK** | 5.07 | 1.46 | -0.78 | 0.14 | 0.84 |
| **TCK** | 4.97 | 1.55 | -0.75 | -0.06 | 0.80 |
| **TPACK** | 5.13 | 1.39 | -0.73 | 0.00 | 0.90 |
| **Use Behaviour** | 3.71 | 1.03 | -0.20 | -0.28 | 0.83 |
| **PEOU** | 4.82 | 1.60 | -0.53 | -0.67 | 0.92 |
| **Media Infusion** | 3.17 | 0.88 | 0.01 | -0.27 | 0.52 |
| **Obstacles: Equipment** | 3.41 | 0.77 | -1.07 | 0.94 | 0.61 |
| **Obstacles: Pedagogy** | 3.25 | 0.77 | -0.74 | 0.09 | 0.77 |
| **Obstacles: Attitude** | 3.35 | 0.78 | -1.05 | 0.90 | 0.47 |
| **Obstacles: Other** | 3.31 | 0.86 | -0.93 | 0.19 | 0.73 |

The four variables related to TPACK scored higher than the other variables; this is the case for Web-TK ($M$ = 5.87, $SD$ = 1.17), TPK ($M$ = 5.07, $SD$ = 1.46), TCK ($M$ = 4.97, $SD$ = 1.55) and TPACK ($M$ = 5.13, $SD$ = 1.39). The values for UB ($M$ = 3.71, $SD$ = 1.03) and PEOU ($M$ = 4.82, $SD$ = 1.60) were within the middle range of all variables. Obstacle-related variables had lower mean values overall; this was true for equipment (*M* = 3.41, *SD* = 0.77), pedagogy (*M* = 3.25, *SD* = 0.77), attitude (*M* = 3.35, *SD* = 0.78) and other obstacles (*M* = 3.31, *SD* = 0.86). Media Infusion (*M* = 3.17, *SD* = 0.88) had the lowest mean.

Table 19 presents the Pearson correlations among variables. The results showed significant correlations among all variables at different strength levels except PEOU, media use, and obstacle variables.

**Table 19** *Pearson Correlations Among Variables*

| | Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Web-TK | -- | | | | | | | | | | |
| **2** | TPK | .60** | -- | | | | | | | | | |
| **3** | TCK | .44** | .65** | -- | | | | | | | | |
| **4** | TPACK | .59** | .80** | .70** | -- | | | | | | | |
| **5** | UB | -.26** | -.35** | -.27** | -.45** | -- | | | | | | |
| **6** | PEOU | .21** | .30** | .26** | .32** | -.31** | -- | | | | | |
| **7** | Media Use | -.14** | -.23** | -.20** | -.26** | .42** | -.05 | -- | | | | |
| **8** | O: Equipment | -.06 | -.14** | -.01 | -.13** | .10* | .02 | .15** | -- | | | |
| **9** | O: Pedagogy | .06 | .13** | .19** | .17** | -.05 | .29** | .03 | .34** | -- | | |
| **10** | O: Other | -.07 | -.08 | .01 | -.05 | .08 | .13** | .09 | .38** | .41** | -- | |
| **11** | O: Attitude | -.08 | -.05 | .02 | -.04 | .08 | .16** | .08 | .40** | .43** | .94** | -- |

**. Correlation is significant at the 0.01 level.

*. Correlation is significant at the 0.05 level.

Results of the Pearson's correlation indicate that Web-TK had a strong correlation with TPK ($r(419) = .60$, $p < .001$) and TPACK ($r(419) = .59$, $p < .001$). It had a moderate correlation with TCK ($r(419) = .44$, $p < .001$). Web-TK had a low correlation with PEOU ($r(419) = .21$, $p < .001$) and a low negative correlation with UB ($r(419) = -.26$, $p < .001$) and with media use ($r(419) = -.14$, $p < .001$). No correlation was found with equipment-related obstacles ($r(419) = -.06$, $p = .249$), pedagogy-related obstacles ($r(419) = .06$, $p = .223$), other obstacles ($r(419) = -.07$, $p = .137$), or attitude-related obstacles ($r(419) = .08$, $p = .099$).

Based on the results of the study TPK had a strong correlation with Web-TK ($r(419) = .60$, $p < .001$), TCK ($r(419) = .65$, $p < .001$) and TPACK ($r(419) = .80$, $p < .001$). It had a moderate correlation with PEOU ($r(419) = .30$, $p < .001$) and a moderate negative correlation with UB ($r(419) = -.35$, $p < .001$). TPK's correlation with pedagogy-related obstacles was low ($r(419) = .13$, $p = .009$), those with media use ($r(419) = -.23$, $p < .001$) and with equipment-related obstacles ($r(419) = -.14$, $p = .005$) were low inverse. It is notable that no correlation existed between TPK and other obstacles ($r(419) = -.08$, $p = .102$) or attitude-related obstacles ($r(419) = -.05$, $p = .291$).

Strong correlations were observed between TCK and TPK ($r(419) = .65$, $p < .001$) and TPACK ($r(419) = .70$, $p < .001$), which had a moderate correlation with Web-TK ($r(419) = .44$, $p < .001$). There was a low correlation of TCK with PEOU ($r(419) = .26$, $p < .001$) and pedagogy-related obstacles ($r(419) = .19$, $p < .001$). A low negative correlation existed between UB ($r(419) = -.27$, $p < .001$) and media use ($r(419) = -.20$, $p < .001$). No correlation was found between equipment-related obstacles ($r(419) = -.01$, $p = .778$), other obstacles ($r(419) = .01$, $p = .819$) and attitude-related obstacles ($r(419) = .02$, $p = .677$).

Pearson's correlations found a strong correlation between TPACK and Web-TK ($r(419) = .59$, $p < .001$), TPK ($r(419) = .80$, $p < .001$) and TCK ($r(419) = .70$, $p < .001$). It had a moderate correlation with UB ($r(419) = -.45$, $p < .001$) and PEOU ($r(419) = .32$, $p < .001$). It must be noted that a low correlation of TPACK existed with media use ($r(419) = -.26$, $p < .001$), equipment-related obstacles ($r(419) = -.13$, $p = .007$) and pedagogy-related obstacles ($r(419) = .17$, $p < .001$). No correlation was observed with other obstacles ($r(419) = -.05$, $p = .264$) or attitude-related obstacles ($r(419) = .04$, $p = .389$).

UB had a moderate correlation with TPK ($r(419) = -.35$, $p < .001$), TPACK ($r(419) = -.45$, $p < .001$), PEOU ($r(419) = -.31$, $p < .001$) and media use ($r(419) = .42$, $p < .001$). It had a low correlation with Web-TK ($r(419) = -.26$, $p < .001$) and equipment-related obstacles ($r(419) = .10$, $p = .038$) and a low negative correlation with TCK ($r(419) = -.27$, $p < .001$). No correlation was found with pedagogy-related obstacles ($r(419) = -.05$, $p = .329$), other obstacles ($r(419) = .08$, $p = .114$) or attitude-related obstacles ($r(419) = .08$, $p = .122$).

A strong correlation was observed between PEOU and TPK ($r(419) = .30$, $p < .001$), UB ($r(419) = .32$, $p < .001$) and TPACK ($r(419) = -.31$, $p < .001$). PEOU had a low correlation with Web-TK ($r(419) = .21$, $p < .001$), TCK ($r(419) = .26$, $p < .001$), pedagogy-related obstacles ($r(419) = .29$, $p < .001$), other obstacles ($r(419) = .13$, $p = .007$) and attitude-related obstacles ($r(419) = .16$, $p = .001$). There was no correlation with media use ($r(419) = -.05$, $p = .315$) or equipment-related obstacles ($r(419) = .02$, $p = .647$)

Based on the results of the study, media use had a moderate correlation with UB ($r$(419) = .42, $p$ < .001). It had a low correlation with Web-TK ($r$(419) = -.14, $p$ = .006), and equipment-related obstacles ($r$(419) = .15, $p$ = .002). It must be noted that there was a low negative correlation between media use and TPK ($r$(419) = -.23, $p$ < .001), TCK ($r$(419) = -.20, $p$ < .001) and TPACK ($r$(419) = -.26, $p$ < .001). No correlation was found between media use and PEOU ($r$(419) = -.05, $p$ = .315), pedagogy-related obstacles ($r$(419) = .03, $p$ = .595), other obstacles ($r$(419) = .09, $p$ = .072) or attitude-related obstacles ($r$(419) = .08, $p$ = .110).

Results of the Pearson's correlation indicate that equipment-related obstacles had a moderate correlation with pedagogy-related obstacles ($r$(419) = .34, $p$ < .001), other obstacles ($r$(419) = .38, $p$ < .001) and attitude-related obstacles ($r$(419) = .40, $p$ < .001). There was a low correlation between equipment-related obstacles and UB (r(419) = .10, $p$ = .038) and media use ($r$(419) = .15, $p$ = .002). It had a low negative correlation with TPK ($r$(419) = -.14, $p$ = .005) and TPACK ($r$(419) = -.13, $p$ = .007). On statistical analyses no correlation was found between equipment-related obstacles and Web-TK ($r$(419) = -.06, $p$ = .249), TCK ($r$(419) = -.01, $p$ = .778) and PEOU ($r$(419) = .02, $p$ = .647).

A strong correlation was observed between pedagogy-related obstacles and equipment-related obstacles ($r$(419) = .34, $p$ < .001), other obstacles ($r$(419) = .41, $p$ < .001) and attitude-related obstacles ($r$(419) = .43, $p$ < .001). Pedagogy-related obstacles had a low correlation with TPK ($r$(419) = .13, $p$ = .009), TCK ($r$(419) = .19, $p$ < .001), TPACK ($r$(419) = .17, $p$ < .001) and PEOU ($r$(419) = .29, $p$ < .001). It is notable that no correlation existed with Web-TK ($r$(419) = .06, $p$ = .223), UB ($r$(419) = -.05, $p$ = .329) and media use ($r$(419) = .03, $p$ = .595).

There was a moderate correlation between other obstacles and equipment-related obstacles ($r$(419) = .38, $p$ < .001), pedagogy-related obstacles ($r$(419) = .41, $p$ < .001) and attitude-related obstacles ($r$(419) = .94, $p$ < .001). Other obstacles had a low correlation with PEOU ($r$(419) = .13, $p$ = .007) Pearson's correlation found no relationship with Web-TK ($r$(419) = -.07, $p$ = .137), TPK ($r$(419) = -.08, $p$ = .102), TCK ($r$(419) = .01, $p$ = .819), TPACK ($r$(419) = -.05, $p$ = .264), UB ($r$(419) = .08, $p$ = .114) or media use ($r$(419) = .09, $p$ = .027).

Attitude-related obstacles had a strong correlation with other obstacles ($r$(419) = .94, $p$ < .001). It is notable that a moderate correlation existed between equipment-related obstacles ($r$(419) = .40, $p$ < .001) and pedagogy-related obstacles ($r$(419) = .43, $p$ < .001). There was a low correlation with PEOU ($r$(419) = .16, $p$ = .001). No correlation existed between attitude-related obstacles and Web-TK ($r(419) = -.08$, $p = .099$), TPK ($r(419) = -.05$, $p = .291$), TCK ($r(419) = .02$, $p = .667$), TPACK ($r(419) = -.04$, $p = .389$), UB ($r(419) = .08$, $p = .122$) or media use ($r(419) = .08$, $p = .110$).

In conclusion, the TPACK (Web-TK, TCK, TPK and TPACK) variables had mainly strong correlations with each other and a relation with UB, PEOU and media use. PEOU correlated highly significant with UB, and UB correlated highly significant with media use. The obstacles variables had moderate correlations with each other and low or no correlation with the other variables.

## 9.2 Differences in Lecturers' TPACK Based on Their Fields of Education

The first hypothesis assumed that "There is a statistically significant difference in the level of technological, pedagogical and content knowledge (TPACK) of lecturers teaching in blended learning study programmes based on the ISCED fields of education."

A one-way MANOVA was conducted to determine the influence of fields of education on four dependent variables TPACK, TCK, TPK and Web-TK. The independent variable "field of education" had the following groups: Education; Arts and Humanities; Social Sciences, Journalism and Information; Business, Administration and Law; Natural Sciences; Mathematics and Statistics; Information and Communication Technologies; Engineering, Manufacturing and Construction; Agriculture, Forestry, Fisheries and Veterinary; Health and Welfare; Services; and Generic Programmes and Qualifications. The two groups Agriculture, Forestry, Fisheries and Veterinary and Services were eliminated because they had only two and seven participants, respectively. No data were missing because all items were mandatory selection items. MANOVA results revealed significant differences among the ISCED fields on the combined dependent variables [Wilks' $\Lambda = .768$, $F(3, 1502) = 3.48$, $p < .001$, $\eta^2 = .064$]. According to Cohen (2009), the effect size $\eta^2$ is assumed to be small (0.01), medium (0.06), and large ($\geq 0.14$).

ANOVA was conducted on each dependent variable as a follow-up test to MANOVA. Differences were significant for all fields: Web-TK [$F(8, 410) = 3.87$, $p < .001$, $\eta^2 = .070$], TPK [$F(8, 410) = 3.51$, $p = .001$, $\eta^2 = .064$], TCK [$F(8, 410) = 3.36$, $p = .001$, $\eta^2 = .061$] and TPACK [$F(8, 410) = 3.81$, $p < .001$, $\eta^2 = .069$]. The Tukey *post hoc* analysis revealed that ICT significantly differed in TPACK from Natural Sciences, Mathematics and Statistics, Engineering, Manufacturing and Construction and Health and Welfare in Web-TK, TPK and

TPACK. ICT significantly differed from Business, Administration and Law in TPK, TCK and TPACK.

Table 20 presents a MANOVA of Web-TK, TPK, TCK, and TPACK by field of education.

**Table 20** *Multivariate Analysis of Variance of Web-TK, TPK, TCK and TPACK Between Fields of Education*

| | Fields of Education | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *1* | | *2* | | *3* | | *4* | | *5* | | *6* | | *7* | | *9* | | *11* | | | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| Web-TK | 6.06 | 1.21 | 6.15 | 1.00 | 6.05 | 1.27 | 5.85 | 1.09 | 5.38 | 1.35 | 6.33 | 0.95 | 5.44 | 1.25 | 5.49 | 1.28 | 5.71 | 0.83 | <.001 | .070 |
| TPK | 5.68 | 1.30 | 4.75 | 1.92 | 5.27 | 1.65 | 4.92 | 1.49 | 4.53 | 1.48 | 5.61 | 1.00 | 4.62 | 1.49 | 4.77 | 1.46 | 5.41 | 1.02 | .001 | .064 |
| TCK | 5.12 | 1.67 | 4.43 | 1.77 | 4.81 | 1.50 | 4.62 | 1.71 | 5.54 | 1.00 | 5.51 | 1.18 | 5.45 | 1.50 | 4.74 | 1.51 | 5.00 | 1.52 | .001 | .061 |
| TPACK | 5.64 | 1.26 | 4.75 | 1.25 | 5.25 | 1.37 | 4.99 | 1.49 | 4.56 | 1.38 | 5.72 | 0.98 | 4.71 | 1.58 | 4.88 | 1.39 | 5.41 | 1.29 | <.001 | .069 |

*Note.* 1: Education, 2: Arts and Humanities, 3: Social Sciences, Journalism and Information, 4: Business, Administration and Law, 5: Natural Sciences, Mathematics and Statistics, 6: Information and Communication Technologies, 7: Engineering, Manufacturing and Construction, 9: Health and Welfare, 11: Generic Programmes and Qualifications

Lecturers scored highest in Web-TK from the fields of Education (*M* = 6.06, *SD* = 1.21), Arts and Humanities (*M* = 6.15, *SD* = 1.00), Social Sciences, Journalism and Information (*M* = 6.05, *SD* = 1.27), Business, Administration and Law (*M* = 5.85, *SD* = 1.09), ICT (*M* = 6.33, *SD* = 0.95), Health and Welfare (*M* = 5.49, *SD* = 1.28), and Generic Programmes and Qualifications (*M* = 5.71, *SD* = 0.83). Lecturers from the same fields scored lowest in TCK: Education (*M* = 5.12, *SD* = 1.67), Arts and Humanities (*M* = 4.43, *SD* = 1.77), Social Sciences, Journalism and Information (*M* = 4.81, *SD* = 1.50), Business, Administration and Law (*M* = 4.62, *SD* = 1.71), ICT (*M* = 5.51, *SD* = 1.18), Health and Welfare (*M* = 4.74, *SD* = 1.51), and Generic Programmes and Qualifications (*M* = 5.00, *SD* = 1.29).

Participants from the fields of Natural Sciences, Mathematics and Statistics and Engineering, Manufacturing and Construction scored highest on TCK (*M* = 5.54, *SD* = 1.00; *M* = 5.45, *SD* = 1.50) and lowest on TPK (*M* = 4.53, *SD* = 1.48; *M* = 4.62, *SD* = 1.49). Web-TK was highest for ICT lecturers (*M* = 6.32, *SD* = 0.95) and lowest for lecturers from the field of Engineering, Manufacturing and Construction (*M* = 5.44, *SD* = 1.25). TPK was generally rated lower than Web-TK. It was highest for lecturers from the field of Education (*M* = 5.69, *SD* = 1.30) and lowest for ICT lecturers (*M* = 5.61, *SD* = 1.00). Lecturers rated TCK as the lowest of all variables. It was highest for Natural Sciences, Mathematics and Statistics lecturers (*M* = 5.54, *SD* = 1.00) and lowest for Arts and Humanities (*M* = 4.43, *SD* = 1.77). TPACK was highest for ICT (*M* = 5.56, *SD* = 1.38) and lowest for Natural Sciences, Mathematics and Statistics (*M* = 5.72, *SD* = 0.98).

In conclusion, there were significant differences in TPACK, TCK, TPK and Web-TK based on the field of education. In particular, differences were significant between ICT lecturers and those from other areas. Overall, most participants scored highest in Web-TK and lowest in TCK.

### 9.3 Differences in Lecturers' TPACK Based on Their Education, Gender, Age and Years of Service

The second hypothesis was based on the assumption that "There is a statistically significant difference in self-assessments of TPACK based on lecturers' education, gender, age and years of service, in blended learning study programmes at universities of applied sciences in Austria." A four-way MANOVA was conducted to determine the influence of four independent variables on four dependent variables TPACK, TCK, TPK and Web-TK. The four independent variables were highest degree (lecturers' education), with the levels secondary school certificate or equivalent, bachelor or equivalent, master's or equivalent, doctoral or equivalent, and habilitation or equivalent; gender, with the levels male, female and other; age, with the levels up to and including 30, 31-40, 41-50, 51-60, and 61 and higher; and years in HE (years of service), with the levels 0-5, 6-10, 11-15, 16-20, 21-25, and 26 and higher. For the analysis, only categories with more than 20 participants were included. Therefore, the categories "secondary school certificate or equivalent" (6 participants), "bachelor or equivalent" (17 participants), "other gender" (5 participants) and "age up to and including 30" (10 participants) were excluded. No data were missing because all items were mandatory selections.

MANOVA results revealed no statistically significant main effects of any independent variable on the combined dependent variables, lecturers' education [Wilks' $\Lambda$ = .977, $F(8, 590) = .85$, $p = .560$, $\eta^2 = .011$], gender [Wilks' $\Lambda$ = .986, $F(4, 295) = 1.08$, $p = .366$, $\eta^2 = .014$], age [Wilks' $\Lambda$ = .968, $F(12, 781) = .80$, $p = .646$, $\eta^2 = .011$] and years of service [Wilks' $\Lambda$ = .957, $F(20, 979) = .66$, $p = .868$, $\eta^2 = .011$]. Furthermore, there was no interaction effect between any of the four independent variables on the combined dependent variables of TPACK. Differences were not significant for lecturers' education, gender, age and years of service on the combined dependent variables for Web-TK, TPK, TCK and TPACK.

ANOVA was conducted on each dependent variable as a follow-up test to MANOVA. Table 21 presents the MANOVA of lecturers' education.

**Table 21** *Multivariate Analysis of Variance of Lecturers' Education*

| | Lecturers' Education | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Master's or Equivalent* | | *Doctoral or Equivalent* | | *Habilitation or Equivalent* | | | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| Web-TK | 5.98 | 1.22 | 5.98 | 1.03 | 5.48 | 1.11 | .525 | .004 |
| TPK | 5.04 | 1.50 | 5.05 | 1.37 | 5.03 | 1.69 | .988 | .000 |
| TCK | 4.79 | 1.60 | 5.16 | 1.52 | 5.42 | 1.43 | .314 | .008 |
| TPACK | 5.06 | 1.44 | 5.12 | 1.34 | 5.08 | 1.50 | .852 | .001 |

Master's or equivalent was highest for Web-TK (*M* =5.98, *SD* = 1.22) and lowest for TCK (*M* = 4.79, *SD* = 1.60). Doctoral or equivalent and habilitation or equivalent were highest for Web-TK (*M* = 5.98, *SD* = 1.03; *M* = 5.48, *SD* = 1.11) and lowest for TPK (*M* = 5.05, *SD* = 1.37; *M* = 5.03, *SD* = 1.69). Web-TK was highest for master's or equivalent (*M* = 5.98, *SD* = 1.22) and lowest for habilitation or equivalent (*M* = 5.48, *SD* = 1.11). TPK was highest for doctoral or equivalent (*M* = 5.05, *SD* = 1.37) and lowest for habilitation or equivalent (*M* = 5.03, *SD* = 1.69). TCK was highest for habilitation or equivalent (*M* = 5.42, *SD* = 1.43) and lowest for master's or equivalent (*M* = 4.79, *SD* = 1.60). TPACK was highest for doctoral or equivalent (*M* = 5.12, *SD* = 1.34) and lowest for master's or equivalent (*M* = 5.06, *SD* = 1.34).

Table 22 presents the MANOVA of gender.

**Table 22** *Multivariate Analysis of Variance of Gender*

| | Gender | | | | | |
|---|---|---|---|---|---|---|
| | *Male* | | *Female* | | | |
| | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| Web-TK | 5.84 | 1.16 | 5.85 | 1.15 | .285 | .004 |
| TPK | 4.97 | 1.50 | 5.15 | 1.40 | .056 | .012 |
| TCK | 4.97 | 1.64 | 4.94 | 1.47 | .408 | .002 |
| TPACK | 4.96 | 1.46 | 5.26 | 1.29 | .084 | .010 |

Male and female scored highest for Web-TK (male: *M* = 5.84, *SD* = 1.16; female: *M* = 5.85, *SD* = 1.15). Differences between the genders in terms of their lowest score were insignificant. Male achieved the lowest values for TPACK (*M* = 4.96, *SD* = 1.46) and female for TCK (*M* = 4.94, *SD* = 1.47).

Table 23 presents the MANOVA of Age.

**Table 23** *Multivariate Analysis of Variance of Age*

| | Age | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *31-40* | | *41-50* | | *51-60* | | *61 and higher* | | | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| Web-TK | 6.09 | 1.13 | 5.97 | 1.15 | 5.66 | 1.18 | 5.53 | 0.94 | .176 | .016 |
| TPK | 5.35 | 1.45 | 5.15 | 1.45 | 4.79 | 1.51 | 4.88 | 1.16 | .247 | .014 |
| TCK | 5.41 | 1.40 | 5.17 | 1.52 | 4.60 | 1.65 | 4.44 | 1.42 | .200 | .015 |
| TPACK | 5.32 | 1.43 | 5.25 | 1.40 | 4.86 | 1.41 | 4.66 | 1.18 | .560 | .007 |

All age groups scored highest for Web-TK (31-40: *M* = 6.09, *SD* = 1.13; 41-50: *M* = 5.97, *SD* = 1.15; 51-60: *M* = 5.66, *SD* = 1.18; 61 and higher: *M* = 5.53, *SD = 0.*94). There were differences between the age groups in relation to the lowest values. Lecturers at the age of 31-40 had the lowest scores for TPACK (*M* =5.32, *SD* = 1.43), those at the age of 41-50 scored lowest for TPK (*M* =5.15, *SD* = 1.45), and TCK was lowest for the age groups of 51-60 (*M* = 4.60, *SD* = 1.65) and 61 and higher (*M* = 4.44, *SD* = 1.42). In contrast to the lowest scores, there was no variation for the highest scores. Web-TK, TPK, TCK and TPACK were highest for the age group 31-40 (Web-TK: *M* =6.09, *SD* = 1.13; TPK: *M* = 5.35, *SD* = 1.45; TCK: *M* = 5.41, *SD* = 1.40; TPACK: *M* = 5.32, *SD* = 1.43) and lowest for the age group 61 and higher (Web-TK: *M* =5.53, *SD = 0.*94; TPK: *M* = 4.88, *SD* = 1.16; TCK: *M* = 4.44, *SD* = 1.42; TPACK: *M* = 4.66, *SD* = 1.18).

Table 24 presents the MANOVA of years of service.

**Table 24** *Multivariate Analysis of Variance of Years of Service*

| | *Years of Service* | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *up to 5* | | *6-10* | | *11-15* | | *16-20* | | *21-25* | | *26+* | | | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| Web-TK | 5.95 | 1.21 | 6.07 | 0.98 | 5.78 | 1.28 | 5.76 | 1.16 | 5.61 | 1.13 | 5.69 | 1.05 | .827 | .007 |
| TPK | 4.95 | 1.42 | 5.22 | 1.35 | 4.91 | 1.57 | 5.01 | 1.51 | 5.10 | 1.48 | 5.13 | 1.40 | .699 | .010 |
| TCK | 4.78 | 1.54 | 5.03 | 1.46 | 4.93 | 1.71 | 4.91 | 1.64 | 5.04 | 1.58 | 5.36 | 1.35 | .752 | .009 |
| TPACK | 4.97 | 1.41 | 5.27 | 1.28 | 4.92 | 1.53 | 5.10 | 1.41 | 5.20 | 1.44 | 5.05 | 1.31 | .866 | .006 |

All levels of years of service were highest for Web-TK (up to 5: *M* = 5.95, *SD* = 1.21; 6-10: *M* = 6.07, *SD* = 0.98; 11-15: *M* = 5.78, *SD* = 1.28; 16-20: *M* = 5.78, *SD* = 1.16; 21-25: *M* = 5.61, *SD* = 1.13; 26+: *M* = 5.69, *SD* = 1.05). TCK was lowest for up to 5 years (*M* = 4.78, *SD* = 1.54), 6-10 years (*M* = 5.03, *SD* = 1.46), 16-20 years (*M* = 4.91, *SD* = 1.64) and 21-25 years (*M* = 5.04, *SD* = 1.58). The group 11-15 years was lowest for TPK (*M* = 4.91, *SD* = 1.57), and over 26 years was lowest for TPACK (*M* = 5.05, *SD* = 1.31). Web-TK was highest for 6-10 years of service (*M* = 6.07, *SD* = 0.98) and lowest for 21-25 years of service (*M* = 5.61, *SD* = 1.13). TPK and TPACK were highest for 6-10 years of service (TPK: *M* = 5.22, *SD* = 1.35; TPACK: *M* = 5.27, *SD* = 1.28) and lowest for 11-15 years of service (TPK: *M* = 4.91, *SD* = 1.57; TPACK: *M* = 4.92, *SD* = 1.53). TCK was highest for over 26 years of service (*M* = 5.36, *SD* = 1.35) and lowest for up to 5 years of service (*M* = 4.78, *SD* = 1.54).

In conclusion, there was no statistically significant interaction effect between lecturers' education, gender, age and years of service in their effects on the combined dependent variable of Web-TK, TPK, TCK and TPACK. Furthermore, there was no main effect of lecturers' education, gender, age and years of service on the combined or individual dependent variables.

## 9.4 Relationships Between Lecturers' Didactic Education and Media Infusion in the Teaching Process

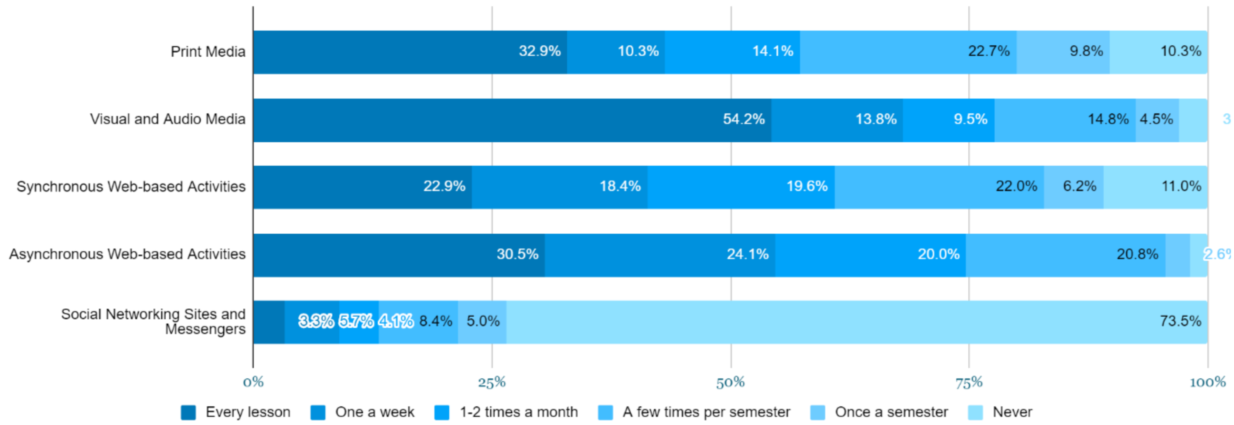
The third hypothesis assumed that "There is a statistically significant relationship between lecturer's didactic education and their media use in blended learning study programmes at universities of applied sciences in Austria."

**Table 25** *Media Use*

| | Every lesson N (%) | Once a week N (%) | 1-2 times a month N (%) | A few times per semester N (%) | Once a semester N (%) | Never N (%) |
|---|---|---|---|---|---|---|
| Print Media | 138 (32.9) | 43 (10.3) | 59 (14.1) | 95 (22.7) | 41 (9.8) | 43 (10.3) |
| Visual and Audio Media | 227 (54.2) | 58 (13.8) | 40 (9.5) | 62 (14.8) | 19 (4.5) | 13 (3.1) |
| Synchronous Web-based Activities | 96 (22.9) | 77 (18.4) | 82 (19.6) | 92 (22.0) | 26 (6.2) | 46 (11.0) |
| Asynchronous Web-based Activities | 128 (30.5) | 101 (24.1) | 84 (20.0) | 87 (20.8) | 11 (2.6) | 8 (1.9) |
| Social Networking Sites and Messengers | 14 (3.3) | 24 (5.7) | 17 (4.1) | 35 (8.4) | 21 (5.0) | 208 (73.5) |

The following media were used by most lecturers in every lesson, as seen in Table 25: visual and audio media (54.2%), print media (32.9%), asynchronous Web-based activities (30.5%) and synchronous Web-based activities (22.9%). Most lecturers never used social networking sites and messengers in blended learning settings (73.5%). The summarised percentages are shown in Figure 16.

**Figure 16** *The Amount of Media Use*




MANOVA results revealed significant differences among the levels of didactic education on the combined dependent variables [Wilks' Λ = .917, $F(20, 1360) = 1.79$,

$p$ = .017, $\eta^2$ = .021]. ANOVA was conducted on each dependent variable as a follow-up test to MANOVA.

Differences were significant for print media [$F$(4, 414) = 2.45, $p$ = .046, $\eta^2$ = .023], synchronous Web-based activities [$F$(4, 414) = 3.92, $p$ = .004, $\eta^2$ = .036] and asynchronous Web-based activities [$F$(4, 414) = 3.56, $p$ = .007, $\eta^2$ = .033]. Differences were not significant for visual and audio media [$F$(4, 414) = 1.21, $p$ = .306, $\eta^2$ = .012] and social networking sites and messengers [$F$(4, 414) = 1.72, $p$ = .208, $\eta^2$ = .012].

The Tukey post hoc analysis revealed that more than three didactic seminars significantly differ from no didactic training for print media. For synchronous Web-based activities and asynchronous Web-based activities, a didactic education differed significantly from no didactic training and one to three didactic seminars.

Table 26 presents the MANOVA of media use for didactic education.

**Table 26** *Multivariate Analysis of Variance of Media Use for Didactic Education*

| | Didactic Education | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *1* | | *2* | | *3* | | *4* | | *5* | | | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| Print Media | 3.69 | 1.88 | 3.14 | 1.68 | 2.80 | 1.66 | 2.75 | 1.68 | 2.93 | 1.75 | .046 | .023 |
| Visual and Audio Media | 2.08 | 1.68 | 2.29 | 1.54 | 2.23 | 1.44 | 1.87 | 1.30 | 1.97 | 1.41 | .306 | .012 |
| Synchronous Web-based Activities | 3.67 | 1.71 | 3.34 | 1.70 | 2.97 | 1.59 | 3.03 | 1.58 | 2.65 | 1.42 | .004 | .036 |
| Asynchronous Web-based Activities | 2.92 | 1.46 | 2.76 | 1.27 | 2.35 | 1.26 | 2.46 | 1.31 | 2.22 | 1.22 | .007 | .033 |
| Social Networking Sites and Messengers | 5.69 | 0.98 | 5.38 | 1.25 | 5.16 | 1.53 | 5.17 | 1.52 | 5.21 | 1.39 | .280 | .012 |

*Note.* 1: no didactic training, 2: one to three didactic seminars, 3: more than three didactic seminars, 4: one didactic seminar programme with a certificate of completion and 5: a didactic education.

Lecturers with no didactic training used print media ($M$ = 3.69, $SD$ = 1.88), synchronous Web-based activities ($M$ = 3.67, $SD$ = 1.71), asynchronous Web-based activities ($M$ = 2.92, $SD$ = 1.46) and social networking sites and messengers ($M$ = 5.69, $SD$ = 1.46) the least. Those with one to three didactic seminars used visual and audio media ($M$ = 2.29, $SD$ = 1.54) the least. With one didactic seminar programme, lecturers used print media ($M$ = 2.75, $SD$ = 1.68) and visual and audio media ($M$ = 1.87, $SD$ = 1.30) the most. Lecturers with a didactic education used synchronous Web-based activities (*M* = 2.65, *SD* = 1.42) and asynchronous Web-based activities (*M* = 2.22, *SD* = 1.22) the most. Those with more than three didactic seminars used social networking sites and messengers (*M* = 5.16, *SD* = 1.53) the most.

All participating lecturers used social networking sites and messengers the least compared to other media. In detail, this was the case for no didactic training (*M* = 5.69, *SD* = 0.98), one to three didactic seminars (*M* = 3.38, *SD* = 1.25), more than three didactic seminars (*M* = 5.16, *SD* = 1.53), one didactic seminar programme with certificate of completion (*M* = 5.17, *SD* = 1.52) and a didactic education (*M* = 5.21, *SD* = 1.39). The second least used was visual and audio media for all levels: no didactic training (*M* = 2.08, *SD* = 1.68), one to three didactic seminars (*M* = 2.29, *SD* = 1.54), more than three didactic seminars (*M* = 2.23, *SD* = 1.44), one didactic seminar programme with certificate of completion (*M* = 1.87, *SD* = 1.30) and a didactic education (*M* = 1.97, *SD* = 1.41).

This analysis showed a relationship between lecturers' didactic education and their use of print media, synchronous Web-based activities and asynchronous Web-based activities. Lecturers with no didactic training used synchronous Web-based activities and asynchronous Web-based activities less than those with one to three didactic seminars or a didactic education. Lecturers used print media more often with one to three seminars than with no didactic training. The mean values of the tested hypothesis can be summarised as follows: the higher the lecturers' didactic education, the higher the media use in teaching.

## 9.5 Differences in Lecturers' TPACK Based on Their Full-time or Adjunct Status

The fourth hypothesis assumed that “There is a statistically significant difference in lecturers' TPACK based on their full-time or adjunct status in blended learning study programmes at universities of applied sciences in Austria.”

A one-way MANOVA was conducted to determine the influence of lecturers' employment status on four combined dependent variables: TPACK, TCK, TPK and Web-TK. The independent variable “employment status” had the levels of full-time or adjunct status. No data were missing because all questions were mandatory selection questions.

MANOVA results revealed significant differences among the fields on the combined dependent variables [Wilks' $\Lambda = .951$, $F(4, 414) = 5.36$, $p < .001$, $\eta^2 = .049$]. ANOVA was conducted on each dependent variable as a follow-up test to MANOVA.

Differences were not significant for Web-TK [$F(1, 417) = .01$, $p = .931$, $\eta^2 < .001$], but the results were significant for TPK [$F(1, 417) = 5.00$, $p = .026$, $\eta^2 = .012$], for TCK [$F(1, 417) = 17.45$, $p < .001$, $\eta^2 = .040$] and for TPACK [$F(1, 417) = 6.16$, $p = .013$, $\eta^2 = .015$].

Table 27 presents the MANOVA of employment status.

**Table 27** *Multivariate Analysis of Variance of Employment Status*

| | Employment Status | | | | | |
|---|---|---|---|---|---|---|
| | *Full-time* | | *Adjunct Status* | | | |
| | *M* | *SD* | *M* | *SD* | *p* | η² |
| Web-TK | 5.87 | 1.16 | 5.86 | 1.17 | .931 | <.001 |
| TPK | 5.25 | 1.35 | 4.93 | 1.53 | .026 | .012 |
| TCK | 5.32 | 1.41 | 4.69 | 1.61 | .000 | .040 |
| TPACK | 5.32 | 1.33 | 4.98 | 1.43 | .013 | .015 |

Lecturers with full-time status scored better in all areas: Web-TK ($M = 5.87$, $SD = 1.16$), TPK ($M = 5.25$, $SD = 1.35$), TCK ($M = 5.32$, $SD = 1.41$), and TPACK ($M = 5.32$, $SD = 1.33$). Those with adjunct status had lower ratings across all areas, namely, for Web-TK ($M = 5.86$, $SD = 1.17$), TPK ($M = 4.93$, $SD = 1.53$), TCK ($M = 4.69$, $SD = 1.61$), and TPACK ($M = 4.98$, $SD = 1.43$). Participants with full-time status scored highest on Web-TK ($M = 5.87$, $SD = 1.16$) and lowest on TPK ($M = 5.25$, $SD = 1.35$). Those with adjunct status scored highest on Web-TK ($M = 5.86$, $SD = 1.17$) and lowest on TCK ($M = 4.69$, $SD = 1.61$).

In brief, lecturers with full-time status scored significantly higher in all TPACK areas except for Web-TK than lecturers with adjunct status. The difference was significant for TCK, TPK and TPACK. Notably, there was no significant difference between lecturers with full-time status and those with adjunct status for Web-TK.

## 9.6 Differences in Lecturers' TPACK Based on Their Level of Media Infusion in the Teaching Process

The fifth hypothesis assumed that "There is a statistically significant difference in lecturers' TPACK based on their teaching with media infusion in blended learning study programmes at universities of applied sciences in Austria." A five-way MANOVA was conducted to determine the influence of five independent variables of media infusion on four dependent variables TPACK, TCK, TPK and Web-TK. The five independent variables were related to the usage of (1) print media, (2) visual and audio media, (3) asynchronous Web-based activities, (4) synchronous Web-based activities and (5) social networking sites and messengers, with three levels: low, medium and high media infusion. No data were missing because all questions were mandatory selection questions.

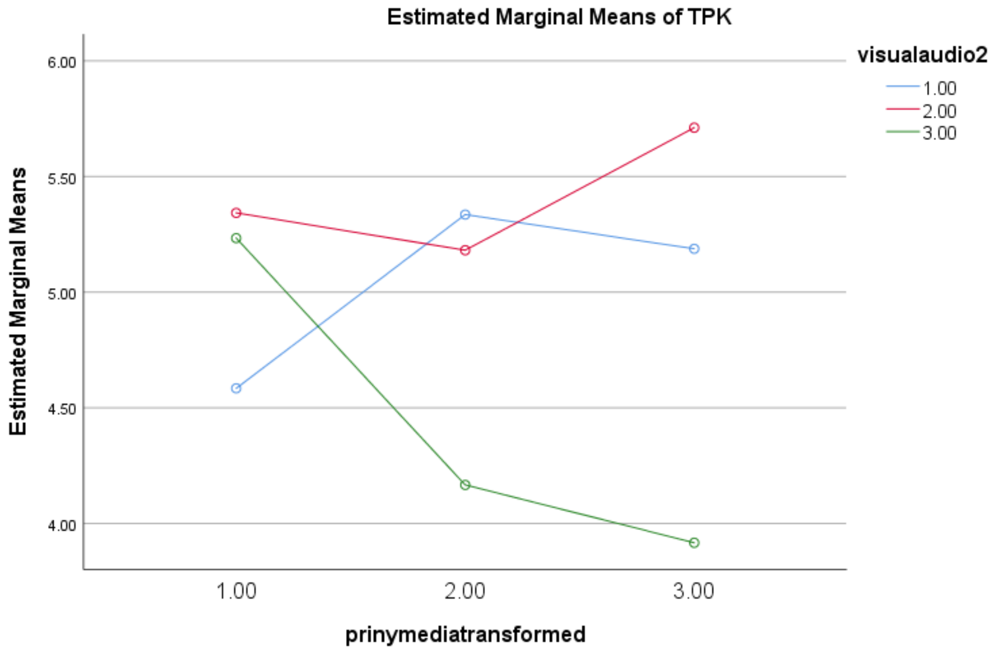
MANOVA results revealed no statistically significant interaction effect between any of the five independent variables on the combined dependent variables of TPACK. As for the main effect, the influence of print media on the combined dependent variables [Wilks' $\Lambda$ = .949, $F(8, 648) = 2.17$, $p = .028$, $\eta^2 = .026$] was statistically significant. Visual and audio media also had a significant influence on the combined dependent variables of TPACK [Wilks' $\Lambda$ = .953, $F(8,648) = 2.00$, $p = .045$, $\eta^2 = .024$]. However, there was no significant effect of asynchronous Web-based activities on the combined dependent variables of TPACK [Wilks' $\Lambda$ = .983, $F(8, 648)= 0.71$, $p = .687$, $\eta^2 = .009$]. This also applied to synchronous Web-based activities [Wilks' $\Lambda$ = .966, $F(8, 648) = 1.41$, $p = .190$, $\eta^2 = .017$] and to social networking sites and messengers [Wilks' $\Lambda$ = .968, $F(8, 648) = 1.33$, $p = .224$, $\eta^2 = .016$].

There was a statistically significant interaction effect between visual and audio media and synchronous Web-based activities on Web-TK [$F(4, 327) = 3.03$, $p = .018$, $\eta^2 = .036$] and TPK [$F(4, 327) = 3.58$, $p = .007$, $\eta^2 = .042$]. Furthermore, the interaction effect between print media, visual and audio media and social networking sites and messengers on TPACK [$F(1, 327) = 5.21$, $p = .023$, $\eta^2 = .016$] was statistically significant. There was a statistically significant interaction effect between print media, asynchronous Web-based activities and synchronous Web-based activities on Web-TK [$F(5, 327) = 2.47$, $p = .032$, $\eta^2 = .036$], just as there was a statistically significant interaction effect between print media, asynchronous Web-based activities and social networking sites and messengers on TPACK [$F(2, 327) = 3.02$, $p = .050$, $\eta^2 = .018$].

The differences were significant for print media infusion for Web-TK [$F(2, 4) = 3.140$, $p = .045$, $\eta^2 = .019$] and TPACK [$F(2, 6) = 3.90$, $p = .021$, $\eta^2 = .023$]. They were not significant for TPK [$F(2, 2) = 1.34$, $p = .264$, $\eta^2 = .008$] or TCK [$F(2, 1) = .61$, $p = .547$, $\eta^2 = .004$].

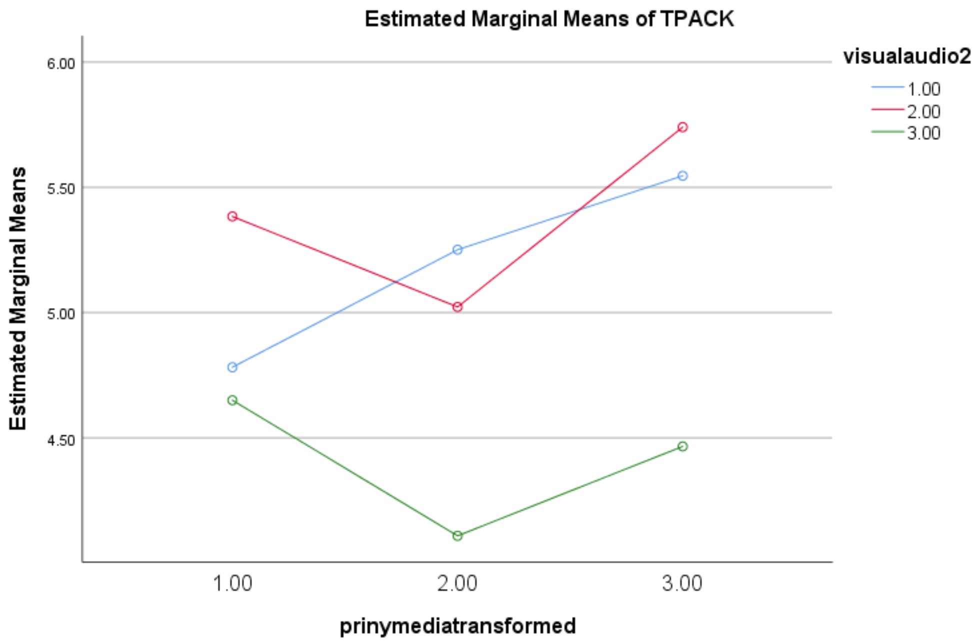
The differences were significant for visual and audio media infusion for TPK [$F(2, 8) = 4.37$, $p = .013$, $\eta^2 = .026$], as seen in Figure 17, and TPACK [$F(2, 10) = 6.48$, $p = .002$, $\eta^2 = .038$] as shown in Figure 18. There was no significant difference for Web-TK [$F(2, 3) = 2.78$, $p = .063$, $\eta^2 = .017$] or TCK [$F(2, 6) = 2.64$, $p = .073$, $\eta^2 = .016$].

**Figure 17** *Differences in TPK Based on Visual and Audio Media Infusion*




*Note.* (1) high media infusion, (2) medium media infusion, (3) low media infusion

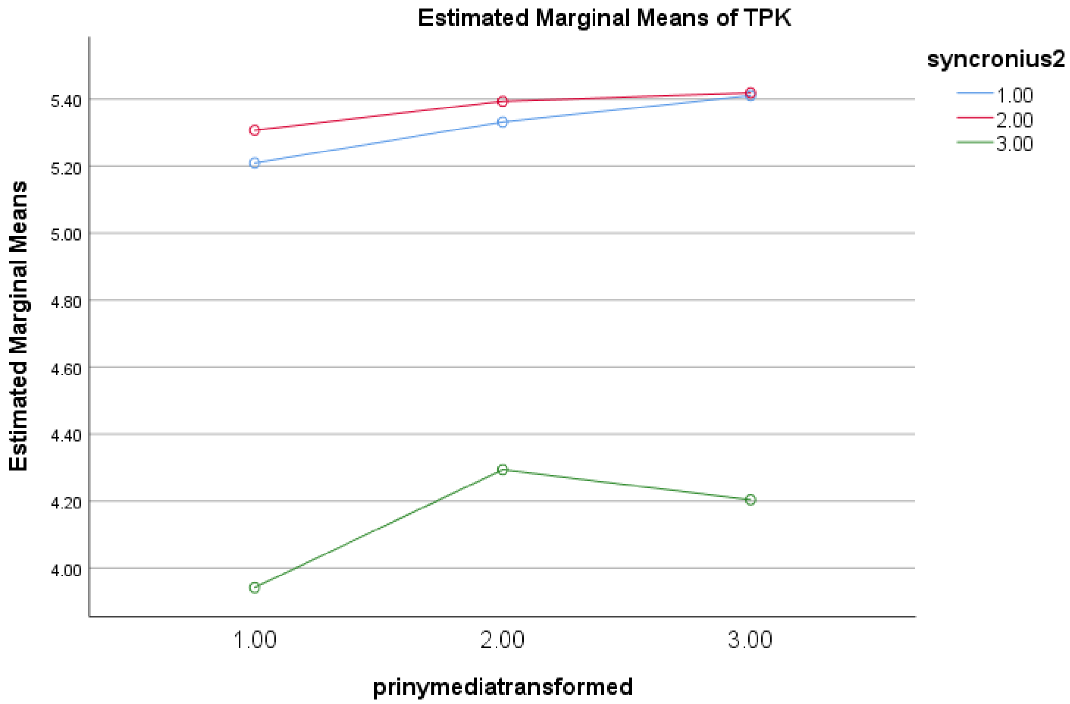
**Figure 18** *Differences in TPACK Based on Visual and Audio Media Infusion*




*Note.* (1) high media infusion, (2) medium media infusion, (3) low media infusion

Differences were significant for TPK based on synchronous Web-based activities [$F$(2, 2) = 1.58, $p$ = .022, $\eta^2$ = .023] as seen in Figure 19. No significant difference was found for Web-TK [$F(2, 2) = 1.58$, $p = .208$, $\eta^2 = .010$], TCK [$F(2, 4) = 2.00$, $p = .138$, $\eta^2 = .012$] or TPACK [$F(2, 1) = 2.88$, $p = .103$, $\eta^2 = .014$].

**Figure 19** *Differences in TPK Based on Synchronous Web-based Activities Infusion*

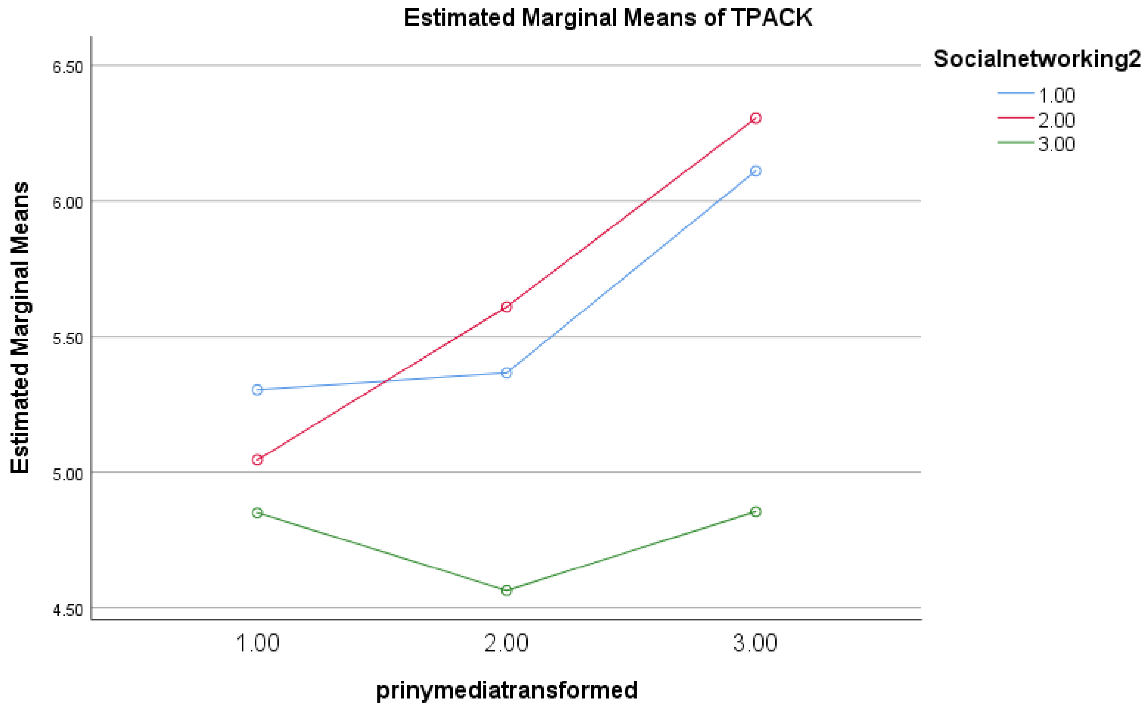



*Note.* (1) high media infusion, (2) medium media infusion, (3) low media infusion

None of the differences was significant for the dependent variables based on asynchronous Web-based activities; this concerns Web-TK [$F(2, 1) = 0.99$, $p = .373$, $\eta_p^2 = .006$], TPK [$F(2, 1) = 0.66$, $p = .517$, $\eta_p^2 = .006$], TCK [$F(2, 0) = 0.25$, $p = .778$, $\eta_p^2 = .002$] and TPACK [$F(2, 0) = 0.04$, $p = .958$, $\eta_p^2 = .000$].

The differences were significant for TPACK [$F(2, 7) = 4.32$, $p = .208$, $\eta^2 = .018$] based on networking sites and messengers infusion as shown in Figure 20, but were not significant for Web-TK [$F(2, 3) = 2.70$, $p = .069$, $\eta^2 = .016$], TPK [$F(2, 3) = 1.84$, $p = .161$, $\eta^2 = .011$], or TCK [$F(2, 4) = 2.10$, $p = .124$, $\eta^2 = .013$].

**Figure 20** *Differences in TPACK Based on Networking Sites and Messengers Infusion*




*Note.* (1) high media infusion, (2) medium media infusion, (3) low media infusion

ANOVA was conducted on each dependent variable as a follow-up test to MANOVA. Table 28 presents the MANOVA of print media infusion.

**Table 28** *Multivariate Analysis of Variance of Print Media Infusion*

| | Print Media Infusion | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *High Media Infusion* | | *Medium Media Infusion* | | *Low Media Infusion* | | | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| Web-TK | 5.78 | 1.26 | 5.97 | 1.03 | 5.87 | 1.19 | .045 | .019 |
| TPK | 5.06 | 1.56 | 5.19 | 1.29 | 4.86 | 1.54 | .264 | .008 |
| TCK | 4.96 | 1.67 | 5.01 | 1.38 | 4.91 | 1.61 | .547 | .004 |
| TPACK | 5.14 | 1.42 | 5.15 | 1.31 | 5.07 | 1.50 | .021 | .023 |

Lecturers with high print media infusion scored highest for Web-TK (*M* = 5.78, *SD* = 1.26) and lowest for TCK (*M* = 4.96, *SD* = 1.67). The same was true for participants with medium print media infusion: They scored highest for Web-TK (*M* = 5.97, *SD* = 1.03) and lowest for TCK (*M* = 5.01, *SD* = 1.38). Low print media infusion was highest for Web-TK (*M* = 5.87, *SD* = 1.19) and lowest for TPK (*M* = 4.86, *SD* = 1.54). Web-TK of lecturers was highest for those with medium print media infusion (*M* = 5.97, *SD* = 1.03) and lowest for those with high print media infusion (*M* = 5.78, *SD* = 1.26). TPK, TCK and TPACK were highest for participants with medium print media infusion (TPK: *M* = 5.97, *SD* = 01.03; TCK: *M* = 5.19, *SD* = 1.29; TPACK: *M* = 5.15, *SD* = 1.31) and lowest for low print media infusion (TPK: *M* = 4.86, *SD* = 1.54; TCK: *M* = 4.91, *SD* = 1.61; TPACK: *M* = 5.07, *SD* = 1.50).

Table 29 presents the multivariate analysis of visual and audio media infusion variance.

**Table 29** *Multivariate Analysis of Variance of Visual and Audio Media Infusion*

| | Visual and Audio Media Infusion | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *High Media Infusion* | | *Medium Media Infusion* | | *Low Media Infusion* | | | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| Web-TK | 5.88 | 1.17 | 5.95 | 1.12 | 5.52 | 1.24 | .063 | .017 |
| TPK | 5.08 | 1.51 | 5.26 | 1.17 | 4.41 | 1.66 | .013 | .026 |
| TCK | 5.01 | 1.60 | 5.10 | 1.39 | 4.17 | 1.40 | .073 | .016 |
| TPACK | 5.39 | 1.24 | 5.40 | 1.35 | 4.17 | 1.54 | .002 | .038 |

The same results were seen for high visual and audio media infusion, medium visual and audio media infusion and low audio media infusion. Lecturers belonging to these groups scored highest for Web-TK and lowest for TCK. In detail, the results were: high visual and audio media infusion for Web-TK (*M* =5.88, *SD* = 1.17) and TCK (*M* = 5.01, *SD* = 1.60), medium visual and audio media infusion for Web-TK (*M* = 5.95, *SD* = 1.12) and TCK (*M* = 5.10, *SD* = 1.39) and low audio media infusion for Web-TK (*M* = 5.52, *SD* = 1.24) and TCK (*M* = 4.17, *SD* = 1.40). Web-TK, TPK, TCK and TPACK were highest for medium visual and audio media infusion (Web-TK: *M* =5.95, *SD* = 1.12; TPK: *M* = 5.26, *SD* = 1.17; TCK: *M* = 5.10, *SD* = 1.39; TPACK: *M* = 5.40, *SD* = 1.35) and lowest for low visual and audio media infusion (Web-TK: *M* = 5.52, *SD* = 1.24; TPK: *M* = 4.41, *SD* = 1.66; TCK: *M* = 4.17, *SD* = 1.40; TPACK: *M* = 4.17, *SD* = 1.54).

Table 30 presents the MANOVA of synchronous Web-based activities infusion.

**Table 30** *Multivariate Analysis of Variance of Synchronous Web-based Activities Infusion*

| | Synchronous Web-based Activities Infusion | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *High Media Infusion* | | *Medium Media Infusion* | | *Low Media Infusion* | | | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| Web-TK | 5.92 | 1.11 | 6.06 | 1.01 | 5.29 | 1.45 | .208 | .010 |
| TPK | 5.23 | 1.36 | 5.33 | 1.30 | 4.06 | 1.64 | .022 | .023 |
| TCK | 5.31 | 1.39 | 4.96 | 1.54 | 4.16 | 1.68 | .138 | .012 |
| TPACK | 5.39 | 1.24 | 5.40 | 1.35 | 4.17 | 1.54 | .103 | .014 |

Lecturers with high synchronous Web-based activities infusion scored highest for Web-TK (*M* =5.92, *SD* = 1.12) and lowest for TCK (*M* = 5.31, *SD* = 1.39). The same applied to lecturers with medium synchronous Web-based activities infusion; they scored highest for Web-TK (*M* = 6.06, *SD* = 1.01) and lowest for TCK (*M* = 4.96, *SD* = 1.54). Low synchronous Web-based activities infusion was highest for Web-TK (*M* = 5.29, *SD* = 1.45) and lowest for TPK (*M* = 4.06, *SD* = 1.64). Web-TK, TPK and TPACK were highest for lecturers with medium synchronous Web-based activities infusion (Web-TK*: M* = 6.06, *SD* = 1.01; TPK*: M* = 5.33, *SD* = 1.30; TPACK*: M* = 5.40, *SD* = 1.35) and lowest for lecturers with low synchronous Web-based activities infusion (Web-TK*: M* = 5.29, *SD* = 1.45; TPK*: M* = 4.06, *SD* = 1.64; TPACK*: M* = 4.17, *SD* = 1.54). TCK was highest for lecturers with high synchronous Web-based activities infusion (*M* = 5.31, *SD* = 1.39) and lowest for lecturers with low synchronous Web-based activities infusion (*M* = 4.16, *SD* = 1.68).

Table 31 presents the MANOVA of asynchronous Web-based activities infusion.

**Table 31** *Multivariate Analysis of Variance of Asynchronous Web-based Activities Infusion*

| | Asynchronous Web-based Activities Infusion | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *High Media Infusion* | | *Medium Media Infusion* | | *Low Media Infusion* | | | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| Web-TK | 5.99 | 1.13 | 5.75 | 1.15 | 5.46 | 1.51 | .373 | .006 |
| TPK | 5.32 | 1.41 | 4.82 | 1.42 | 4.30 | 1.79 | .517 | .004 |
| TCK | 5.16 | 1.52 | 4.80 | 1.56 | 4.11 | 1.56 | .778 | .002 |
| TPACK | 5.43 | 1.31 | 4.84 | 1.42 | 4.24 | 1.89 | .958 | .000 |

The results were the same for the three items high asynchronous Web-based activities infusion, medium asynchronous Web-based activities infusion and low asynchronous Web-based activities infusion. Lecturers who belonged to these groups scored highest for Web-TK and lowest for TCK. The detailed results were as follows: high asynchronous Web-based activities infusion for Web-TK ($M$ = 5.99, $SD$ = 1.13) and TCK ($M$ = 5.16, $SD$ = 1.51), medium asynchronous Web-based activities infusion for Web-TK ($M$ = 5.75, $SD$ = 1.15) and TCK ($M$ = 4.80, $SD$ = 1.56) and low asynchronous Web-based activities infusion for Web-TK ($M$ = 5.46, $SD$ = 1.51) and TCK ($M$ = 4.11, $SD$ = 1.56). Web-TK, TPK, TCK and TPACK were highest for high asynchronous Web-based activities infusion (Web-TK: $M$ = 5.99, $SD$ = 1.13; TPK: $M$ = 5.32, $SD$ = 1.41; TCK: $M$ = 5.16, $SD$ = 1.52; TPACK: $M$ = 5.43, $SD$ = 1.31) and lowest for low asynchronous Web-based activities infusion (Web-TK: $M$ = 5.46, $SD$ = 1.51; TPK: $M$ = 4.30, $SD$ = 1.79; TCK: $M$ = 4.11, $SD$ = 1.56; TPACK: $M$ = 4.24, $SD$ = 1.89).

Table 32 presents the MANOVA of networking sites and messengers' infusion.

**Table 32** *Multivariate Analysis of Variance of Networking Sites and Messengers Infusion*

| | Networking Sites and Messengers Infusion | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *High Media Infusion* | | *Medium Media Infusion* | | *Low Media Infusion* | | | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| Web-TK | 6.24 | 1.17 | 6.33 | 0.86 | 5.75 | 1.18 | .069 | .016 |
| TPK | 5.44 | 1.60 | 5.64 | 1.12 | 4.94 | 1.47 | .161 | .011 |
| TCK | 5.33 | 1.43 | 5.40 | 1.29 | 4.86 | 1.59 | .124 | .013 |
| TPACK | 5.80 | 1.18 | 5.72 | 1.18 | 4.98 | 1.44 | .014 | .026 |

The same results were seen for high networking sites and messengers infusion, medium networking sites and messengers infusion and low networking sites and messengers infusion. Lecturers in all three areas scored highest for Web-TK and lowest for TCK. In detail, the results were: high networking sites and messengers infusion for Web-TK ($M$ = 6.24, $SD$ = 1.17) and TCK ($M$ = 5.33, $SD$ = 1.43), medium networking sites and messengers infusion for Web-TK ($M$ = 6.33, $SD$ = 0.86) and TCK ($M$ = 5.40, $SD$ = 1.29) and low networking sites and messengers infusion for Web-TK ($M$ = 5.75, $SD$ = 1.18) and TCK ($M$ = 4.86, $SD$ = 1.59). Web-TK, TPK and TCK were highest for medium networking sites and messengers infusion (Web-TK: $M$ = 6.33, $SD$ = 0.86; TPK: $M$ = 5.64, $SD$ = 1.12; TCK: $M$ = 5.40, $SD$ = 1.29) and lowest for low networking sites and messengers infusion (Web-TK: $M$ = 5.75, $SD$ = 1.18; TPK: $M$ = 4.94, $SD$ = 1.47; TCK: $M$ = 4.86, $SD$ = 1.59). TPACK was highest for high networking sites and messengers infusion (*M* = 5.80, *SD* = 1.18) and lowest for low networking sites and messengers infusion (*M* = 4.98, *SD* = 1.44).

In conclusion, print media infusion and visual and audio media infusion affected TPACK. In several cases, the difference between low media infusion in contrast to medium and high media infusion was evident. This applied for Web-TK based on print media infusion and TPK and TPACK for visual and audio media infusion. Based on synchronous Web-based activities, this was only the case for TPK, and based on networking sites and messengers infusion, for TPACK. The same picture emerged when looking at the mean values. Low media infusion differed from both medium and high media infusion.

It is also notable that lecturers scored highest for Web-TK and lowest for TCK for almost all items, which means high, medium and low visual and audio media infusion, visual and audio media infusion, synchronous Web-based activities infusion, asynchronous Web-based activities infusion and networking sites and messengers infusion. The only exception was that lecturers with low print media infusion scored lowest for TPK.

## 9.7 Differences in Lecturers' Synchronous and Asynchronous Media Use Based on Their Fields of Education

The sixth hypothesis assumed that “There is a statistically significant difference in the frequency of use of synchronous or asynchronous media in the online part of blended learning based on the ISCED fields of education of universities of applied sciences in Austria.”

A one-way MANOVA was conducted to determine the influence of fields of education on two dependent variables, synchronous and asynchronous media use. The independent variable “field of education” had the levels Education; Arts and Humanities; Social Sciences, Journalism and Information; Business, Administration and Law; Natural Sciences; Mathematics and Statistics; ICT; Engineering, Manufacturing and Construction; Agriculture, Forestry, Fisheries and Veterinary; Health and Welfare; Services; and Generic Programmes and Qualifications. The two groups Agriculture, Forestry, Fisheries and Veterinary and Services were eliminated because they had only two and seven participants, respectively. No data were missing because all questions were mandatory selection questions.

MANOVA results revealed a significant effect of the teaching fields on the combined dependent variables [Wilks' $\Lambda = .927$, $F(16, 818) = 1.98$, $p = .012$, $\eta^2 = .037$]. ANOVA was conducted on each dependent variable as a follow-up test to MANOVA. Differences were not significant for synchronous media [$F(8, 410) = .78$, $p = .619$, $\eta^2 = .015$] and were significant for asynchronous media [$F(8, 410) = 2.93$, $p = .003$, $\eta^2 = .054$].

The Tukey post hoc analysis revealed that “Engineering, Manufacturing and Construction” differed significantly from “Social Sciences, Journalism and Information”, “Health and Welfare”, and “Generic Programmes and Qualifications” in using asynchronous media.

Table 33 presents the MANOVA of synchronous or asynchronous media by ISCED fields of education.

**Table 33** *Multivariate Analysis of Variance of Synchronous or Asynchronous Media by ISCED Fields of Education*

| | ISCED Fields of Education | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *1* | | *2* | | *3* | | *4* | | *5* | | *6* | | *7* | | *9* | | *11* | | | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| synchronous | 2.64 | 1.36 | 3.10 | 1.41 | 2.93 | 1.67 | 3.06 | 1.56 | 2.71 | 1.57 | 3.03 | 1.62 | 3.18 | 1.91 | 3.36 | 1.59 | 2.67 | 1.59 | .619 | .015 |
| asynchronous | 2.14 | 1.25 | 2.15 | 1.18 | 2.11 | 1.12 | 2.56 | 1.27 | 2.88 | 1.12 | 2.44 | 1.25 | 3.21 | 1.60 | 2.34 | 1.23 | 2.10 | 1.41 | .003 | .054 |

*Note.* 1: Education, 2: Arts and Humanities, 3: Social Sciences, Journalism and Information, 4: Business, Administration and Law, 5: Natural Sciences, Mathematics and Statistics, 6: Information and Communication Technologies, 7: Engineering, Manufacturing and Construction, 9: Health and Welfare, 11: Generic Programmes and Qualifications

Lecturers from the field of Health and Welfare used synchronous media (*M* = 3.36, *SD* = 1.59) the least. Lecturers from the field of Education adopted the most synchronous media (*M* = 2.64, *SD* = 1.36). Lecturers from the field of Natural Sciences, Mathematics and Statistics used asynchronous media the least (*M* = 2.88, *SD* = 1.12) and those from Generic Programmes and Qualifications the most (*M* = 2.10, *SD* = 1.41).

In conclusion, the frequency of use of synchronous or asynchronous media differed between the fields of education. More specifically, the difference was in the use of asynchronous media between lecturers from “Engineering, Manufacturing and Construction” and those from three other fields. The mean values of the tested hypothesis can be summarised as follows: Lecturers from the field of education used synchronous media the most, while those from Health and Welfare used it the least. Asynchronous media was used most often by lecturers from the field of Generic Programmes and Qualifications and least often by those from Natural Sciences, Mathematics and Statistics.

## 9.8 Relationships Between Lecturers' TPACK and Technology Use

The seventh hypothesis assumed that “There is a significant relationship between TPACK and technology use in blended learning.” Standard multiple regression analyses were used to test if Web-TK, TPK, TCK, and TPACK significantly predict lecturers' UB and PEOU. UB of LMS had nine items, as seen in Table 34.

**Table 34** *Use Behaviour (UB) of Learning Management Systems (LMS)*

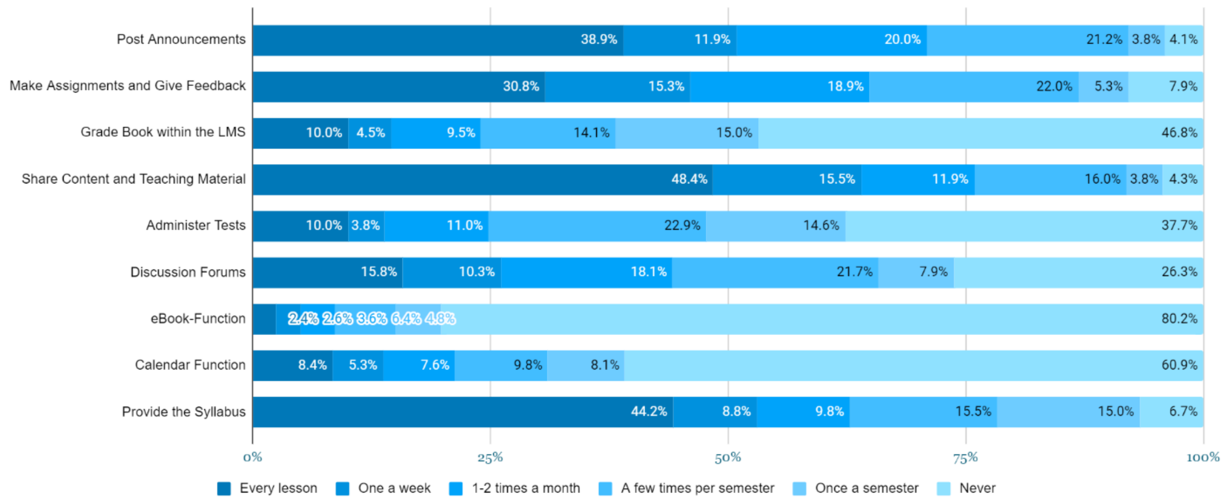
| | Every lesson<br>N (%) | Once a week<br>N (%) | 1-2 times a month<br>N (%) | A few times per semester<br>N (%) | Once a semester<br>N (%) | Never<br>N (%) |
|---|---|---|---|---|---|---|
| Post Announcements | 163 (38.9) | 50 (38.9) | 84 (20.0) | 89 (21.2) | 16 (3.8) | 17 (4.1) |
| Make Assignments and Give Feedback | 129 (30.8) | 64 (15.3) | 79 (18.9) | 92 (22.0) | 22 (5.3) | 33 (7.9) |
| Grade Book within the LMS | 42 (10.0) | 19 (4.5) | 40 (9.5) | 59 (14.1) | 63 (15.0) | 196 (46.8) |
| Share Content and Teaching Material | 203 (48.4) | 65 (15.5) | 50 (11.9) | 67 (16.0) | 16 (3.8) | 18 (4.3) |
| Administer Tests | 42 (10.0) | 16 (3.8) | 46 (11.0) | 96 (22.9) | 61 (14.6) | 158 (37.7) |
| Discussion Forums | 66 (15.8) | 43 (10.3) | 76 (18.1) | 91 (21.7) | 33 (7.9) | 110 (26.3) |
| eBook Function | 10 (2.4) | 11 (2.6) | 15 (3.6) | 27 (6.4) | 20 (4.8) | 336 (80.2) |
| Calendar Function | 35 (8.4) | 22 (5.3) | 32 (7.6) | 41 (9.8) | 34 (8.1) | 255 (60.9) |
| Provide the Syllabus | 185 (44.2) | 37 (8.8) | 41 (9.8) | 65 (15.5) | 63 (15.0) | 28 (6.7) |

To determine how often an LMS tool was used, the five items indicating the frequency of use in percent can be added together. These are (1) every lesson, (2) once a week, (3) 1-2 times a month, (4) a few times per semester and (5) once a semester, which gives a value that includes every use except “never.” Lecturers most often used the LMS to post announcements (95.8%), share content and teaching material (95.6%), provide the syllabus (93.3%) and make assignments and give feedback (92.3%). Other LMS functions were used by more than half of the lecturers, namely, the discussion forum (73.8%), tests (62.3%) and the grade book (53.1%). The calendar function (39.2%) and the eBook function (19.8%) were the least used.

Looking only at the percentage value for the item “every lesson”, one can see which LMS tools were most frequently used per lesson; these were the function for sharing content and teaching material (48.4%), the syllabus (44.2%), and the function to post announcements (38.9%).

The results of the item “never” give a more accurate picture of which LMS tools were used least. Two functions were never used by more than half of the lecturers: the eBook function (80.2%) and the calendar function (60.9%). The percentages listed are illustrated in detail in Figure 21.

**Figure 21** *Percentages of Use Behaviour (UB) of Learning Management Systems (LMS)*




The PEOU of LMS had four levels, as seen in Table 35.

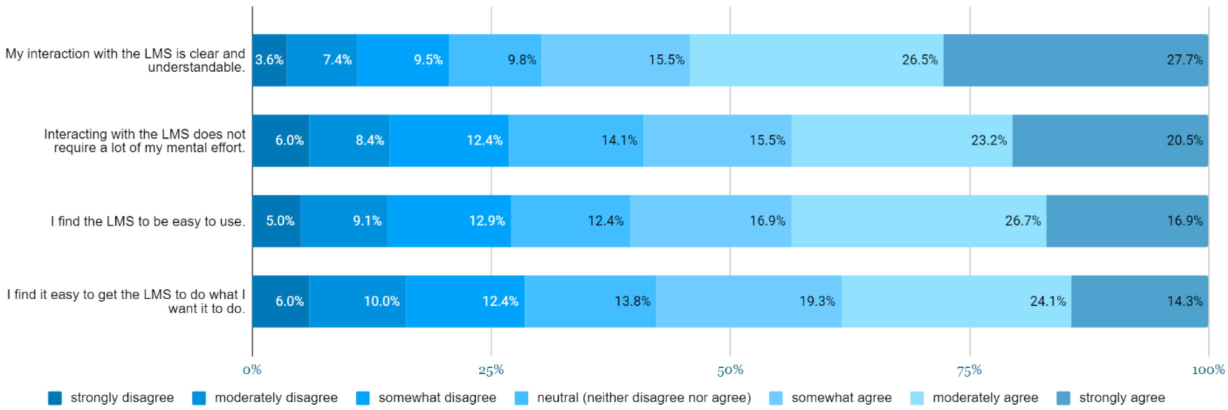
**Table 35** *Perceived Ease of Use (PEOU) of Learning Management Systems (LMS)*

| | strongly disagree N (%) | moderately disagree N (%) | somewhat disagree N (%) | neutral (neither disagree nor agree) N (%) | somewhat agree N (%) | moderately agree N (%) | strongly agree N (%) | *M* | *SD* |
|---|---|---|---|---|---|---|---|---|---|
| My interaction with the LMS is clear and understandable. | 15 (3.6) | 31 (7.4) | 40 (9.5) | 41 (9.8) | 65 (15.5) | 111 (26.5) | 116 (27.7) | 5.16 | 1.75 |
| Interacting with the LMS does not require a lot of my mental effort. | 25 (6.0) | 35 (8.4) | 52 (12.4) | 59 (14.1) | 65 (15.5) | 97 (23.2) | 86 (20.5) | 4.76 | 1.83 |
| I find the LMS to be easy to use. | 21 (5.0) | 38 (9.1) | 54 (12.9) | 52 (12.4) | 71 (16.9) | 112 (26.7) | 71 (16.9) | 4.75 | 1.77 |
| I find it easy to get the LMS to do what I want it to do. | 25 (6.0) | 42 (10.0) | 52 (12.4) | 58 (13.8) | 81 (19.3) | 101 (24.1) | 60 (14.3) | 4.60 | 1.78 |

The three items for agreement with the PEOU of LMS are somewhat agree, moderately agree and strongly agree. In summary, these statements had more than 50% agreement: for “my interaction with the LMS is clear and understandable” 69.7%, for “Interacting with the LMS does not require a lot of my mental effort” 60.5%, for “I find the LMS to be easy to use” 59.2% and for “I find it easy to get the LMS to do what I want it to do” 57.7%.

The items for the rejection of the PEOU for LMS were strongly disagree, moderately disagree and somewhat disagree. All values for disagreement with these statements were below 30%: 28.4% for “my interaction with the LMS is clear and understandable”, 27.0% for “Interacting with the LMS does not require a lot of my mental effort”, 26.8% for “I find the LMS to be easy to use”, and 20.5% for “I find it easy to get the LMS to do what I want it to do”. The summarised percentages listed are depicted in detail in Figure 22.

**Figure 22** *Percentages of Perceived Ease of Use (PEOU) of Learning Management Systems*




The Pearson correlation coefficient was calculated for UB and PEOU. Table 36 shows positive and significant correlations between UB and PEOU and Web-TK, TPK, TCK, and TPACK.

**Table 36** *Correlation of Web-TK, TPK, TCK and TPACK with UB and PEOU (N = 419)*

| | UB | PEOU |
|---|---|---|
| Web-TK | .263** | .212** |
| TPK | .353** | .303** |
| TCK | .274** | .264** |
| TPACK | .445** | .316** |

** indicates *p* < .01.

The results of the regression analysis indicate that the four predictors Web-TK, TPK, TCK and TPACK together highly significantly explain 20.1% of the variance of the UB [$R^2$ = .201, $R^2_{adj}$ = .193, $F$(4, 414) = 26.03, $p$ < .001].

Table 37 and Table 38 summarise the regression coefficients for the dependent variables UB and PEOU.

**Table 37** *Coefficients for Use Behaviour (UB)*

| | B | β | *t* | *p* | Bivariate *r* | Partial *r* |
|---|---|---|---|---|---|---|
| Web-TK | -0.002 | -.002 | 0.203 | .971 | .263 | -.002 |
| TPK | 0.009 | .013 | 1.487 | .864 | .353 | .008 |
| TCK | -0.050 | -.076 | 0.937 | .229 | .274 | -.059 |
| TPACK | 0.363 | .489 | 1.960 | <.001 | .445 | .283 |

Only TPACK made a statistically significant unique contribution to UB [β = .489, $t(419) = 1.96$, $p < .001$)]. Web-TK [β = -.002, $t(419) = 0.20$, $p = .971$)], TPK [β = .013, $t(419) = 1.49$, $p = .864$)] and TCK [β = -.076, $t(419) = 0.94$, $p = .229$)] were not significant predictors of UB.

**Table 38** *Coefficients for Perceived Ease of Use (PEOU)*

| | B | β | *t* | *p* | Bivariate *r* | Partial *r* |
|---|---|---|---|---|---|---|
| Web-TK | 0.017 | .012 | -0.036 | .839 | .212 | .010 |
| TPK | 0.133 | .121 | 0.171 | .138 | .303 | .073 |
| TCK | 0.064 | .062 | -1.205 | .349 | .264 | .046 |
| TPACK | 0.194 | .168 | 6.015 | .051 | .316 | .096 |

The results of the regression analysis indicate that the four predictors Web-TK, TPK, TCK and TPACK together significantly explain 12.6% of the variance of the PEOU [$R^2 = .330$, $R^2_{adj} = .193$, $F(4, 414) = 12.66$, $p < .001$]. None of the predicators made a significant unique contribution to the PEOU: Web-TK [β = .012, $t(419) = -0.04$, $p = .839$)], TPK [β = .121, $t(419) = 0.17$, $p = .138$)], TCK [β = .062, $t(419) = -1.21$, $p = .349$)] and TPACK [β = .168, $t(419) = 6.02$, $p = .051$)].

In conclusion, Web-TK, TPK, TCK and TPACK as a group explained 20.1% of the variance of UB, but only TPACK made a statistically significant unique contribution. All statements for the PEOU of LMS had more than 50% agreement, and all values for disagreement with these statements were below 30%. Concerning the detailed results, the LMS was most often used by lecturers to post announcements, share content and teaching material, provide the syllabus and make assignments and give feedback. The calendar function and the eBook function were the least used.

### 9.9 Relationships Between Lecturers' Fields of Education and the Difficulties in Technology Use

A one-way MANOVA was conducted to determine the influence of fields of education on the combined dependent variables of difficulties of technology use. The variable “field” had the levels Education; Arts and Humanities; Social Sciences, Journalism and Information; Business, Administration and Law; Natural Sciences; Mathematics and Statistics; ICT; Engineering, Manufacturing and Construction; Agriculture, Forestry, Fisheries and Veterinary; Health and Welfare; Services; and Generic Programmes and Qualifications. The two groups Agriculture, Forestry, Fisheries and Veterinary and Services were eliminated because they had only two and seven participants, respectively. As seen in Table 39, the dependent variable difficulties of technology use had 11 items with the levels equipment-related obstacles, pedagogy-related obstacles, attitude-related obstacles and other obstacles. No data were missing because all questions were mandatory selection questions.

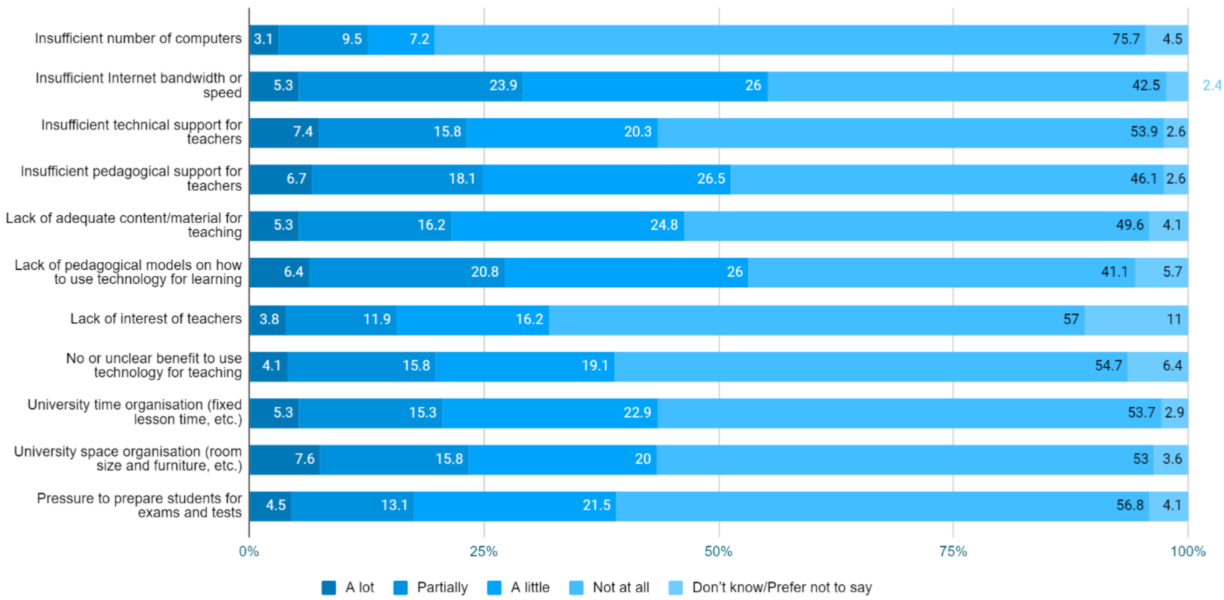
**Table 39** *Descriptive Statistics for Difficulties of Technology Use*

| | A lot<br>N (%) | Partially<br>N (%) | A little<br>N (%) | Not at all<br>N (%) | Don't know/Prefer not to say<br>N (%) | *M* | *SD* |
|---|---|---|---|---|---|---|---|
| Equipment-related obstacles | | | | | | | |
| Insufficient number of computers | 13 (3.1) | 40 (9.5) | 30 (7.2) | 317 (75.7) | 19 (4.5) | 3.69 | 0.83 |
| Insufficient internet bandwidth or speed | 22 (5.3) | 100 (23.9) | 109 (26.0) | 178 (42.5) | 10 (2.4) | 3.13 | 0.98 |
| Pedagogy-related obstacles | | | | | | | |
| Insufficient technical support for lecturers | 31 (7.4) | 66 (15.8) | 85 (20.3) | 226 (53.9) | 11 (2.6) | 3.29 | 1.01 |
| Insufficient pedagogical support for lecturers | 28 (6.7) | 76 (18.1) | 111 (26.5) | 193 (46.1) | 11 (2.6) | 3.20 | 0.99 |
| Lack of adequate content/material for teaching | 22 (5.3) | 68 (16.2) | 104 (24.8) | 208 (49.6) | 17 (4.1) | 3.31 | 0.97 |
| Lack of pedagogical models for how to use technology for learning | 27 (6.4) | 87 (20.8) | 109 (26.0) | 172 (41.1) | 24 (5.7) | 3.19 | 1.04 |
| Attitude-related obstacles | | | | | | | |
| Lack of interest of lecturers | 16 (3.8) | 50 (11.9) | 68 (16.2) | 239 (57.0) | 46 (11.0) | 3.59 | 0.96 |
| No or unclear benefit to the use of technology for teaching | 17 (4.1) | 66 (15.8) | 80 (19.1) | 229 (54.7) | 27 (6.4) | 3.44 | 0.97 |
| University time organisation (fixed lesson times, etc.) | 22 (5.3) | 64 (15.3) | 96 (22.9) | 225 (53.7) | 12 (2.9) | 3.34 | 0.95 |
| Other obstacles | | | | | | | |
| University space organisation (room size and furniture, etc.) | 32 (7.6) | 66 (15.8) | 84 (20.0) | 222 (53.0) | 15 (3.6) | 3.29 | 1.03 |
| Pressure to prepare students for exams and tests | 19 (4.5) | 22 (13.1) | 90 (21.5) | 238 (56.8) | 17 (4.1) | 3.43 | 0.93 |

For all entries N=419.

The summarised percentages listed are illustrated in Figure 23.

**Figure 23** *Percentages of Difficulties of Technology Use*




Lecturers at UAS faced the fewest problems with insufficient number of computers ($M = 3.69$, $SD = 0.83$) and lack of interest of lecturers ($M = 3.59$, $SD = 0.97$). They had the most problems with insufficient internet bandwidth or speed ($M = 3.13$, $SD = 0.98$), lack of pedagogical models on how to use technology for learning ($M = 3.19$, $SD = 1.04$) and insufficient pedagogical support for lecturers ($M = 3.20$, $SD = 0.99$). Concerning these obstacles, lecturers faced the fewest challenges with attitude-related obstacles, followed by other obstacles. Lecturers faced the most difficulties with pedagogy-related obstacles.

MANOVA results revealed no significant differences among the fields on the combined dependent variables of difficulties of technology use [Wilks' $\Lambda = .927$, $F(32, 1502) = 0.98$, $p = .504$, $\eta^2 = .019$]. ANOVA was conducted on each dependent variable as a follow-up test to MANOVA. Differences were not significant for any obstacles, which means equipment-related obstacles [$F(8, 410) = 1.57$, $p = .133$, $\eta^2 = .030$] pedagogy-related obstacles [$F(8, 410) = 0.96$, $p = .471$, $\eta^2 = .018$], other obstacles [$F(8, 410) = 0.76$, $p = .635$, $\eta^2 = .015$] and attitude-related obstacles [$F(8, 410) = 0.86$, $p = .550$, $\eta^2 = .017$]. Table 40 presents the MANOVA of difficulties of technology use (obstacles) by ISCED fields of education.

**Table 40** *Multivariate Analysis of Variance of Difficulties of Technology Use (Obstacles) by ISCED Fields of Education*

| | ISCED Fields of Education | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *1* | | *2* | | *3* | | *4* | | *5* | | *6* | | *7* | | *9* | | *11* | | | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *p* | $\eta^2$ |
| Equipment | 3.25 | 0.90 | 3.00 | 0.84 | 3.30 | 0.79 | 3.49 | 0.74 | 3.56 | 0.70 | 3.51 | 0.74 | 3.45 | 0.65 | 3.37 | 0.82 | 3.24 | 0.80 | .133 | .030 |
| Pedagogy | 3.33 | 0.91 | 2.86 | 0.92 | 3.22 | 0.70 | 3.26 | 0.79 | 3.30 | 0.69 | 3.36 | 0.67 | 3.28 | 0.72 | 3.16 | 0.82 | 3.25 | 0.88 | .471 | .018 |
| Attitude | 3.17 | 0.79 | 3.32 | 0.83 | 3.36 | 0.79 | 3.33 | 0.83 | 3.40 | 0.82 | 3.43 | 0.66 | 3.59 | 0.69 | 3.21 | 0.80 | 3.35 | 0.87 | .550 | .017 |
| Other | 3.05 | 0.89 | 3.35 | 0.89 | 3.27 | 0.89 | 3.30 | 0.90 | 3.35 | 0.93 | 3.40 | 0.77 | 3.53 | 0.75 | 3.21 | 0.86 | 3.33 | 0.97 | .635 | .015 |

*Note.* 1: Education, 2: Arts and Humanities, 3: Social Sciences, Journalism and Information, 4: Business, Administration and Law, 5: Natural Sciences, Mathematics and Statistics, 6: Information and Communication Technologies, 7: Engineering, Manufacturing and Construction, 9: Health and Welfare, 11: Generic Programmes and Qualifications

Lecturers from the fields of Natural Sciences, Mathematics and Statistics had the fewest difficulties with equipment-related obstacles ($M$ = 3.56, $SD$ = 0.70) and those from the field of Generic Programmes and Qualifications had the most problems ($M$ = 3.24, $SD$ = 0.80). Pedagogy-related obstacles were most common among Arts and Humanities lecturers ($M$ = 2.86, $SD$ = 0.92) and least common among those from ICT ($M$ = 3.36, $SD$ = 0.67). Attitude-related obstacles were most common among lecturers from the field of Education ($M$ = 3.17, $SD$ = 0.79) and least common among those from Engineering, Manufacturing and Construction ($M$ = 3.59, $SD$ = 0.69). Lecturers from the fields of Engineering, Manufacturing and Construction had the fewest difficulties with other obstacles ($M$ = 3.53, $SD$ = 0.75) and those from the field of Education had the most problems ($M$ = 3.05, $SD$ = 0.89).

Lecturers from the field of Education faced the most difficulties with other obstacles ($M$ = 3.05, $SD$ = 0.89) and the least difficulties with pedagogy-related obstacles ($M$ = 3.33, $SD$ = 0.91). Other obstacles presented the fewest problems for lecturers from Arts and Humanities ($M$ = 3.35, $SD$ = 0.89), and equipment-related obstacles ($M$ = 3.00, $SD$ = 0.84) were the greatest obstacle for them. Lecturers from the field of Social Sciences, Journalism and Information faced the most difficulties with pedagogy-related obstacles ($M$ = 3.22, *SD* = 0.70) and had the fewest difficulties with attitude-related obstacles (*M* = 3.36, *SD* = 0.79).

Equipment-related obstacles presented the fewest the problems for lecturers from Business, Administration and Law (*M* = 3.49, *SD* = 0.74), Natural Sciences, Mathematics and Statistics (*M* = 3.56, *SD* = 0.70), ICT (*M* = 3.51, *SD* = 0.74) and Health and Welfare *M* = 3.37, *SD* = 0.82). Lecturers from the same fields had the most problems with pedagogy-related obstacles: Business, Administration and Law (*M* = 3.26, *SD* = 0.79), Natural Sciences, Mathematics and Statistics (*M* = 3.30, *SD* = 0.69), ICT (*M* = 3.36, *SD* = 0.67) and Health and Welfare (*M* = 3.16, *SD* = 0.82).

Lecturers from the field of Engineering, Manufacturing and Construction faced the most difficulties with attitude-related obstacles (*M* = 3.59, *SD* = .69) and the fewest difficulties with pedagogy-related obstacles (*M* = 3.28, *SD* = .72). Attitude-related obstacles presented the fewest problems for lecturers from Generic Programmes and Qualifications (*M* = 3.24, *SD* = .80), and equipment-related obstacles (*M* = 3.35, *SD* = .87) were their greatest problem.

In brief, there was no significant relationship between the difficulties of technology use and ISCED fields. Lecturers teaching in blended learning settings at Austrian UAS faced the most difficulties with insufficient internet bandwidth or speed, lack of pedagogical models for how to use technology for learning and insufficient pedagogical support for lecturers.

# 10 Qualitative Results

The qualitative part of this thesis aims to explain the quantitative study results in more detail and expound on them. The design of the interview protocol was based on both the results of the hypotheses and the state of the research. However, the interviews also developed in new directions and brought unforeseen insights related to the influence of the Distance Learning Phase caused by COVID-19. This chapter documents the results of the analysis of the qualitative interviews. The interviews were conducted with 20 programme directors of UAS study programmes who had already led blended learning programmes before 2019 and were also active lecturers. The chapter is structured according to the five main categories that reflect the result of the quantitative analysis: (1) pedagogical support for lecturers, (2) media used in blended learning, (3) differences between lecturers in teaching, (4) lessons learned from the Distance Learning Phase and (5) changes after the Distance Learning Phase. Each category is divided into three subcategories, to which codes are assigned. For each category, the results of the hypotheses or research questions to which they are related are listed. Then, where the subcategories are derived is explained. A table follows with the codes and information on how they relate to the literature. Finally, the central part of the presentation of the results includes the thematic summary and analysis of the statements of the programme directors, grouped by subcategory, with illustrative quotations.

## 10.1 Support for Lecturers in Teaching

The category pedagogical support for lecturers is connected to the results of the tests of three hypotheses. The quantitative findings that led to the decision to create this main category are that lecturers with higher didactical education used more print media and synchronous and asynchronous Web-based activities and that full-time lecturers had a higher TPACK score than part-time lecturers. Furthermore, the lecturers in Austrian blended learning study programmes at UAS named the lack of pedagogical models for how to use technology for learning and insufficient pedagogical support for lecturers as two of their most frequent difficulties of technology use. On the one hand, the conclusion to be drawn is that more didactic training for UAS would be helpful, including pedagogical models. On the other hand, more pedagogical support would be useful, especially for part-time lecturers. Based on these assumptions, the following two research questions were formulated and investigated within the framework of the qualitative study: (1) “What are lecturers' perspectives on the pedagogical support in blended learning study programmes at Austrian universities of applied science?” and (2) “What knowledge do lecturers in blended learning study programmes at Austrian universities of applied sciences need to be taught to use media effectively for teaching??” The purpose of the main category “support for lecturers in teaching” is to explain the results of the hypotheses and to answer the research questions that emerged. The two subcategories “contents of pedagogical support” and “types of pedagogical support” are deductively based on the results of the hypotheses and the literature. The subcategory “aspects of pedagogical support” arose inductively from the evaluations of the interviews. Each subcategory contains between five and nine codes. Between five and 22 text segments were assigned to each code. Some codes were attributed several times per programme director, so the number of codes assigned to each respondent is between two and 14. Table 41 shows the subcategories and codes for pedagogical support for lecturers.

**Table 41** *Subcategories and Codes for Pedagogical Support for Lecturers*

| Subcategory | Code | Number of Codes* | n** |
|---|---|---|---|
| Aspects of pedagogical support | Satisfaction with the existing pedagogical support | 15 | 11 |
| | Pedagogical support for part-time lecturers | 13 | 7 |
| | Overall view of the pedagogical support | 12 | 9 |
| | Ideas for the pedagogical support | 12 | 4 |
| | Pedagogical support in the Distance Learning Phase | 11 | 7 |
| Contents of pedagogical support | Tools | 17 | 11 |
| | Planning of blended learning courses | 11 | 8 |
| | Pedagogical models | 10 | 10 |
| | Moodle | 9 | 8 |
| | Pedagogy basics | 9 | 7 |
| | Synchronous and asynchronous teaching | 6 | 6 |
| | Online exams | 6 | 4 |
| | Design of distance learning | 4 | 4 |
| Types of pedagogical support | Coaching | 22 | 14 |
| | Short online training courses | 20 | 13 |
| | Best practice | 13 | 5 |
| | Videos | 12 | 8 |
| | Lecturer exchange | 11 | 6 |
| | Job shadowing | 6 | 3 |
| | Tutorials | 6 | 5 |
| | Further training in blended learning study form | 5 | 4 |
| | Blogs | 5 | 2 |

* The number of codes is the total number of codes assigned. A code can be applied more than once in an interview.

** n is the number of programme directors for whom the code was assigned.

The codes and subcategories of the main category “pedagogical support for lecturers” are also related to the literature. Further training and support were already offered throughout the HE sector before COVID-19 to enhance the didactic qualifications of lecturers (Mürmann et al., 2016; Riewerts et al., 2016). During the Distance Learning Phase initiated by COVID-19, these services were adapted and expanded to online offerings (Bakhmat et al., 2021; Troidl & Simon, 2020). Austrian UAS also reported about this development (Breinbauer & Schiessl-Foggensteiner, 2021; Pauschenwein & Schinnerl-Beikircher, 2021). Concerning the contents of pedagogical support, Mercader and Gairín (2020) identified the lack of knowledge about teaching approaches to digital technologies as one of the most influential obstacles to using technology in HE. Sanders and Georg (2017) stated that effective training for lecturers should focus on pedagogy. Unlike the programme directors interviewed, the literature sees the exclusive focus on educational technology training critically (Kirkwood & Price, 2013; Sanders & Georg, 2017), which is conclusive from a didactic point of view and also in the light of the TPACK model (Mishra & Koehler, 2006). Regarding the subcategory “types of pedagogical support”, Sanders and Georg (2017) reported that lecturers should be provided with good practice examples to support the development of a holistic view of teaching. They also underlined the critical impact of role models for the effective further training of lecturers. According to their findings (Sanders & Georg, 2017), focusing on the needs of lecturers is the most critical factor for the success of advanced training. The following sections summarise the main category “pedagogical support” results for lecturers, broken down into three subcategories.

#### *10.1.1 Aspects of Pedagogical Support*

Most of the programme directors mentioned different aspects of pedagogical support for lecturers. This issue included (1) satisfaction with the existing pedagogical support, (2) pedagogical support for part-time lecturers, (3) the overall view of the pedagogical support, (4) ideas for the pedagogical support, and (5) pedagogical support in the Distance Learning Phase.

Eleven programme directors described different perspectives on pedagogical support at their UAS (P2:34; P4:146; P6:122; P11:80; P13:60; P14:138; P15:68; P16:45; P17:87; P18:99; P20:59). Nine of them explicitly expressed their satisfaction with current pedagogical support (P2:34; P11:80-83; P13:60; P14:138-140; P15:68; P16:45; P17:87; P18:99; P20:63); this referred to both the further training offered (P2:34; P14:138-140) and the pedagogical support (P11:80-83; P13:60; P15:68; P16:45; P17:87; P18:99; P20:59). Central departments mostly provide pedagogical support at the UAS (P11:96; P14:138; P15:68; P16:45; P17:87; P18:99), but in some models, individual persons in the departments are responsible for it (P6:122; P13:60; P20:59). One ICT programme director reported that even before the COVID-19 Distance Learning Phase, they ran twice-yearly workshops on e-learning design internally in their department, independent from central support (P6:122). However, another programme director of the same department said that the level of knowledge in their department was so high that the lecturers usually knew more than those responsible in the e-learning department and had stopped asking there (P4:146). The satisfaction with the existing pedagogical support can be illustrated by the following quotation from a programme director from Health and Welfare:

> *"We have a centre for [...]. This is a department that has been around for a very long time, which had always focused on e-learning. And which is now even more of a focus. And which does a great job too. They are also doing a great job of creating these tutorials and providing support. And offers for further training are also organised in the form of institutionalised higher education training" (P18:99).*

Seven programme directors made suggestions for pedagogical support to assist the part-time lecturers (P1:56; P3:56; P13:41; P14:138; P18:39; P19:126; P20:103). Five of them explicitly pointed out that the part-time lecturers have little time available for further training (P1:56; P3:56; P13:41; P14:138; P18:39). Four said that it was easier for part-time lecturers to participate in short online events at the end of the day (P1:56; P18:39; P19:126; P20:103), in contrast to full-time lecturers, who prefer further training during working hours (P1:56). Two programme directors stated that part-time lecturers participate less in further training at the UAS compared to full-time lecturers (P1:48; P18:103). A programme director from the field of Social Sciences, Journalism and Information suggested a toolbox for part-time lecturers. It should contain tools that can be used in distance learning and require little time on the part of the lecturer (P3:56). An example of a quote on pedagogical support for part-time lecturers is:

> *"For the external lecturers, it is probably always a question of finding time, especially if the direct benefit is not apparent. That's why I don't think that a training course of one or two days will be well received. It has to be very short and crisp, two or three hours. And preferably also online" (P18:39).*

Nine programme directors made statements that reflected an overall view of the pedagogical support (P4:144; P10:83; P11:127; P12:101; P13:49; P15:39; P16:39; P19:71; P20:96). Some of them said that the educational support should be tailored to the needs of the lecturers (P15:61; P16:39) and should be pragmatically designed (P19:71). According to a programme director from the field of Engineering, Manufacturing and Construction, the most suitable format for further training depends on the topic (P10:83). A programme director from the ICT department reported that lecturers have to try out many aspects of distance learning by themselves to experience their effects (P4:17). For him, the role model function was essential (P4:164). By this, he referred to lecturers who received particularly positive feedback on distance learning and thus acted as role models for others (P4:144). A programme director from Engineering, Manufacturing and Construction also mentioned that pedagogical support is always technological support (P12:101). From his perspective, this requires much training and individual support (P12:102). As a new lecturer, preparing the courses takes much time and adjusting to the teaching situation (P12:91). This would require quality assurance measures and further training in didactics (P12:92). A programme director from the field of Health and Welfare added that educational support is often not about trivial topics but about how to convey content (P13:47). This type of support should be carried out by programme directors and university lecturers (P13:49). A programme director from Business, Administration and Law also pointed out that what lecturers want in pedagogical support is not always useful from the programme director's perspective (P20:96). Another programme director from the same field summarised his view on pedagogical support as follows:

> *"[Pedagogical support should be] Individually tailored. Each colleague somehow starts a little bit different, from a slightly different starting point. And I really appreciate the fact that we offer different packages here at regular intervals" (P16:39).*

Four programme directors suggested ideas that would change pedagogical support (P6:42; P9:88; P11:107; P15:92). For example, a programme director in the field of Social Sciences, Journalism and Information suggested that the UAS could improve the positioning of teaching awards and teaching innovation, which he argued should be shown and communicated more strongly (P9:88). A programme director from the field of Social Sciences, Journalism, and Information came up with several ideas for further education design. She said that university didactic certificates should be mandatory (P11:107), full-time and part-time lecturers should be given paid time for further training (P11:103), the content should be more gender-sensitive (P11:97) and include the LGBTQI aspect (P11:131), and final seminar papers in these courses should relate to the courses held by the participating lecturers (P11:117). She also stated that lecturers should receive mandatory training every five years (P11:127). An ICT programme director also believed that for new lecturers, e-learning should be a compulsory part of continuing education for lecturers in the future (P6:42). Another programme director from Business, Administration and Law suggested establishing a point system for continuing education for lecturers (P15:92); this would entail attending several annual training courses, for which the lecturer would then be awarded points. In these courses, lecturers could be given a brief introduction to the latest tools (P15:111). He proposed the following idea for pedagogical support:

> *"Maybe one should establish a system of training points at universities as well. You have to collect at least ten points per year, and you collect them by taking part in such training courses. This is also common with other professional groups such as doctors, tax consultants" (P15:92).*

Seven programme directors listed the types of educational support offered by the UAS during the COVID-19 Distance Learning Phase (P2:26; P5:37; P6:42; P8 94; P10:104; P15:19; P16:35). An ICT programme director said that the lecturers had needed support in three main areas during the transition to the COVID-19 Distance Learning Phase. That was the regulatory framework, the technical framework, and the didactic concept. For him, the regulatory framework included the legal framework with, for example, the examination regulations. In his opinion, simple technical systems should be made available for the technical framework. The didactic concept was least important for him because the universities had already completed the planning of the semester before the first lockdown (P8:94-97). Some programme directors reported that the demand for internal training has increased (P2:26; P10:104; P15:19; P16:41). They also reported that the lecturers at their UAS received extensive coaching (P5:37; P6:42; P16:35). An example of pedagogical support in the Distance Learning Phase was given by a programme director from the field of Business, Administration and Law:

> *"We have set up a comprehensive support and training programme. So, after these first improvisation phases for those who had never done anything, we immediately*

*followed up with comprehensive mentoring, coaching, and training activities in April and May" (P16:35).*

In summary, the programme directors interviewed identified different aspects of educational support. In their opinion, during the COVID-19 Distance Learning Phase, the staff of the UAS extensively coached the lecturers. Another result was that lecturers' demands for UAS professional development programmes increased over this period (P2:26; P10:104; P15:19; P16:41). Several programme directors expressed their satisfaction with both the in-service training offered (P2:34; P14:138-140) and the educational support (P11:80-83; P13:60; P15:68; P16:45; P11:80-83; P13:60; P15:68; P16:45; P17:87; P18:99; P20:59). According to some interviewees, the greatest challenge for the educational support of part-time lecturers was that they had very little time for further training (P1:56; P3:56; P13:41; P14:138; P18:39). Therefore, short online training courses during off-peak hours were particularly well suited for part-time lecturers (P1:56; P18:39; P19:126; P20:103). Several programme directors believed the pedagogical support for lecturers should be tailored (P15:61; P16:39) and pragmatic (P19:71). Two respondents suggested compulsory training courses for lecturers, for example, in the form of mandatory training every five years (P11:127) or a point system for further training obliging lecturers to collect a specified number of credits in further training annually (P15:92).

#### *10.1.2 Contents of Pedagogical Support*

Most programme directors had different suggestions regarding content that should be covered as part of the educational support. These included (1) tools, (2) the planning of blended learning courses, (3) pedagogical models, (4) Moodle, (5) pedagogy basics, (6) synchronous and asynchronous teaching, (7) online exams and (8) the design of distance learning.

Eleven programme directors described content for pedagogical support regarding digital tools to be used in the distance learning part of blended learning as being useful (P3:53; P4:124; P5:41; P9:65; P10:74; P11:124; P13:80; P15:95; P16:40; P19:49; P20:89): One ICT programme director called for initial support for lecturers to help them overcome their fear of using tools (P7:32). Another programme director from Business, Administration and Law argued that lecturers should receive an induction concerning the online tools offered by the UAS at the beginning of each semester, for example, in the form of a checklist (P19:49). Two programme directors suggested that in-service training should also demonstrate what can be done with standard tools (P7:33; P16:40). Three others explicitly mentioned online tools that lecturers should be trained to use (P3:53; P5:40; P13:80), while another mentioned the use of new tools (P10:74). An ICT programme director also stated that technical matters regarding sound and light and everything needed to produce a film should be further training topics (P4:124). On the other hand, according to a programme director from Social Sciences, Journalism and Information, tool-oriented training should be condensed into a short and concise evening course (P5:43). A programme director from Business, Administration and Law added that technical knowledge is essential for lecturers to enjoy teaching at a distance (P20:89). Tools as contents of pedagogical support can be illustrated by the following quote from an ICT programme director:

> *"I think that support is necessary on two levels [the first is didactic support, the second is], that you have to give people at least some initial support so that they lose their shyness of different tools, that they lose their fear of trying out different things and say, it works for me, it works less well for me" (P7:32).*

Eight programme directors mentioned that lecturers would need support to plan blended learning courses (P2:34; P4:130; P9:65; P10:51; P13:100; P16:41; P17:93; P20:90). Six of them felt that it was important for lecturers to develop and implement a concept for blended learning courses concerning didactic design (P2:36; P10:77; P13:100; P16:41; P17:93; P20:90). Another topic mentioned by three respondents was the definition of learning objectives for these courses (P4:130; P10:51; P20:90). According to a programme director from Business, Administration and Law, the lecturers needed to learn the difference between online teaching and classroom teaching and how they can didactically implement both equally well (P2:34). Another ICT programme director thought they needed to know how to arrange a course with asynchronous and synchronous elements (P4:130).
A programme director from the field of Social Sciences, Journalism and Information said that it is about tools and dramaturgy, fine-tuning and upgrading for digital learning (P9:65). For two programme directors, lecturers needed to learn how to use a variety of elements in blended learning (P10:77; P17:93). A programme director from Health and Welfare

expressed his perspective on the importance of planning blended learning courses by saying:

> *"Now the question is, what am I really doing in face-to-face sessions? When do I teach face-to-face? When do I do synchronous teaching and when do I do blended learning? And when do the lecturers need guidance and when do you say: think about it, dear lecturer, now it's really about - I really want to have you because you are good in terms of content - but now it's about also additionally thinking about a didactic concept for you before the semester starts. And not just to say: When do you have time to come? That's just how it was in the past, if we are really being honest. The question was, when do you have time to teach?" (P13:100).*

Ten programme directors commented on whether lecturers should learn about pedagogical models in in-service training (P2:40; P3:60; P7:53; P8:68; P9:73; P13:88; P15:97; P16:49; P19:71; P20:94). Of these, five believed that pedagogical models for the use of technology were less well known among lecturers (P2:38; P3:58; P7:53; P9:73; P13:90). Eight would find it useful to include these models in further training (P2:38; P8:69; P9:74; P13:88; P15:97; P16:49; P19:71; P20:94), two others saw little demand for them on the part of the lecturers (P3:60; P7:53). One ICT programme director suggested that these training courses should be in short online formats (P8:67). The importance of pedagogical models for the content of pedagogical support is illustrated by a quote from a programme director from the field of Engineering, Manufacturing and Construction:

> *"I think that this is interesting for the teachers, but many are not familiar with these models. I believe that the demand would be medium-high, because possibly you might not be able to imagine what all these [models] could do; but there would be a demand. And then it could be more of a sustained demand" (P9:73).*

Eight programme directors believed that further training and other educational support should deal with the use of Moodle (P2:34; P1:48; P3:54; P7:46; P10:53; P13:79; P16:40; P17:94). The topics mentioned for further training were: Moodle basic training (P2:34; P13:84; P16:40), how to design a course quickly and easily (P1:48), including activities and elements (P3:54; P10:53; P13:79), tests related to question forms (P3:54) and Moodle for advanced users (P3:54, P7:46). A programme director from the field of

Engineering, Manufacturing and Construction pointed out the technical support required for Moodle, for example, as support for the creation of tests (P17:94). A typical example of a quote on the relevance of Moodle for the content of pedagogical support is:

> *"Then in particular really dealing with Moodle, more Moodle advanced, like the one course I did with tests in Moodle, question forms in Moodle and things like that. Or also the tools of Moodle, because we all use Moodle, to get to know the tools of Moodle a bit better; which elements it has in itself" (P3:54).*

Seven programme directors found that pedagogical support should include didactic topics (P5:43, P7:31; P10:47; P14:151; P15:91; P19:72; P20:90). However, according to three of them, this content should primarily appeal to lecturers with no didactic education (P10:47; P15:94; P20:90). Two also said that these lecturers mainly build on their experience as students and how they would have wanted to be taught. (P10:74; P19:72). A programme director from Social Sciences, Journalism and Information suggested a comprehensive course on didactic basics (P5:43). Pedagogy basics such as the contents of pedagogical support can be illustrated by the following quote from a programme director from the field of Business, Administration and Law:

> *"I do think that didactic concepts are important. In blended learning, I'm thinking of flipped classrooms or the interactive design of lessons so that things like that have to have a place. But sometimes also very basic tools. For example, lesson planning or the formulation of learning objectives. So, you really have to start with something like that. Because many external lecturers bring in great expertise in their field. But they have no didactic-pedagogical education" (P20:90).*

Six programme directors mentioned ideas through which pedagogical support could support the use of synchronous and asynchronous forms of study (P1:80; P2:60; P3:49; P7:62; P10:97; P15:103). A programme director from the field of Business, Administration and Law said that synchronous and asynchronous forms of study should not be separated in further education, as lecturers should be able to do both (P15:103). According to a course director from the field of Engineering, Manufacturing and Construction, the content of these training courses should be the advantages and disadvantages of synchronous and asynchronous forms of study and their combination (P10:97). A programme director from the field of Social Sciences, Journalism and Information noted that during the COVID-19 Distance Learning Phase, pedagogical support for synchronous forms of study was more important (P3:84), while afterwards, it will be essential to learn about ways to combine synchronous and asynchronous elements in distance learning (P2:64; P3:84). Finally, two programme directors stated that the lecturers could be motivated by instructions for using more synchronous and asynchronous study forms (P2:60; P7:62). A programme director from Engineering, Manufacturing and Construction expressed his perspective on synchronous and asynchronous teaching by saying:

> *"Basically, there are two approaches to this asynchronous distance learning. One is that you do the theory during synchronous attendance and the calculation examples as distance learning - or vice versa. Personally, I think that the theory is better suited as asynchronous distance learning in videos and the examples for synchronous. It would be good if you could really offer good further training on how to implement this optimally" (P1:80).*

Four programme directors found that online exams are essential for further training for lecturers (P1:48; P2:34; P3:54; P10:75). However, the main focus was on basic information on tests in distance learning, for example, how to set up tests online (P1:48; P2:34), what types of questions are possible online (P3:54), and how to check competencies with an online test (P10:75). A programme director from Business, Administration and Law also explicitly pointed out the usefulness of further training to design multiple-choice test questions (P2:98). Online exams as contents of pedagogical support can be illustrated by what he said:

> *"Yes, I really don't find it that easy. That would be a possibility for further training: How do I create a good multiple-choice test? Something like formulating questions, which I find extremely difficult because drafting an open question is easily done, but [preparing] a clear and well-formulated multiple-choice question [is hard]" (P2:98).*

Four programme directors found further training and support on the subject of the design of distance learning useful (P2:40; P4:125; P6:70; P13:86). For example, an ICT programme director stated that it should be about preparing content and presentation slides, improving screen quality and streaming quality (P6:70). Another from the area of

Health and Welfare emphasised that lecturers should learn how to use different social forms in their synchronous online teaching in a didactically meaningful way (P13:86). Two programme directors attached particular importance to using cameras in distance learning (P2:40; P4:125). An ICT programme director summarised his view on the design of distance learning as follows:

> *"And on the didactic side, it's about things like rhetoric. That you say, you need a different rhetoric when interacting with a digital medium, as opposed to normally in face-to-face interaction — [a] specific example: You're supposed to talk in such a way that is ready for production. When we're in the theatre, I mean lecture theatre, then it's not very disruptive if you make a mistake and have to correct yourself. Misspeak" (P4:125).*

In summary, the programme directors named a range of content that should be covered by educational support from their point of view. This included further training on pedagogical basics (P5:43, P7:31; P10:47; P14:51; P15:91; P19:72; P20:90) and the planning of blended learning courses (P2:34; P4:130; P9:65; P10:51; P13:100; P16:41; P17:93; P20:90), especially with regard to didactic design (P2:36; P10:77; P13:100; P16:41; P17:93; P20:90). The programme directors also requested pedagogical support for designing distance learning (P2:40; P4:125; P6:70; P13:86) and synchronous and asynchronous forms of study (P1:80; P2:60; P3:49; P7:62; P10:97; P15:103). According to them, pedagogical models for using technologies in teaching are less well known among lecturers (P2:38; P3:58; P7:53; P9:73; P13:90). However, providing information about these models in further education seemed to be most useful (P2:38; P8:69; P9:74; P13:88; P15:97; P16:49; P19:71; P20:94). Another topic for pedagogical support was using digital tools in teaching, especially in the distance learning part of blended learning (P3:53; P4:124, P5:41; P9:65; P10:74; P11:124; P13:80; P16:40; P19:49; P20:89). The use of Moodle was specifically mentioned (P2:34; P1:48; P3:54; P7:46; P10:53; P13:79; P16:40; P17:94). In addition, online exams are an important topic for programme directors for the further training of their lecturers (P1:48; P2:34; P3:54; P10:75).

***10.1.3 Types of Pedagogical Support***

Most programme directors gave examples of formats in which educational support should occur from their point of view. These were (1) coaching, (2) short online training courses, (3) best practice, (4) videos, (5) lecturer exchange, (6) job shadowing, (7) tutorials, (8) further training in blended learning study form and (9) blogs.

Fourteen programme directors named coaching as a particularly useful format for pedagogical support (P4:162; P5:106; P6:120; P7:49; P8:62; P9:34; P10:71; P11:98; P13:43; P15:57; P16:44; P17:89; P19:77; P10:67). For 11 directors, this was individual coaching (P4:149; P5:106; P6:120; P9:34; P10:62; P11:98, P13:43; P15:57; P16:44, P17:89; P19:77), while three mentioned small-group coaching (P7:64; P8:62; P10:71). Also, three programme directors reported on coaching in the course planning process (P5:106; P15:55; P20:75). A programme director from Business, Administration and Law applied this, for example, in an online appointment before the actual course to train the lecturers and discuss tools and didactic elements (P15:55). A programme director from the aforementioned field reported that a staff member supported distance learning for courses (P20:75). This person had teaching experience (P20:83) and, depending on the level of support, was then allocated a share of the lecturer's course units (P20:79). The support can include the design of the course, the use of the learning platform or online tools, and other activities (P20:67). The coaching for lecturers started a few weeks before the training courses for lecturers commence and continued until the end of the course (P20:69). A typical example of a quote on the relevance of coaching is:

> *"Yes, it is exactly about this question, where you are at the moment. It's about picking up the lecturers from where they are. Just find out what someone can already do? Because when I send someone to a learning platform training or a webinar training or a coursebook development training, they sometimes sit in the classes and don't understand because they have never dealt with it before. Or they're bored because they're already three levels ahead, and this coaching just helps to establish, what is someone working with? What skills has someone already developed? And what tips and tricks and hints can be used to help?" (P16:47).*

Thirteen programme directors suggested short training courses as an appropriate format for pedagogical support (P1:56; P3:48; P5:43; P7:43; P8:66; P9:51; P15:90; P16:44;

P17:95; P10:80; P18:39; P19:79; P20:105). Nine of them explicitly referred to online events (P1:56; P3:48; P5:43; P8:66; P9:51; P10:80; P15:90; P18:39; P20:105). There were different suggestions regarding the duration and time of day for these training courses. For three programme directors, the online training courses should occur either early in the morning or perhaps in the evening (P1:56; P3:48; P5:43), and four suggested two- to three-hour evening appointments (P3:51, P9:71; P18:39; P19:79). However, three also named half-days as a period (P3:51; P16:44; P19:79). A programme director from Business, Administration and Law named one teaching unit as the period for regular further education to take place (P15:90). The reasons given for these suggestions were that it is difficult, especially for part-time lecturers, to participate in longer continuing education courses (P1:56; P9:51; P10:79; P18:39; P19:71). However, according to a programme director from Engineering, Manufacturing and Construction, this was also true for full-time lecturers (P10:79). The time factor is relevant not only because the part-time lecturers have very little time, but they also have to travel to the UAS to attend events (P7:43; P9:51; P18:39; P20:103). An example of a quote on short online training courses is from a programme director from the field of Health and Welfare:

> *"Therefore, I don't think that a training course of one or two days will be well received. But it has to be very short and crisp of two or three hours. And preferably also online" (P18:39).*

For six programme directors, best practice was a valuable format for pedagogical support (P2:52; P8:91; P9:66; P15:95; P18:37; P19:50). Three of them reported forms in which best practice was presented at their UAS (P2:52; P8:68; P19:125). For two programme directors, the purpose of best practice is to show the lecturers what possibilities exist and how other lecturers have implemented their teaching (P2:52; P8:54). A programme director from Business, Administration and Law said that this gives lecturers an overall view of a course and not just a tiny piece in the puzzle (P8:56). Another programme director from Social Sciences, Journalism and Information suggested that it does not have to be best practice, it could also be good practice, but it should be from the subject areas of the lecturers so that the lecturers can quickly implement the ideas (P9:82). These good or best practice examples could also be communicated through further training (P9:85), whereby application areas in the different fields should be presented (P9:86). These should then be disseminated through all media channels, such as newsletters, faculty meetings, and training (P9:94). An ICT programme director described his view on best practices as follows:

> *"And to see the whole thing, you like to see how someone has done something from the beginning to the end, and you want to exchange ideas. So, I would say that's always what worked best. So that's what I'm counting on. If I have the feeling that there is a teacher or something that works very well, then that is dealt with in a workshop setting" (P8:56).*

Eight programme directors mentioned videos as an adequate format for pedagogical support for lecturers (P3:78; P4:129; P9:38; P10:84, P11:79; P13:69; P15:58; P17:184). Two of them referred to training on how to create videos so that lecturers can produce instructional videos themselves (P4:127; P9:38). In two other cases, the programme directors described the use of recordings from training courses of lecturers (P10:84; P17:184). Four others believed that video tutorials should be made available to lecturers (P3:78; P11:79; P13:69; P15:58). A programme director from Health and Welfare thought that video tutorials are better accepted because the lecturers can wind back and forth and proceed at their own pace (P13:71). From the perspective of a programme director in Business, Administration and Law, video tutorials are often better suited than group training for tool training (P15:58). A programme director from the field of Engineering, Manufacturing and Construction described his experience with videos as follows:

> *"I have to say, what really worked are video sequences. For example, this video on how to do a planning sheet has been used a lot more compared to a description or a guide that you just look at or click through. And it has been better accepted" (P13:69).*

Six programme directors mentioned lecturer exchanges as a suitable format for pedagogical support (P2:80; P4:138; P9:84; P17:97; P9:84; P19:58). Three explicitly named lecturer meetings (P2:80; P9:84, P19:58). According to two programme directors, these should offer input from the course management and space for knowledge exchange between the lecturers (P9:40; P17:97). AN ICT programme director also reported staff meetings on didactic topics (P4:138). Another programme director from Business, Administration and Law imagined a lectors' round table with best practices, exchanging ideas about what the other lecturers were doing and answering specific questions on didactic and organisational issues (P19:58). The importance of lecturer exchange is illustrated by a quote from a programme director from the field of Social Sciences, Journalism and Information:

> *"But I think the lecturer evenings are the most important thing because people only go to the training if they already think it is a good idea. And that's why it's not the primary place; it's the secondary place" (P9:87).*

Three programme directors mentioned job shadowing as appropriate for delivering pedagogical support to lecturers (P4:139; P5:41; P10:72-73). An ICT programme director said that the best way is to attend a few units and derive appropriate guidance from this. However, he also pointed out that there is usually not enough time for this (P4:134), and there are few people who openly show their teaching (P4:139) even though it would be an ideal way of improvement (P4:141). A programme director from Social Sciences, Journalism and Information explained how job shadowing could be a part of further training for lecturers (P5:41), but also that this type of lecturer training is very complex (P5:43). Finally, a programme director from Engineering, Manufacturing and Construction pointed out that it makes sense to have a third person for educational supervision (P10:73). He proposed the following idea for job shadowing:

> *"[…] And I definitely want to choose the second one, observing each other. Show me your course, and I'll go into yours with you and listen to how you do it - and vice versa. That [idea] was not invented by us; it's common practice in other fields. Whether it's a surgeon or a soccer coach, everyone does it. And I think that is very helpful. And if that is now supplemented, perhaps by a third person. Because otherwise, it's just the layman learning from the layman, which can also be valuable. Of course, if the other person is from a subject-related field, you experience similar problems in understanding students and so on. But if that is also monitored by a third person who moderates and comments and says, that would also be another possibility or let's think about whether that is so ideal - then I think that would be a good thing" (P10:72-73).*

Five programme directors cited tutorials as a form of pedagogical support for lecturers (P2:60; P7:62; P9:39; P13:61; P19:52). Examples they mentioned were the quick-start guide for recording videos with the equipment of the UAS (P9:39), options for asynchronous teaching (P2:60), and interactions via Moodle (P13:77). A programme director from Business, Administration and Law also suggested that these tutorials could take the form of checklists and in-depth videos (P19:54). However, a programme director from Health and Welfare noted that lecturers do not always take the time to look at the tutorials and are often unwilling to deal with the content in a didactic manner (P13:61). A programme director from the field of Business, Administration and Law had the following suggestion for tutorials:

> *"What would be quite nice, I think, would be a three- to five-page document that also lists possibilities for asynchronous teaching. I could just send it to every lecturer at the very beginning and say: 'Look at this! These are the possibilities that exist'. I mean, three to five pages are probably too long anyway; nobody reads that. Maybe there's only one page" (P2:60).*

Four programme directors thought that UAS should also offer further training for lecturers in blended learning forms of study (P9:52; P10:82, P11:167; P20:97). A programme director from the area of Social Sciences, Journalism and Information mentioned a further training course in video design as an example (P9:53). Initial training should be offered in an online phase, followed by an on-site introduction with the university equipment, recording the video with the devices, and an online debriefing (P9:56). A programme director from Engineering, Manufacturing and Construction also noted that in full online training courses, the lecturers exchange and get to know each other less (P10:81). Therefore, blended learning training courses with a face-to-face part make sense (P10:80). Another programme director from the Health and Welfare programme believed that in the future, lecturers should be offered both online and face-to-face appointments for further training (P11:167). However, the face-to-face training should then take place in blocks and in a setting where the lecturers get to know each other, such as lunch together (P20:101). A programme director from the field of Business, Administration and Law described her view on further training in blended learning study form as follows:

*"I think a lot of people teach the way they were taught. That also means that if I actually want my lecturers to teach more innovatively, then they would have to experience it for themselves. I think it makes it easier if you experience it yourself. And for me that would also mean, for example, that it would be exciting to do a training course in the flipped classroom format or with case studies" (P20:97).*

For two programme directors, blogs could provide educational support for lecturers (P3:80; P19:113). They both suggested regular tips for lecturers in the form of blogs (P3:76; P19:103). A programme director from Business, Administration and Law said it should be a very low-threshold offer, a short message that lecturers receive as a tip of the day or tip of the week (P19:109). Another programme director from Social Sciences, Journalism and Information suggested that these short contributions or "didactic posts" should refer to content that can be used online, such as tutorials, videos or audio contributions (P3:78). He proposed the following idea for blogs:

*"The blog, where I get brief information and if I'm interested, then a long post that really shows me how it works, just like with blog topics, the regularity and continuity in there. That would be extremely exciting, yes" (P3:80).*

In summary, the programme directors recommended several formats for pedagogical support. The most common form suggested was coaching of the lecturers (P4:162; P5:106; P6:120; P7:49; P8:62; P9:34; P10:71; P11:98; P13:43; P15:57; P16:44; P17:89; P19:77; P10:67), both in individual coaching (P4:149; P5:106; P6:120; P9:34; P10:62; P11:98, P13:43; P15:57; P16:44, P17:89; P19:77), and in small-group coaching sessions (P7:64; P8:62; P10:71), which could be especially helpful for the process of course planning (P5:106; P15:55; P20:75). Exchange between the lecturers is also important to the programme directors (P2:80; P4:138; P9:84; P17:97; P9:84; P19:58), especially in the form of lecturer meetings (P2:80; P9:84, P19:58), but also in the form of mutual observation of courses (P4:139; P5:41; P10:72-73). Videos are another popular format for pedagogical support at UAS (P3:78; P4:129; P938; P10:84, P11:79; P13:69; P15:58; P17:184), as video tutorials (P3:78; P11:79; P13:69; P15:58) and in the form of video recordings of further training (P10:84; P17:184) or training courses for video creation (P4:127; P9:38). Here and in other formats, best practices from teaching should also be presented (P2:52; P8:91; P9:66;

P18:37; P19:50). Other forms of pedagogical support mentioned are tutorials for lecturers (P2:60; P7:62; P9:39; P13:61; P19:52) and blogs (P3:80; P19:113). Further training courses should be brief (P1:56; P3:48; P5:43; P7:43; P8:66; P9:51; P15:90; P16:44; P17:95; P10:80; P18:39; P19:79; P20: 105) and if they are, they should be held online (P1:56; P3:48; P5:43; P8:66; P9:51; P10:80; P15:90; P18:39; P20:105), taking place either early in the morning or late in the afternoon (P1:56; P3:48; P5:43). According to the programme directors, it would make sense to hold longer training sessions for lecturers of blended learning programmes in the blended learning form of study (P9:52; P10:82, P11:167; P20:97).

## 10.2 Media Use in Blended Learning

The major category "media used in blended learning" is meant to explain and expand on the findings of the hypotheses on media use. The outcome was that lecturers with higher didactic training used more print media and synchronous and asynchronous Web-based activities. The conclusion could also be drawn that print media infusion and lecturers' visual and audio media infusion affected TPACK. The results indicated that the frequency of use of synchronous or asynchronous media in the individual educational fields was different. Lecturers from Education used synchronous media the most, and lecturers from Generic Programmes and Qualifications used asynchronous media the most. One result was that lecturers named the lack of pedagogical models on how to use technology for learning as one of the most critical difficulties of technology use. Based on these outcomes, several aspects of media use were asked about in the interviews; these were whether or not lecturers knew about or were familiar with pedagogical models, and if there are lecturers with low media use and if the media use had changed as a result of the Distance Learning Phase. Based on this, a further research question was developed to take the quantitative results further: "What influences the use of synchronous and asynchronous media of lecturers in blended learning study programmes at Austrian universities of applied sciences?" Therefore, the subcategory "reasons for asynchronous or synchronous media use in blended learning" was developed deductively, and only the subcategory "assessment of asynchronous and synchronous media use" arose inductively during the analyses of the interviews. Each of the subcategories comprises between three and eight codes. A code could also be assigned multiple times per programme director, and the codes for media use were attributed to the programme directors between three and 13 times. The subcategories and codes for media used in blended learning are shown in Table 42.

**Table 42** *Subcategories and Codes for Media Used in Blended Learning*

| Subcategory | Code | Number of Codes* | n** |
|---|---|---|---|
| Aspects of media use | Media use changed as a result of the Distance Learning Phase | 20 | 13 |
| | No lecturers with low media use | 11 | 9 |
| | Lecturers are not familiar with pedagogical models | 10 | 9 |
| | Lecturers with low media use | 9 | 7 |
| | Media use unchanged as a result of the Distance Learning Phase | 8 | 7 |
| | Lecturers know pedagogical models | 6 | 5 |
| Reasons for asynchronous or synchronous media use | Asynchronous media use requires more effort for lecturers | 13 | 8 |
| | Synchronous or asynchronous depending on the task | 7 | 7 |
| | Synchronous is easier for lecturers | 6 | 5 |
| | Asynchronous and synchronous because of time aspects | 5 | 5 |
| | Synchronous due to lecturers with little experience | 4 | 3 |
| | Asynchronous self-study needs less media competence | 4 | 4 |
| | Synchronous and asynchronous due to personality | 3 | 3 |
| | Asynchronous due to the fear of being recorded by a camera | 3 | 2 |
| Assessment of asynchronous and synchronous media use in blended learning | More synchronous online in the future | 14 | 10 |
| | Experience with asynchronous media use | 6 | 4 |
| | More asynchronous in the future | 5 | 4 |
| | Synchronous and asynchronous will remain the same | 4 | 4 |
| | Experience with synchronous media use | 4 | 3 |

* The number of codes is the total number of codes assigned. A code can be applied more than once in an interview.
** n is the number of programme directors for whom the code was assigned.

The subcategory "media used in blended learning" is also linked to the literature. For aspects of media use, different studies documented a change in media use by lecturers due to COVID-19 (Babbar & Gupta, 2021; Blömer et al., 2020; Cohen & Sabag, 2020; Stewart, 2021). Stewart (2021) found in his review of ERT during COVID-19 that lecturers in distance learning were forced to teach differently. Blömer et al. (2020) and Cohen and Sabag (2020) reported a short-term development and use of digital teaching formats in HE. Babbar and Gupta (2021), in their cross-national comparison of the response of educational institutions to COVID-19, found that there was a radical shift to digital pedagogy and technological empowerment of teachers. Concerning the subcategory “reasons for asynchronous or synchronous media use”, several authors argued that both synchronous and asynchronous elements are essential for successful blended learning (Bower et al., 2015; Ho, 2017; Picciano, 2009; Smits & Voogt, 2016). The advantage of synchronicity seen by Serdyukov (2020) is the possibility of collaboration. Various authors see the advantage of asynchrony as temporal independence (Hrastinski, 2008; Ho, 2017; Serdyukov, 2020). About the subcategory “assessment of asynchronous and synchronous media use in blended learning”, Beckwith (2020) argued that lecturers should combine synchronous and asynchronous elements in online teaching to balance their respective advantages and disadvantages.

#### *10.2.1 Aspects of Media Use*

Most programme directors mentioned different aspects of media use by lecturers: (1) media use changed as a result of the Distance Learning Phase, (2) no lecturers with low media use, (3) lecturers are not familiar with pedagogical models, (4) lecturers with low media use, (5) media use unchanged as a result of the Distance Learning Phase and (6) lecturers know pedagogical models.

Thirteen programme directors stated that the media use of lecturers at their UAS had changed due to the COVID-19 Distance Learning Phase (P3:64; P4:153; P6:130; P7:57; P8:74; P10:88; P11:151; P13:95; P15:84; P16:53; P17:124; P20:84; P20:111). Six of them mentioned the increased use of video conference systems (P7:57; P10:88; P13:96; P17:122; P19:86; P20:111). According to the respondents, other media that lecturers increasingly used were online whiteboards (P3:64, P4:154), tools for surveys and reviews (P4:154), self-produced videos (P4: 153), video recordings of lectures (P4:128), podcasts (P11:151), and Moodle (P10:88; P17:122). Two programme directors said that the gap between lecturers who use little media and those who use many media has widened due to the COVID-19 Distance Learning Phase (P3:15; P16:55). They attributed this to the fact that the media-savvy lecturers tried out more new tools in the COVID-19 Distance Learning Phase.

A programme director from the field of Social Sciences, Journalism and Information also stated that the lecturers' media use had increased over time, but not its quality (P3:64). Another type of new media use was described by an ICT programme director. He dismantled the devices of his laboratory and mailed the parts to the students so that they could participate in the exercise (P4:135). From his point of view, analogue media use has also changed (P4:138). A programme director from the field of Business, Administration and Law described his view of why media use changed as a result of the Distance Learning Phase:

> *“Whenever there is a common enemy, people are willing to change. It doesn't matter which group you see; well, humans would probably live together differently if we discovered that there were aliens on Mars. You can apply that to any area of life. Now there is COVID. So, if we had said one year ago, ‘Dear teachers, we need to use more digital [tools for teaching]’ then [they would have answered]: ‘I'm sorry, I can't do that, I'm not that technically versed.’ So now we had to do it. This has accelerated the change management process a lot. [...] Yes, people have used more media and also the universities have provided more media” (P15:84-86).*

Nine programme directors believed there are no longer any lecturers at UAS with little media use (P1:92; P2:28; P7:68; P11:185, P13:107; P16:57; P17:122; P18:55; P19:90). Six of them stated that the lecturers who preferred to continue teaching in person with little media use had no choice due to COVID-19 and switched to distance learning with more media use (P1:92; P2:28; P7:68; P16:57; P17:122; P19:90). An ICT programme director added that some lecturers who use very little media in classroom teaching developed completely new didactics for distance learning (P7:68). However, he also stated that basic media competence of the lecturers is essential for the use of media in teaching (P7:101). A programme director from Engineering, Manufacturing and Construction stated that the changeover to more media use in the COVID-19 Distance Learning Phase was only successful to a greater extent from the 2020 winter semester onwards (P17:122). A programme director from Health and Welfare stated that using media and interaction platforms through COVID-19 has become an essential part of the lecturers' working environment and positively impacts teaching (P13:107). A programme director from the same department said that her course had had no lecturers with little media use for 15 years as this is a requirement in the programme (P11:185). The aspect lecturers with low media can be illustrated by a quote from a programme director from the field of Business, Administration and Law:

> *"I have to think about whether they [lecturers with low media use] still exist. I didn't get any feedback from the students that someone was not familiar with technical devices and equipment. That is positive, which was different at the beginning of the pandemic. I don't think anyone can afford to reject technical devices and systems, whether professionally or in teaching. That's simply no longer possible, and I don't believe that there is anyone left. Because they have to admit for themselves, well, then I can't take on a teaching job anymore" (P19:90).*

Nine programme directors felt that lecturers were not aware of any pedagogical models for teaching (P2:38; P3:58; P7:53; P9:73; P10:60; P11:135; P13:90; P19:68; P20:92). Five of them stated that it would be interesting for the lecturers to know these models (P2:38; P7:53; P9:73; P11:135; P20:92). A programme director from Engineering, Manufacturing and Construction added that the lecturers did not know about pedagogical models because nobody had taught them (P10:60). Another ICT programme director stated that pedagogical models are not in demand in further education at UAS because lecturers do not know how to use them successfully in teaching. According to him, this could change if selected models were presented to the lecturers and they see benefits for their teaching (P7:53). A programme director from the field of Social Sciences, Journalism and Information expressed his perspective on why lecturers are unfamiliar with pedagogical models, saying:

> *"I think this is less well known, except for people who have already dealt intensively with teaching, who may have a different didactic background. But I think that is rather less well known" (P3:58).*

Seven programme directors described lecturers with low media use (P1:94; P2:76; P3:76; P4:160; P8:92; P9:79; P10:103). A programme director from Engineering, Manufacturing and Construction said that lecturers with little media use are often part-time lecturers who do minimal teaching (P1:94). Another programme director from Business, Administration and Law pointed out that lecturers with low media use used video conference systems during the COVID-19 Distance Learning Phase and held traditional webinars (P2:70-72). These lecturers are susceptible to suggestions by the programme directors (P2:76; P9:79) and willing to learn through examples from other lecturers (P9:80). A programme director from the field of Social Sciences, Journalism and Information believed that lecturers with little media use need guidance, support, guidelines and tips and tricks for media use in teaching (P3: 71). Two programme directors also stated that this support should ideally be packaged in small units (P3:76; P10:103). An ICT programme director underlined the need for much support for lecturers with little media use (P8:92). Another programme director from the same field made special reference to the role model function of programme directors (P4:160). He described his experience with lecturers with low media use as follows:

> *"Yes, in the end, the issue is a role model. The solution is always to start slowly. So, just start. And that's easier said than done. And it fizzles out if you don't do it yourself. I can't ask a lecturer to do an online lecture or make videos. If I don't do it myself" (P4:160).*

Seven programme directors found that the media use of the lecturers had not changed due to the COVID-19 Distance Learning Phase (P1:68; P2:50; P3:66; P8:72; P9:76; P12:118; P18:48) and that they used the same media as before (P2:48; P3:66; P9:76; P12:118; P18:48). An ICT programme director referred above all to lecturers who had already had experience with distance learning before COVID-19 (P8:72). However, one programme director from Engineering, Manufacturing and Construction believed that the use of media by lecturers in the classroom had not changed, but that private media consumption had (P12:119). A programme director from the field of Social Sciences, Journalism and Information expressed his perspective on media use being unchanged as a result of the Distance Learning Phase by saying:

> *"I believe that the people who used to use little technology now do not use a lot more technology or have not developed a lot of media skills. They continue to use the basic instruments, so to speak. And those who were already technically savvy and experimented there, of course, have now carried on and maybe got to know new things. But I think we haven't turned a media sceptic into an absolute media freak. I don't think that the basic pattern of use has changed that much" (P3:66).*

Five programme directors stated that their lecturers were familiar with pedagogical models (P1:62; P10:59; P15:99; P16:49; P17:109). Three of them said they had come into contact with this as part of the HE didactic training at the UAS (P15:99; P16:49; P17:109). A programme director from Engineering, Manufacturing and Construction added that some part-time lecturers had been exposed to pedagogical models in their training for their main job (P10:59). A reason why lecturers know pedagogical models was given by a programme director from the field of Business, Administration and Law:

> *"Yes, we have a higher education didactic training course that every lecturer has to complete, that's almost 10 ECTS or so, converted. I think it's quite a lot, and a lot is done there. But certainly not everything. And above all, then you have that once. So far, that's the system; everyone has to do it once, but if I've been at the university for 20 years..." (P15: 99).*

In summary, the different aspects of media use present a heterogeneous picture. There were two contradictory answers, explicitly or implicitly, to whether the lecturers' media use had changed due to the COVID-19 Distance Learning Phase. Thirteen programme directors stated that the lecturers' media use had changed (P3:64; P4:153; P6:130; P7:57; P8:74; P10:88; P11:151; P13:95; P15:84; P16:53; P17:124; P20:84; P20:111). In contrast, seven said that media use had not changed (P1:68; P2:50; P3:66; P8:72; P9:76; P12:118; P18:48). Two programme directors mentioned arguments both for and against a change in the lecturers' media use (P3:64-66; P8:72-74). An equally inconsistent picture emerged regarding whether lecturers at UAS had little media use. Nine programme directors believed that such lecturers no longer exist (P1:92; P2:28; P7:68; P11:185, P13:107; P16:57; P17:122; P18:55; P19:90). On the other hand, seven respondents described lecturers with low media use (P1:94; P2:76; P3:76; P4:160; P8:92; P9:79; P10:103). Two programme directors gave arguments for and against this assumption (P1:92-94; P2:28; P2:76). Concerning whether the lecturers are familiar with pedagogical models for use in teaching, there were again two different perspectives. Nine programme directors felt such models were not known among lecturers (P2:38; P3:58; P7:53; P9:73; P10:60; P11:135; P13:90; P19:68; P20:92). However, five respondents stated that the lecturers in their degree programmes are familiar with pedagogical models (P1:62; P10:59; P15:99; P16:49; P17:109). One programme director gave arguments for and against this assumption (P10:59-60).

### *10.2.2 Reasons for Asynchronous or Synchronous Media Use*

Most programme directors gave different reasons for using asynchronous and synchronous media. These were in particular (1) asynchronous media use requires more effort for lecturers, (2) synchronous or asynchronous depends on the task, (3) synchronous is easier for lecturers, (4) asynchronous and synchronous because of time aspects, (5) synchronous due to little experience of lecturers, (6) asynchronous self-study needs less media competence, (7) synchronous and asynchronous due to personality, (8) asynchronous due to the fear of being recorded by a camera.

Teaching with asynchronous media was considered by eight programme directors to be more complex than using synchronous media (P1:88; P2:32; P3:56; P7:60; P10:90; P12:122; P13:105; P15:101). The reasons for this were the initial effort to create asynchronous media (P7:60; P13:105), the effort for the conception of competence-oriented asynchronous tasks and the time required to provide feedback to students (P1:90; P12:122). On the other hand, two programme directors thought it was comparatively the least time-consuming for lecturers to present the subject matter, whether in the lecture hall (P1:88) or with the help of video conferencing systems (P2:58). In addition, four respondents stated that full-time lecturers work more with asynchronous media than part-time lecturers (P2:32; P3:56; P13:105; P15:38). They justified this with the lower time resources of the external lecturers (P2:30-32; P15:38) but also because the reusability of asynchronous media, once created, plays a more significant role for the full-time lecturers (P15:101), who have more time to develop asynchronous media (P15:38). A programme director from the field of Engineering, Manufacturing and Construction expressed why he believed that asynchronous media use requires more effort for lecturers by saying:

> *"So, for those who use elaborated asynchronous elements, it is certainly the case that the effort is seen as very large. To really set up a competence-imparting asynchronous module" (P10:90).*

Seven programme directors felt that the use of synchronous or asynchronous media depended on the task (P3:106; P4:89; P6:133; P8:89; P9:17; P17:144; P19:8). They gave different examples of the use of synchronous elements. In particular, these were topics that require interaction (P4:89; P8:89; P9:17; P17:142; P19:8), such as feedback, group work

(P8:89), exercises, case studies (P17:142) and project work (P19:8). In addition, these are dialogue-oriented courses (P9:17). Theoretical lectures and meaningful monologues (P3:106; P17:17) were also listed by two programme directors using synchronous teaching cases. According to two programme directors, the third type of task considered to be particularly suitable for synchronous teaching was work in laboratories (P3:105; P6:133), even if this is also possible online synchronously via VPN (P6:133). Examples of fields of application that are particularly suitable for asynchronous teaching were practice and practical fields of application (P4:89; P6:132). An ICT programme director said that the tools and methods used in teaching should conform to the topic being conveyed (P8:89). Another programme director from Engineering, Manufacturing and Construction explained that the choice of asynchronous and synchronous media varies depending on the content and learning outcome. The selection is based on the levels in which one is oriented on Bloom's taxonomy (P17:144). An ICT programme director summarised that for him, synchronous or asynchronous depends on the task:

> *"And it depends a bit, so I think if you now have a mediation topic, then it is likely that you - or that I tend to do a lot in sync, with elements of interaction, less asynchronously. If I am more into a practical application topic, then I would probably work with relatively large slots of asynchronicity" (P4:89).*

Five programme directors believed that lecturers use synchronous media because they are easier to use than asynchronous media (P2:58; P3:94; P10:94; P12:123; P18:50). Two attribute this to the fact that the lecturers are used to synchronous teaching (P10:94; P12:121). A programme director from Business, Administration and Law also explained that it is easier for lecturers to hold an online course with a video conferencing system than with asynchronous media (P2:58; P12:121). However, another programme director from Social Sciences, Journalism and Information said that lecturers who only use videoconferencing systems in distance learning are the minority (P3:94). Finally, a programme director from the field of Health and Welfare brought in the students' perspective. She argued that while lecturers prefer traditional lectures online, students do not prefer them (P18:50).
A programme director from the field of Engineering, Manufacturing and Construction described why he believes that synchronous is easier for lecturers:

*"And the synchronous, that's what we are and were all used to. And that's why it's perceived as easier" (P10:94).*

Five programme directors mentioned various temporal aspects that lead to the use of asynchronous or synchronous media (P3:49; P11:155; P17:140; P19:88; P20:113). Most notably, this was the temporal independence of teaching with asynchronous media (P3:49; P11:155; P19:88). From the perspective of three programme directors, the use of asynchronous media offers more flexibility in terms of time for lecturers (P11:155; P19:88) and students (P3:49) in distance learning. Lecturers can decide when to prepare their teaching materials and assignments and correct them without sticking to synchronous course dates, and students do not have to attend synchronous appointments; they can decide for themselves when to complete assignments. On the other hand, some degree programmes specify the proportion of synchronous and asynchronous teaching (P17:140; P20:113). Thus, in one case, the lecturers jointly determined the extent and design of asynchronous teaching during module development (P17:140); in another case, it was defined for the entire degree programme (P20:113). A programme director from the field of Business, Administration and Law described why she thought that asynchronous and synchronous media is used because of time constraints:

*"I think it's a time factor. A time factor in the sense of when I give asynchronous distance learning, I can decide when to look at the submissions, give feedback, respond to the email, depending on. But synchronous always means time-bound" (P19:88).*

Three programme directors attributed the increased use of synchronous media compared to asynchronous media to less experience of lecturers in e-learning (P3:68; P15:39; P16:59). For example, a programme director from Business, Administration and Law stated that the less lecturers had worked with blended learning elements before COVID-19, the more likely they were to transfer the seminar room situation with synchronous media one-to-one into online teaching (P16:62). Another programme director from the same department added that teaching with synchronous online media, e.g. video conference systems, is didactically the slightest different compared to face-to-face teaching (P15:39). On the other hand, a programme director from the field of Social Sciences, Journalism and

Information noted that lecturers in blended learning courses were already familiar with video conference systems before COVID-19. They then used these increasingly in the Distance Learning Phase (P3:68). A programme director from the field of Business, Administration and Law expressed his perspective that synchronous media is used due to lecturers having little experience:

> *"I think the less someone had previous experience with blended learning, the more they tend to work synchronously. Because it somehow reflects this logic of the seminar room" (P16:59).*

Four programme directors stated that lecturers with less media competence used intrinsically asynchronous self-study (P3:95; P10:91; P15:38; P18:51). For the students, these are courses where they learn independently without supervision. For the lecturer, it is comparable to writing textbooks or scripts. Two programme directors described individual work, tasks and self-study based on printed literature as classic asynchronous self-study (P3:97; P10:91). According to a programme director from Business, Administration and Law, these assignments required less experience in content creation and less time (P15:38). Some people imagine that asynchronous teaching is just self-study, said a programme director from Health and Welfare (P18:51). A programme director from the field of Social Sciences, Journalism and Information summarised his view on why asynchronous self-study needs fewer media competence as follows:

> *"I think if I have less competence in media, then I do things more easily asynchronously by giving tasks or doing more self-study. Of course, I can also do a lot asynchronously; I do screencasts, I produce videos, whatever, do my own audio. It's a different group, so of course, I need a lot of media competence to do things like that. But I was referring to the people, so to speak, who make distance learning less time-consuming or who tend to go into self-employment or self-study with classical instruments, quite deliberately. So, use less of the variety of media, but simply work very, very classically" (P3:95).*

Three programme directors named the lecturer's personality as the reason for the different use of synchronous and asynchronous media (P3:69; P9:16; P12:124). For example, an ICT programme director explained that lecturers within a subject area use media differently, such as language lecturers. He attributes this to the unique type of teaching (P3:69). Another aspect was mentioned by a programme director from the field of Engineering, Manufacturing and Construction. In his view, many lecturers become lecturers because they want to pass on knowledge. This task is often associated with a filling of meaning. Therefore, in his opinion, these lecturers usually prefer synchronous media that allow direct knowledge transfer (P12:124). A programme director from the field of Social Sciences, Journalism and Information described his perspective on why synchronous and asynchronous media is used due to personality as follows:

> *"Of course, as always, it depends very much on the lecturer. I think even more on the lecturer than on the content. There is, of course, a barrier that is there - it is not very pronounced in my degree programme now, but even there it is sometimes there - that is this 'You can't do that online'. If someone has that as a very strong mindset, then, of course, everything is somewhat impeded and complicated in that respect. This is very rarely the case with me, but it is not at all not the case. That is actually what is most of the hindrance" (P9:16).*

Two programme directors found that lecturers also used more asynchronous elements because they shied away from using the camera (P3:92; P10:23). A programme director from Engineering, Manufacturing and Construction stated that knowing that their course is being recorded costs lecturers quite a lot of effort. They can reduce this fear by looking at other lecturers' recordings (P10:23). Another ICT programme director pointed out that the perceived distance during virtual transmission is often tiny (P4:158). He described his experience that asynchronous media is used due to the fear of being recorded by a camera as follows:

> *"So, one reason is definitely being afraid of the camera. So, I think there are lecturers - malicious insinuation on my part - who say, watch out, I don't really want to expose myself here like that. And that's why they tend to switch to asynchronous formats. So apart from the technical hurdles that may exist, I think there's also a psychological hurdle that you say, I'll expose myself that far" (P4:156).*

In summary, the programme directors described several reasons for synchronous or asynchronous media use. One reason for the increased use of synchronous media was the lecturers' low experience with distance learning (P3:68; P15:39; P16:59). In addition, from their perspective, synchronous media are easier for lecturers to use than asynchronous media (P2:58; P3:94; P10:94; P12:123; P18:50). In comparison, the use of asynchronous media is assessed as more complex (P1:88; P2:32; P3:56; P7:60; P10:90; P12:122; P13:105; P15:101). An exception is an asynchronous self-study, which lecturers with low media competence also use (P3:95; P10:91; P15:38; P18:51). Programme directors also believed that lecturers use asynchronous media because they shy away from using the camera (P3:92; P10:23). Other reasons given for using synchronous or asynchronous media were the task (P3:106; P4:89; P6:133; P8:89; P9:17; P17:144; P19:8), time-related aspects (P3:49; P11:155; P17:140; P19:88; P20:113) and the lecturer's personality (P3:69; P9:16; P12:124).

#### *10.2.3 Assessment of Asynchronous and Synchronous Media Use in Blended Learning*

Several programme directors made assumptions about the future use of synchronous and asynchronous media and shared their experiences of their use. This subcategory includes the codes (1) more synchronous online in the future, (2) experiences with asynchronous media use, (3) more asynchronous in the future, (4) synchronous and asynchronous will remain the same, and (5) experiences with synchronous media use.

Ten programme directors indicated that they would like to use more synchronous online elements after the COVID-19 Distance Learning Phase (P1:16; P3:23; P4:88; P6:47; P9:13; P10:20; P11:50; P13:16; P18:17; P19:34). Four of them want to convert distance learning elements that were held asynchronously before the COVID-19 Distance Learning Phase to synchronous online distance learning (P3:23; P11:49; P19:34; P18:17). Three would like to increase the synchronous online elements at the expense of face-to-face teaching (P1:16; P10:20; P13:16). A programme director from Engineering, Manufacturing and Construction said that synchronous classroom teaching should be available at least at the beginning and end of each course (P1:16). Another ICT programme director believed that the proportion of synchronous and asynchronous elements should be 50% each (P4: 89). For the programme directors, synchronous distance learning elements are more manageable because it is easier to prove the lecturer's activity than with asynchronous elements, said a programme director from the field of Health and Welfare (P13:13). A programme director from the field of Social Sciences, Journalism and Information sees more effects of the COVID-19 Distance Learning Phase on the synchronous than on the asynchronous elements

(P3:25), whereby from his point of view, the diversity of activities in synchronous media use has increased (P3:27). The assumption that there will be more synchronous online media use in the future can be illustrated by the following quote :

> *"I could imagine that now that we have had 100% online teaching in the COVID phase, which was then also a lot of synchronous online teaching, lectures that have always been synchronous [in presence] up to now. That the experiences from this will also be included into distance learning and that there will perhaps be more synchronous appointments there, because more instruments are simply available for the synchronous appointments and therefore, perhaps, more quality is put into the synchronous elements" (P3:23).*

Four programme directors reported their experiences with asynchronous media use in teaching (P10:101; P14:25; P15:36; P17:66). From the perspective of a programme director from the field of Engineering, Manufacturing and Construction, content that is independent of the course schedule is particularly suitable for asynchronous media. Otherwise, from his point of view, the planning of the timetable will be limited (P10:98). Asynchronous distance learning should not be restricted to a few days (P10:100). This allows students to work at their own pace. Starting the asynchronous elements after the first third of the course and continuing until the end is ideal (P10:101). A programme director from the same subject pointed out that asynchronous elements enable students to manage their time independently. From her perspective, asynchronous and synchronous elements should be systematically linked (P17:66). An ICT programme director pointed out that students learn less in unsupervised asynchronous phases than in supervised ones in which they also receive feedback (P14:25). His experience is that the students value the contact with the lecturer, which can also occur through asynchronous feedback (P14:109). A programme director from Business, Administration and Law adds that one advantage of using asynchronous media is that the lecturers are not bound to the 45-minute units of synchronous teaching (P15:34). Experience with asynchronous media use can be illustrated by the following quotation from a programme director from the field of Engineering, Manufacturing and Construction:

> *"This means that asynchronous teaching makes sense so that students can use their own time management to determine when they want to familiarize themselves with*

*the content. Of course, within a certain period of time. In any case, the phases have to overlap perfectly for the system to work. And, also that the learning success can be upheld" (P17:66).*

Four programme directors expected increased use of asynchronous media in the future (P2:22; P5:38; P9:12; P15:34). Three of them see a trend towards more asynchronous teaching (P2:22; P5:38; P15:34); one sees a shift towards digital means and asynchronous elements (P9:12). He justifies this because the lecturers gained experience in the COVID-19 Distance Learning Phase, improving quality (P9:13). A programme director from the field of Business, Administration and Law stated that his UAS has the equipment and services available to produce more videos for teaching, which can be used multiple times in the future (P15:34). Finally, a programme director from the same department would like to use more asynchronous elements in the future because she believes that the students perceive these as less work (P2:22). A programme director from the field of Social Sciences, Journalism and Information explained his expectations that there would be more asynchronous media use in the future by saying:

*"I assume that there will be a general shift towards more digital means. But whether they will be more asynchronous or synchronous is the question. I think both, to be honest, will be stronger. Because asynchronous production is now of higher quality and can also be produced in higher quality because we now have even more skills and tools" (P9:12).*

Four programme directors believed that synchronous and asynchronous media ratio would remain the same after the COVID-19 Distance Learning Phase (P1:20; P7:18; P17:65; P20:47). In addition, they referred to the fact that the asynchronous components in their degree programmes after COVID-19 should have the same proportion as before (P1:20; P7:18; P17:65; P20:47). A programme director from Engineering, Manufacturing and Construction said that this division should remain the same to enable students to learn on different levels (P17:65). The assumption that synchronous and asynchronous media use will remain the same can be illustrated by the following quotation from an ICT programme director:

*"Nothing has changed for me. The asynchronous to synchronous ratio was similar last year, plus or minus marginal fluctuations, as in previous years. I don't intend to change it for the bachelor's [programme] either" (P7:18).*

Three programme directors reported on their experiences of synchronous media use (P4:85; P14:156; P17:68). One ICT programme director argued that an online course does not work without synchronous elements (P4:85). He also experienced synchronous online coaching for students as being very positive (P4:93). Another programme director from the same department preferred to do practical exercises in the synchronous phase of a course (P14:156). Finally, before a synchronous phase, a programme director from the Engineering, Manufacturing and Construction department checks the level of knowledge the students have acquired in the asynchronous phase (P17:68). An ICT programme director described his experience of synchronous media use by saying:

*"And you could say that a course without synchronous components is doomed to failure. We also had other courses; a course with too little interaction is poorly accepted, just like a course with too much interaction. You can also overdo it with synchronicity" (P4:85).*

In summary, assessing the future use of synchronous and asynchronous media results in a heterogeneous picture. Programme directors assumed both an increased use of synchronous elements (P1:16; P3:23; P4:88; P6:47; P9:13; P10:20; P11:50; P13:16; P18:17; P19:34) and an increased use of asynchronous media (P2:22; P5:38; P9:12; P15:34) in teaching after the COVID-19 Distance Learning Phase. Some respondents also felt that the ratio between synchronous and asynchronous media would remain the same (P1:20; P7:18; P17:65; P20:47). Concerning asynchronous media use, programme directors reported that the advantages lie in flexibility in terms of time (P10:98; P15:34; P17:66). Synchronous elements, on the other hand, are necessary for online courses (P4:85) and are also suitable for coaching students (P4:93) and practical exercises (P14:156) in the view of the programme directors.

## 10.3 Differences Between Lecturers in Blended Learning Environments

The programme directors at UAS were asked how the lecturers in their courses differ in their teaching and whether there are differences between full-time and part-time lecturers. These questions for the interview protocol were based on the results of three hypotheses. The quantitative results showed statistically significant differences between lecturers teaching in blended learning study programmes at Austrian UAS based on their TPACK. These differences exist in their fields of education, between full-time and part-time lecturers and concerning media infusion but not concerning education, gender, age, years of service and the use of LMS. In the qualitative study, differences between lecturers were examined from the perspective of the programme directors interviewed. For the qualitative analysis, the subcategories "differences within the group of lecturers" and "differences between full-time and part-time lecturers" were deductively based on the hypotheses and the literature. The subcategory "type of employment as a distinguishing feature between lecturers" arose inductively from the evaluations of the interviews. The subcategories include three to four codes each, assigned five to 22 times, as listed in Table 43.

**Table 43** *Subcategories and Codes for Differences Between Lecturers in Teaching*

| Subcategory | Code | Number of Codes* | n** |
|---|---|---|---|
| Differences within the group of lecturers | No differences between lecturers | 14 | 11 |
| | Differences to technicians | 11 | 6 |
| | Differences by subject field | 6 | 6 |
| | Differences in openness to new things | 5 | 5 |
| Type of employment as a distinguishing feature between lecturers | No differences between full-time and part-time lecturers | 10 | 9 |
| | Too few full-time lecturers to see differences | 5 | 5 |
| | Full-time and part-time lecturers as a distinguishing feature | 5 | 3 |
| Differences between full-time and part-time lecturers in teaching | Differences in didactic competences | 22 | 11 |
| | Differences in practical experience | 12 | 6 |
| | Differences in the knowledge of internal processes concerning teaching | 11 | 6 |
| | Differences in teaching areas | 8 | 4 |

* The number of codes is the total number of codes assigned. A code can be applied more than once in an interview.

** n is the number of programme directors for whom the code was assigned.

The codes of the main category "differences between lecturers in teaching" are linked to the literature. Concerning the subcategory "differences within the group of lecturers", research confirms the findings of the quantitative study about the influence of the subject field (Cubeles & Riu, 2018). Nevertheless, considerably more literature found no relationship between the subject field and lecturers' TPCK (Alzahrani, 2014; Fabian et al., 2019; Lye, 2013; Rienties et al., 2013; Voithofer et al., 2019). In this context, Castéra et al. (2020) discovered that the TPACK of lecturers varies according to the country studied and the group of lecturers surveyed. In the case of this thesis, a less studied group is researched, namely, lecturers in HE who do not teach in teacher education programmes (Herring et al., 2016; Rodríguez Moreno et al., 2019). It is therefore understandable that the results differ from those of teachers and lecturers who train teachers. Concerning the differences between full-time and part-time lecturers, both Fabian et al. (2019) and Chukwuemeka and Iscioglu (2016) documented differences. Full-time lecturers rated their TPACK higher, and part-time lecturers ranked their TK higher. The following sections present the qualitative study results for the main category "differences between lecturers in teaching".

#### *10.3.1 Differences Within the Group of Lecturers*

The differences programme directors saw or did not see within their lecturer groups included (1) no differences between lecturers, (2) differences to technicians, (3) differences by subject field, and (4) differences in openness to new things.

Eleven programme directors did not see any differences between the lecturers who teach in their courses that distinguish them as subgroups (P3:36; P7:29; P9:27; P10:45; P11:66; P12:79; P14:131; P16:35; P17:89; P18:32; P20:57). This group of directors was also unable to pinpoint general distinguishing characteristics between lecturers. The faculty was described as both a heterogeneous group (P11:66; P20:57) and a homogeneous group (P9:29). These assessments meant that the views on the lecturers' differences varied substantially among the programme directors. A programme director from the field of Business, Administration and Law summarised her view that there are no differences between lecturers as follows:

> *"They are actually very diverse, very heterogeneous. But I could imagine that this is precisely what makes them so appealing to the students" (P20:57).*

Nevertheless, programme directors reported differences in the group of all lecturers in their degree programmes. They mentioned differences between technicians and non-technicians most frequently. Programme directors mainly saw these differences between Engineering, Manufacturing and Construction (P1; P10; P12) and ICT (P4; P6; P14). In addition, they referred to the methods used for teaching (P1:82; P10:64). One programme director stated that technicians tended to present teaching content frontally and less cooperatively (P1:84). Three ICT programme directors saw themselves as pioneers in using technology in teaching (P4:69; P6:191; P14:163). One assumed that technicians at home have access to a better technical infrastructure for teaching (P14:163). He explained why he believes that there are differences between technicians and other lecturers as follows:

*"Someone who has always worked with computers from the very beginning has played computer games since his youth and has always used video chats - I am now addressing these prejudices against computer scientists - these people naturally find it easier. If someone only uses the computer for Word used to check his e-mails and read a bit of the online standard [online newspaper], he, of course, has a different approach to now suddenly teaching lessons via the computer" (P14:167).*

Six programme directors highlighted further differences between the lecturers related to the subject areas (P2:26; P8:52; P9:30; P10:56; P12:89; P20:161). One programme director from Business, Administration and Law particularly noticed this in the different specialisations of her degree programme (P2:26). At the same time, another ICT programme director recognised differences between lecturers according to the subject (P8:52).
A programme director from the field of Engineering, Manufacturing and Construction expressed his perspective on differences within the lecturer group by subject field by saying:

*"And there are already differences; you can notice that between lecturers as far as subject disciplines are concerned" (P10:56).*

A further difference affecting all lecturers that was mentioned by five programme directors was openness to new things (P1:54; P7:59; P14:132; P15:49; P17:81). It was described as the lecturer's attitude to try things out (P7:59) or to come up with new concepts (P14:132) or as the willingness to change (P15:47). This affinity for the new was seen as the decisive factor differentiating the lecturers (P17:81). An example of the difference between lecturers concerning their openness to new things was given by a programme director from the field of Business, Administration and Law:

*"There are those who are not ready to change and are trapped in their world of thought, whatever that is now. And then there are the others who are more flexible, so to speak" (P15:49).*

In summary, most of the programme directors interviewed did not see any differences between lecturers that would merit dividing them into subgroups (P3:36; P7:29; P9:27; P10:45; P11:66; P12:79; P14:131; P16:35; P17:89; P18:32; P20:57). However, some of the programme directors did cite differences, referring to differences between lecturers from different subject areas (P2:26; P8:52; P9:30; P10:56; P12:89; P20:161). Programme directors from the fields of ICT (P4; P6; P14) and Engineering, Manufacturing and Construction (P1; P10; P12) noted differences between lecturers who are technicians and those who are not. Another distinctive feature mentioned was openness to new things (P1:54; P7:59; P14:132; P15:49; P17:81).

### *10.3.2 Teaching Employment Type*

Many programme directors commented that they saw or did not see the type of employment as distinguishing between lecturers. This subcategory included (1) no differences between full-time and part-time lecturers, (2) too few full-time lecturers to see differences, and (3) full-time and part-time lecturers as a distinguishing feature.

Seven programme directors saw no differences between their full-time and part-time lecturers that impacted teaching (P3:34; P7:27; P8:48; P9:25; P11:60; P17:74; P18:29). Thus, there were no distinguishing characteristics between these groups from their point of view. A programme director from Social Sciences, Journalism and Information attributed this to the training programmes at the UAS (P9:29). The assumption that there is no difference between full-time and part-time lecturers can be illustrated by what he said:

*"I don't think there's that much difference at all" (P9:25).*

Other interviewees, five of whom were programme directors of master's programmes, were unsure whether there were differences between internal and external lecturers or not (P5:85; P9:25; P13:53; P14:124; P19:38). It is important to note that these five master's programmes feature particularly few in-house lecturers; in some cases, the programme directors are the only in-house lecturers in their programmes. An example of the perspective that there are too few full-time lecturers to see differences is provided by an ICT programme director:

*"Frankly, I don't know. Because we only have external staff in the master's programme. And I'm actually the only one who really does teaching, as an internal" (P14:124).*

However, three other programme directors indicated the difference between full-time and part-time lecturers as the primary distinguishing feature among their course lecturers (P1:26; P4:105; P13: 35). A programme director from the field of Engineering, Manufacturing and Construction expressed his perspective on full-time and part-time lecturers as a distinguishing feature by saying:

> *"The main difference is that there are lecturers who are full-time lecturers. I include those employed here full-time as university teachers and those who come from universities. And then there are lecturers who have another main job besides teaching" (P1:26).*

In summary, several programme directors saw no differences between full-time and part-time lecturers (P3:34; P7:27; P8:48; P9:25; P11:60; P17:74; P18:29), but this was not true for all respondents (P1:26; P4:105; P13:35). Furthermore, programme directors of master's courses whose teaching staff consisted mainly of external lecturers could not make any statements about their differences (P5:85; P9:25; P13:53; P14:124; P19:38).

#### *10.3.3 Differences Between Full-time and Part-time Lecturers in Teaching Approaches*

Most programme directors saw differences between full-time and part-time lecturers in teaching. This subcategory included (1) differences in didactic competencies, (2) differences in practical experience, (3) differences in knowledge of internal processes concerning teaching, and (4) differences in teaching areas.

The most common difference the programme directors saw between their full-time and part-time lecturers was didactic competence. Ten programme directors (P1; P2; P3; P5; P9; P10; P12; P13; P15; P20) recognised differences here. The full-time lecturers mostly attended basic didactic training (P3:42; P1:32) and continued their didactic training during their working hours (P5:45). Programme directors reported that full-time lecturers used more complex methods and a greater variety of methods (P2:30) for a greater didactic variety (P20:55). Thus, they were better and more flexible in didactics (P1:28). Full-time lecturers also prepared their teaching materials differently and used Moodle more intensively (P3:44; P10:33). Two programme directors from the field of Engineering, Manufacturing and Construction observed a difference when teaching was a lecturer's profession or only a part-time job for them (P1:26; P10:34). An exception are lecturers who are also teachers at the secondary level (P1:32) or other universities (P3:35; P13:55) and therefore have didactic training. In contrast, some part-time lecturers had no teaching experience before their teaching position (P5:104). It took them longer to settle into teaching (P12:90). However, they were appreciative of training offers to expand their didactic competencies (P9:29). A programme director from the field of Engineering, Manufacturing and Construction summarised his view on the differences between full-time and part-time lecturers in didactic competencies as follows:

> *"I would say that those who work full-time in teaching are better in terms of didactics, better in terms of the variety of teaching, and more flexible" (P1:28).*

Another difference between internal and external lecturers was particularly emphasised by the programme directors, namely, the relation to the part-time lecturers' practical experience. They share their practical experience (P10:32; P18:120) and ensure a practical connection to the professional world (P1:64; P5:45). According to a programme director from Engineering, Manufacturing and Construction, part-time lecturers can be lecturers who cannot be recruited as full-time lecturers but who can relate better to research and society (P12:93). Thus, programme directors saw two motives for teaching as part-time lecturers on their programmes: the contact with students and, therefore, potential applicants (P1:64), and the part-time lecturers' enjoyment in showing and sharing their practical knowledge (P8:120). A programme director from the field of Engineering, Manufacturing and Construction expressed his perspective on the differences in practical experience between full-time and part-time lecturers by saying:

> *"But the real professional expert naturally has the advantage that he can bring up really current issues. And that is his advantage" (P10:7).*

Full-time lecturers know the processes, instruments and curriculum of the programmes in which they teach better than part-time lecturers. According to a programme director from the Business, Administration and Law field, they knew more about the programme's developments at the UAS (P2:78). A programme director from Health and Welfare felt they had a better curriculum overview (P11:62). According to two programme directors, full-time lecturers had the opportunity to learn from and with one another in a team (P11:56; P20:53); this exchange was easier with full-time lecturers than with external lecturers, according to a programme director from Business, Administration and Law (P20:53). An ICT programme director mentioned in this context that external lecturers had

to be accompanied more intensively during changes (P4:105). From the perspective of a programme director from Engineering, Manufacturing and Construction, this group of lecturers had to be serviced more (P12:81). Overall, according to a programme director from the field of Social Sciences, Journalism and Information, part-time lecturers had less discipline to use the tools provided and adhere to the rules of the UAS (P3:43).
A programme director from the field of Engineering, Manufacturing and Construction described his perspective on differences in knowledge of internal processes concerning teaching between full-time and part-time lecturers as follows:

> *"We all know that the more I work digitally, the more programmes, tools and workflows I need. That means we have to brief the externals again and again very precisely about the processes, procedures and the tools and methods that are made available to them. That takes a lot more servicing with the externals than it does with the internals" (P12:80).*

In some degree programmes, full-time and part-time lecturers teach different types of courses. For example, according to the view of two programme directors from the field of Engineering, Manufacturing and Construction (P1:96; P10:30), full-time lecturers are better suited to present basic subjects. On the other hand, in a study programme in Health and Welfare, internal lecturers mainly teach in the laboratory (P18:29). For master's theses in Social Sciences, Journalism and Information, an external first supervisor is appointed from professional practice and a second supervisor from the programme (P5:92). An example of the differences in teaching areas between full-time and part-time lecturers was given by a programme director from the field of Engineering, Manufacturing and Construction:

> *"I try, I have to say that now, to relocate basic subjects to the full-time professionals and to give what goes beyond that to the external, because that makes more sense" (P1:96).*

In summary, the programme directors mentioned several differences between full-time and part-time lecturers in the interviews. For example, some believed that full-time lecturers had more didactic skills than part-time lecturers (P1; P2; P3; P5; P9; P10; P12; P13; P15; P20). However, the external lecturers had more practical experience and a connection to the professional world (P1:64; P5:45; P10:32; P18:120). In addition, programme directors said that the full-time lecturers knew internal procedures, instruments, and the study programmes' curriculum better (P2:78; P3:43; P4:105; P11:62; P12:81; P20:53). In several degree programmes, programme directors assigned full-time and part-time lecturers for different types of courses (P1:96; P5:92; P10:30; P18:29).

### 10.4 Lessons from the Distance Learning Phase

The programme directors of the UAS blended learning courses were asked what they had learned from the first year of the COVID-19 Distance Learning Phase. This question was intended as a brief introductory question to address the current conditions of HE teaching at the time of the interview. However, the answers were varied and comprehensive. They contained so many educational implications that they formed the basis for a research question, namely, “What are lessons learned by the programme directors of blended learning programmes at Austrian UAS from the COVID-19 Distance Learning Phase?” The three subcategories for the main category emerged inductively from the analysed interviews. These subcategories were (1) organisational aspects, (2) type of study and (3) design of online courses. Each subcategory comprised between four and nine codes that were assigned between five and 23 times, as seen in Table 44.

**Table 44** *Subcategories and Codes for Lessons Learned from the Distance Learning Phase*

| Subcategory | Code | Number of Codes* | n** |
|---|---|---|---|
| Organisational aspects | Lessons learned regarding technical equipment | 21 | 7 |
| | Lessons learned by universities of applied sciences | 17 | 9 |
| | Lessons learned regarding the workload | 14 | 7 |
| | Lessons learned from the switch from blended to distance learning | 13 | 8 |
| | Lessons learned by programme directors | 12 | 8 |
| | Lessons learned by lecturers | 10 | 7 |
| | Lessons learned regarding the quality of e-learning | 9 | 6 |
| | Lessons learned in communication with students | 7 | 4 |
| | Lessons learned in the design of distance learning | 7 | 5 |
| Type of teaching approach | Lessons learned in synchronous distance learning | 12 | 8 |
| | Lessons learned in hybrid teaching | 7 | 4 |
| | Lessons learned in face-to-face teaching | 7 | 5 |
| | Lessons learned in asynchronous teaching | 6 | 4 |
| Design of online courses | Lessons learned regarding the interaction | 23 | 14 |
| | Lessons learned through lectures | 18 | 10 |
| | Lessons learned regarding tests | 16 | 9 |
| | Lessons learned regarding content that cannot be taught online | 16 | 7 |
| | Lessons learned regarding social factor | 13 | 7 |
| | Lessons learned regarding a variety of formats | 13 | 8 |
| | Lessons learned regarding tools | 6 | 5 |
| | Lessons learned regarding videos | 6 | 3 |
| | Lessons learned regarding breaks and duration of lessons | 5 | 3 |

* The number of codes is the total number of codes assigned. A code can be applied more than once in an interview.

** n is the number of programme directors for whom the code was assigned.

The codes used for the main category "lessons learned" are also related to the literature. Concerning the multiple organisational aspects of lessons learned from the Distance Learning Phase, Anderson (2020) also argued that COVID-19 required universities to implement a digitisation strategy within a few months that usually takes ten years. In this context, Crawford et al. (2020) added that those educational institutions that had already digitalised some part of their teaching in the form of blended learning before COVID-19 were able to switch more efficiently to distance learning. For the lessons learned about the type of teaching approach, both Murphy (2020) and Pokhrel and Chhetri (2021) stated that traditional formats of face-to-face teaching do not work online. Concerning hybrid or blended learning types, Murphy (2020) argued that they help traditional HE institutions to improve the quality of face-to-face teaching by shifting the delivery of content online and allowing lecturers to focus on actively teaching students. Greenhow et al. (2021) stated that learner engagement online could only be achieved through a high level of interaction in the design of online courses. Also, modified and alternative assessments were a typical response to the COVID-19 pandemic, according to Babbar and Gupta's (2021) cross-national comparison of the response of educational institutions. The following section presents the qualitative study results for the main category “lessons learned” from the Distance Learning Phase and takes them further. The results are in line with the literature reviewed.

### *10.4.1 Organisational Aspects*

The programme directors named nine different organisational experiences that they had had in distance learning. This subcategory included the following codes: (1) the technical equipment, (2) the UAS, (3) the workload, (4) the switch from blended to distance learning, (5) the programme directors, (6) the lecturers, (7) the quality of e-learning, (8) the communication with students and (9) the design of distance learning.

Seven programme directors stated that they had learned more about the technical equipment for distance learning in the COVID-19 Distance Learning Phase (P4:65; P6:18; P10:12; P12:83; P13:57; P14:120; P17:176). Most of the experiences were shared by two ICT programme directors in the areas of infrastructure for equipping classrooms and equipping lecturers and students in the home office. At a UAS, all seminar rooms were equipped with cameras, microphones, and interactive smartboards to be fitted for hybrid teaching (P6:26). This required more budget for the technical infrastructure (P6:108). At the same institution, some employees had problems with broadband internet in rural areas (P6:151), so a mobile internet solution was made available to them (P6:156). Since some students' hardware did not sufficiently meet the requirements of the IT course, they were lent devices (P6:157). In addition, the programme director sent Raspberry Pi single-board computers to all students in a semester (P6:163).

Another ICT programme director described the equipment in his home office for online courses. He furnished his home office with a green wall and holds his lessons in front of this green wall (P4:30) in front of a height-adjustable desk (P4:46). The students see his gestures and thus have a visual variety (P4:30). The programme director used the camera on his smartphone to film himself. This setting is suitable for a small room like his home office because of the camera's resolution (P4:36). One critical point for him when making videos was the light. Therefore, he had mounted a rod on the ceiling of his home office with lamps for lighting (P4:44). He had a front light, a light from the side and a light from above when filming (P4:50). He also used the pole to attach other equipment, such as a holder for the smartphone (P4:52). Another critical point for the programme director was sound. He used the webcam's room microphone for meeting situations (P4:56). However, he used a clip-on microphone in an online lecture (P4:64). In addition, he monitored the audio signal on his computer screen to see if the audio signal was being properly transmitted (P4:65). Before each online lecture, the programme director needed a quarter of an hour to set up the room for the teaching setting (P4:53).

A programme director from Health and Welfare also mentioned that the lecturers are now technically much better equipped than before the COVID-19 Distance Learning Phase (P13:57). Furthermore, a programme director from Engineering, Manufacturing and Construction remarked that after several semesters of distance learning, the lecturers can now use video conference systems, cameras, and microphones (P12:83). As far as the technical equipment is concerned, a programme director from Engineering, Manufacturing and Construction said nothing has changed in the toolchain used in the last five years. The tools used are a webcam, a microphone, a headset, and a video camera (P12:10). According to an ICT programme director, the quality of a unit depends heavily on the internet connection (P17:176). Another programme director from the same field indicated that they had focused on technology when switching to distance learning. However, by offering different platforms, students were overwhelmed (P14:120). A quote on lessons learned regarding technical equipment is from a programme director from the field of Engineering, Manufacturing and Construction:

*"What is, of course, also helpful now in distance learning is that everyone can use these video conferencing tools. That was quite different a year ago. But now, many*

*actually understand what is happening there. And have the camera, the microphone, and other things under control and know how to do it" (P12:83).*

Four programme directors stressed that their focus was on offering high-quality programmes during the COVID-19 Distance Learning Phase (P2:26; P6;142; P12:99; P16:84). In addition, one ICT programme regarded this as a feature that distinguished UASs from universities (P6:144). Several statements shed light on programme directors' picture of the UAS sector, even in COVID-19 Distance Learning. Two saw it as the core task of the UAS to offer practice-oriented education based on a theoretical foundation (P5:102; P17:152). According to the views of a programme director from Engineering, Manufacturing and Construction (P10), it is the responsibility of the UAS to remove anything that takes up a student's time but does not contribute to the acquisition of knowledge (P10:54). The UAS should use the student's limited time specifically for the systematic acquisition of competencies (P10:55). A programme director from the field of Business, Administration and Law saw the strength of the UAS in providing structure for the students (P16:20). In the past, this was also offered by being present, which is difficult in full distance learning. In the future, in his view, the UAS must do this through prepared, structured, and documented courses (P16:24). Another characteristic of Austrian UAS mentioned by an ICT programme director, in contrast to Austrian universities and German UAS, is the organisation of study programmes in year groups (P6:226). This form of organisation means that the students attend all courses with the same group, creating a solid bond. Another programme director from the same department saw the close contact with other students and lecturers as an important reason why students apply to UAS. He said this suffered during the COVID-19 Distance Learning Phase (P14:110). The orientation of UAS degree programmes to the economy was addressed by two programme directors (P11; P17). One believed that coordination with industry and business is essential but has suffered during COVID-19 (P17:150). Another saw some tension in the extent to which UASs should provide education or training and how extensive the business orientation should be (P11:141). An ICT programme director summarised his view on lessons learned by UAS as follows:

*"And in our higher education sector, I don't know, but the quality standard that I have experienced in my team is to provide quality, if you will, to the students despite home-schooling" (P6:142).*

Four programme directors saw an increased workload due to the COVID-19 Distance Learning Phase for students (P2; P6; P12; P17) and five saw an increase for lecturers (P1; P6; P11; P12; P14). One programme director from Engineering, Manufacturing and Construction noted mental and physical staff and student overload (P12:75). Another ICT programme director stated that it takes great effort to convey quality in full distance learning (P6:146). Three programme directors justified the extra work for the lecturers by explaining that they had to develop new concepts for full distance learning (P6:109; P11:57; P14:124). Creating online exams were an additional burden (P1:42). Three programme directors attributed the extra effort to students in the COVID-19 Distance Learning Phase because they received additional in-depth materials connected with supplementary assignments (P2:12; P6:34, P17:52). Furthermore, it was mentioned that compared to the time before COVID-19, there were many additional synchronous appointments in addition to the attendance weekends (P2:16). A programme director from the field of Engineering, Manufacturing and Construction described her perspective on lessons learned regarding the workload as follows:

> *"Another learning is definitely that the workload has to be looked at very carefully. Because if you smother the students with too many self-study phases, no, not with the self-study phases, but you demand too much content in this time. Considering one's own basic attitude, that means that when I create something, I am familiar with the field of knowledge. And of course, for me as a person, this can be completed more quickly than for students. And to that extent, you have to take that more into account" (P17:52).*

The experience of the programme directors with the conversion from blended learning courses to full distance learning was relatively uniform. Six said it was easier for them to switch to full distance learning because they already used distance learning elements before COVID-19 (P3:14; P5:20, P6:15, P12:76; P16:70; P20:22). Four of them saw this as different from other programmes at the same UAS (P5:20; P6:15; P16:70; P20:115). Two indicated that lecturers with experience in blended learning could switch to distance learning more easily (P3:14, P20:115). There were also challenges with students working in industries with a higher workload due to COVID-19 (P15:26). A programme director in Social

Sciences, Journalism, and Information reported that he passed on his knowledge of distance learning within the university to other degree programmes that did not use online elements before COVID-19 (P5:20). An ICT programme director stated that it is essential to specify the framework such as dates first, then to provide the lecturers and students with technical support, and third to offer didactic support (P8:101). Another director from Engineering, Manufacturing and Construction stated that in distance learning it is crucial to monitor the tools, processes, and methods used continuously, for internal management and control and to know what is happening online (P12:71). A programme director from the field of Social Sciences, Journalism and Information described his experience with the switch from blended to distance learning as follows:

> *"Learned? Good example. In any case, that we managed to switch to distance learning very quickly, that the switch was possible very quickly" (P3:14).*

Six programme directors reported that they individually accompanied the external lecturers during the switch to distance learning (P1:44, P2:83; P8:92, P13:35, P14:124; P15:41). Two of them also assisted them in creating Moodle tests (P1:44, P2:82). An ICT programme director reported that lecturers who had already taught with online elements before the COVID-19 Distance Learning Phase needed less support with the transition than those who did not do so before COVID-19 (P8:84). His role is to establish the connections among all courses and motivate the students toward the professional world and their graduation (P8:41). This view of one's role, i.e. keeping an eye on the overall concept, is shared by programme directors from the field of Engineering, Manufacturing and Construction (P8:119; P17:148). A programme director from the field of Social Sciences, Journalism and Information saw it as an essential task for him to maintain social contact with the lecturers, even during COVID-19 (P5:25). A typical example of a quote from a programme director in the field of Business, Administration and Law, about lessons learned by programme directors was as follows:

> *"What I also did, at the very first lockdown, was that I actually sought contact with all the teachers the next day in order to change their course concept" (P2:83).*

The effects and lessons learned from the switch to distance learning for lecturers were described variously by the programme directors. A programme director from

Engineering, Manufacturing and Construction perceived the switch from face-to-face teaching to distance learning as an additional effort for lecturers (P1:42), which also applied to online exams (P1:42). He saw that the conversion effort for part-time lecturers with only a few semester hours per week was often disproportionately high (P1:42). Two respondents stated that part-time lecturers opposed the changeover (P6:44; P11:57). For example, not all part-time lecturers wanted to adopt a given tool or provide scripts in an ICT course programme (P6:44). This programme director felt that full-time lecturers could better adapt to distance learning than part-time lecturers who were professionally challenged by COVID-19 (P6:49). In one degree programme in Business, Administration and Law, younger lecturers found it easier to adapt than older lecturers (P19:40). A programme director from the area of Health and Welfare planned to include synchronous distance learning as a fixed element in the timetable after COVID-19 (P13:64) so that the lecturers would know in advance that they had to engage with it (P13:65). On the other hand, three other interviewees reported that the changeover worked well for many lecturers (P6:54; P11:58; P14:124). A programme director from the field of Health and Welfare expressed his perspective on lessons learned by lecturers by saying:

> *"I think still technically a lot of lecturers have become quite comfortable with the online setting or blended learning, where maybe we wouldn't have expected that at the beginning" (P18:37).*

Five programme directors felt that full distance learning had harmed the quality of teaching (P4:224; P9:6; P12:77; P15:14; P18:14). A programme director from Engineering, Manufacturing and Construction stated that the quality decreased due to full distance learning and that the grade point average had fallen by 10% (P12:77). In a degree programme in Business, Administration and Law, the achievement performance has dropped to about 60% compared to the level before the COVID-19 Distance Learning Phase (P15:24). However, he also noted that study programmes could improve the quality of distance learning through detailed course books (P16:21) and that quality control is essential in distance learning (P18:14). A programme director from Business, Administration and Law reported two possible variants concerning the quality of distance learning (P15:15). In one variant, the existing content from face-to-face teaching is held in the lecture style. In this scenario, the lecturer loses the students because they do not follow the online lecture for hours (P15:15). In the other variant, the students are activated through various didactic elements. This scenario means that the lecturer can teach less content than in face-to-face teaching (P15:16). In his view, full distance learning leads to either less content or less quality being taught. He summarised his view on lessons learned regarding the quality of e-learning as follows:

> *"The greatest learning was actually that 100% e-Learning leads to a massive reduction in the quality output or the learning effect. That is the great overall learning" (P15:14).*

Four programme directors commented on aspects of communication with students during the COVID-19 Distance Learning Phase. They reported that they deliberately planned regular online meetings with students (P5:26; P8:38; P17:172) or with student representatives (P6:29). Social contact is desired by students (P5:26). An ICT programme director noted that personal contact with students directly impacts motivation (P8:40). A programme director from Engineering, Manufacturing and Construction shared that her learning is communicating more clearly (P17:51). An example of the lessons learned in communication with students was given by an ICT programme:

> *"That led me to really get monthly feedback sessions with the year representatives. Very intensively as a programme director via Teams" (P6:29).*

Five programme directors shared their experiences of distance learning design at UAS (P4:18; P6:38; P9:7; P12:134; P18:65). Two of them stated that learning how best to design distance learning only comes with practice (P4:18; P12:134). An ICT programme director stated that he had managed and coached about e-learning throughout the Distance Learning Phase. However, he received the essential lessons in the courses he taught (P4:28). Two programme directors noted differences between the first and subsequent distance learning semesters. They pointed out that the teaching from the winter semester onwards, which means the second lockdown, worked well, and this view was confirmed by the students (P6:38; P9:7). A programme director from Health and Welfare stated that he postponed laboratory exercises in spring 2020, which were then rescheduled until September (P18:69). The lessons learned in the design of distance learning can be illustrated by the following quote from a programme director from the field of Social Sciences, Journalism and Information:

> *"And with that, things are now also already being designed for online, and that is a big difference from phase 1, as I call it - summer semester 2020 - versus phase 2, winter semester 20/21. Because there, of course, the teaching was designed fundamentally differently and not rearranged. And you can see that in everything. You notice it in the quality of the teaching; you notice it in the evaluation, in the feedback. And this is true for both the lecturers and the students" (P9:7).*

In summary, the programme directors learned about several organisational aspects from the COVID-19 Distance Learning Phase. From their point of view, it was easier for them to switch to full distance learning because they were already using distance learning elements before COVID-19 (P3:14; P5:20, P6:15, P12:76; P16:70; P20:22). Nevertheless, many individually guided their part-time lecturers through transitioning to full online teaching (P1:44, P2:83; P8:92, P13:35, P14:124; P15:41). Several programme directors also held regular online meetings with students and student representatives (P5:26; P8:38; P17:172; P6:29) to get feedback on the quality of teaching in the Distance Learning Phase. Their goal during the COVID-19 Distance Learning Phase was to offer high-quality education (P2:26; P6;142; P12:99; P16:84) that was practice-oriented (P5:102; P17:152). Their lessons learned also related to the technical equipment (P4:65; P6:18; P10:12; P12:83; P13:57; P14:120; P17:176) concerning the teaching rooms (P6:26) and the home offices (P4:36; P12:83; P13:57). From their point of view, the COVID-19 Distance Learning Phase brought an increased workload for lecturers (P1; P6; P11; P12; P14) and students (P2; P6; P12; P17). The increased workload for students was attributed to the in-depth material and additional tasks provided (P2:12; P6:34, P17:52). The additional effort of the lecturers resulted from the development of new teaching concepts for online teaching (P6:109; P11:57; P14:124). For many lecturers, the switch to full distance learning worked well (P6:54; P11:58; P14:124). Nevertheless, from the point of view of several programme directors, full distance learning harmed the quality of teaching (P4:224; P9:6; P12:77; P15:14; P18:14). However, the quality of online teaching increased after the second lockdown (P6:50, P9:7).

### *10.4.2 Type of Teaching Approach*

Several programme directors mentioned their lessons learned concerning various types of teaching approaches throughout the interviews. These were (1) synchronous distance learning, (2) hybrid teaching, (3) face-to-face teaching and (4) asynchronous teaching.

Eight programme directors reported their lessons learned about synchronous distance learning (P1:14, P2:42; P4:21; P6:58; P7:15; P10:17; P19:14; P20:117). Many of these stories came from Business, Administration and Law, ICT, and Engineering, Manufacturing and Construction. Programme directors from Business, Administration and Law felt that synchronous online courses lacked communication with students compared to face-to-face courses and that this impacted the learning process (P2:41-42). The ideal setting for synchronous distance learning depended on the course in question (P19:14). At the same time, synchronous online courses during the COVID-19 Distance Learning Phase were complicated by students' family commitments (P20:117). An ICT programme director reported teaching while standing during synchronous online teaching (P4:21). Another programme director of the same profession preferred synchronous teaching to asynchronous teaching since otherwise, the students are faced with doubled time burdens (P6:58). A certain discipline was also important during synchronous distance learning. The programme director meant that the students in the online room would raise their hands and ask questions via chat, thus avoiding disruptions caused by excessive discussions (P6:74). In his view, the preparation of synchronous online courses is significantly more time-consuming than face-to-face appointments (P6:79). Another director stated that he learned to add interactive elements to his previous lectures during synchronous distance learning (P7:15). Programme directors from Engineering, Manufacturing and Construction reported that some synchronous online courses worked well, and others less so (P1:14). They also pointed out the positive aspects of synchronous distance learning. These aspects were the possibility of recording courses (P10:14) and showing simulations on the computer without media disruption (P10:17). A programme director from the field of Engineering, Manufacturing and Construction summarised his view on lessons learned in synchronous distance learning as follows:

*"What was said at the moment in face-to-face teaching, in the context of a course, was sometimes overestimated to the extent that online synchronous teaching has*

*shown that the stored word, when it is stored, beats the word that fades away. So that it is definitely valuable to record either a course or short sequences that have been recorded afterward so that the students can go through it several times in a row at their own pace" (P10:14).*

Four programme directors reported hybrid teaching experiences (P4:95; P6;59; P10:15; P11:161). They consistently described the challenges that this form of study brings with it. The challenges began with the equipment of the seminar rooms, which one ICT programme director had equipped with microphones and cameras throughout (P6:95). Two respondents indicated the challenge of working with two groups simultaneously, with one group of students physically present and the other group in the virtual room (P4:97; P11:165). However, they both felt that UAS would use this form of teaching more often in the future. An ICT programme director described his experience with lessons learned in hybrid teaching by saying:

*"So that's another challenge. You have to focus on two audiences and maybe balance them, serve them, which is difficult. So that's another scale set again. You have to make sure that you don't focus too much on online or too much on presence. That's why hybrid is definitely another challenge. But one that I believe is still to come. In the long run, I believe that many offers will be hybridized" (P4:97).*

Two programme directors believed that the need for attendance phases had to be justified in the meantime (P5:16; P10:11). Usually, this happens for social reasons (P5:16; P4:101). Therefore, content that requires less social interaction, such as lectures, is preferably moved to the virtual space (P13:20; P17:43). However, a programme director from Social Sciences, Journalism and Information stated that students have expressly requested face-to-face classes (P5:18). A programme director from the field of Engineering, Manufacturing and Construction expressed her perspective on lessons learned in face-to-face teaching, stating:

*"So, the attendance time should be used to really practice and do case studies. And to apply the knowledge they have learned. And the preparatory phase, i.e., the self-study phase, the preparation phase, and the online phase, serve the theory and, in principle, consolidation with exercises that the students have to do in advance. So*

*that when they come into the classroom, the knowledge is practised, so to speak" (P17:43).*

Three programme directors pointed out the importance of asynchronous teaching (P2:22; P10:95; P17:54). From the perspective of a programme director from Business, Administration and Law, the students' perceived workload in asynchronous teaching was lower (P2:22). Another programme director from Engineering, Manufacturing and Construction believed that the students are often delighted with the asynchronous teaching (P10:91). Another ICT programme director felt that there should be fewer asynchronous elements to free up students' time (P6:58). A programme director from Business, Administration and Law pointed out that there are still no regulations for lecturers regarding what is counted and paid as asynchronous teaching (P2:17). The lessons learned in asynchronous teaching can be illustrated by the following quote from a programme director from the field of Engineering, Manufacturing and Construction:

*"But I think COVID showed that too - the benefits of asynchronicity are being seen more now than they were perhaps seen two years ago. What the thing can do if you do it well" (P10:95).*

In summary, the programme directors have different perspectives on the impact of the COVID-19 Distance Learning Phase on forms of study. From their perspective, awareness of the importance of asynchronous distance learning has increased (P2:22; P10:95; P17:54). Synchronous distance learning was assessed variously by the programme directors (P1:14, P2:42; P4:21; P6:58; P7:15; P10:17; P19:14; P20:117). They could see the negative (P2:41-42; P6:58; P20:117) and positive (P10:14) aspects. Hybrid teaching was seen as another study form that UAS could practice after the Distance Learning Phase (P4:95; P6;59; P10:15; P11:161). Several programme directors stated that the role of the face-to-face phases could change after the COVID-19 Distance Learning Phase, towards a more purposeful use and more social interaction (P5:16; P4:101; P10:11; P13:20; P17:43).

### *10.4.3 Design of Online Courses*

Most of the programme directors reported lessons learned related to concrete experiences in designing distance learning courses. Major subcategories were (1) interaction in synchronous online courses, the design of both (2) lectures and (3) online tests, (4) content that cannot be taught online, the (5) impact of distance learning on the social factor and the importance of (6) the variety of formats, the use of (7) online tools and (8) video recordings in teaching and (9) breaks and duration of lessons in synchronous online courses.

Fourteen programme directors pointed out the importance of interactivity and communication with students in synchronous online courses compared to face-to-face teaching (P2:72; P3:29; P4:33; P6:74; P7:16; P9:18; P12:13; P13:36; P14:14; P16:61; P17:56; P18:37; P19:26; P20:51). Two programme directors added that active participation in synchronous online teaching without activating elements is much lower than in face-to-face teaching (P7:29; P14:118). Two other programme directors believed that the quality of communication in synchronous online courses suffers due to online tools compared to face-to-face teaching (P9:19; P12:13). Ten programme directors listed several possibilities to increase interactivity with the students in synchronous online courses. These included asking questions directly to students (P19:98) or in the chat (P4:33; P6:74), conducting surveys (P4:33), creating breakout rooms (P4:33; P14:129; P16:65; P17:56), designing online exercises (P7:16; P9:18; P14:129; P16:61), and collaborative editing of online documents for example in online whiteboards (P13:40; P17:56; P20:28). An ICT programme director described his experience with lessons learned regarding interaction as follows:

> *"And if you have a longer slot, that's where we come to the next point; then you need interaction" (P4:33).*

Nine programme directors commented on the design of lectures in distance learning, especially in comparison to face-to-face teaching (P7; P9; P12; P14; P15; P16; P17; P19; P20). Eight of them felt that traditional lecture formats do not work online (P7:22; P9:19, P14:118; P15:15, P16:60; P17:55; P19:17; P20:24). Three of them stated that lecturers receive few or no questions from students during highly monological elements and that they therefore noticed a loss of quality during online lectures (P9:19; P14:118; P16:65). For this reason, three programme directors found that the lecturers cannot directly transfer the seminar room situation to the internet (P16:62; P19:40; P20:51). One ICT programme director stated that lecturers no longer did traditional frontal teaching online (P7:78); according to him, this was possible due to the smaller group sizes at UAS (P7:93). Another programme director from Engineering, Manufacturing and Construction declared that it was necessary to get away from fully frontal lectures but that they were still important. He gave the example that TEDx videos are also frontal lectures, yet it is an innovative online platform (P12:112). A programme director from the field of Engineering, Manufacturing and Construction described her perspective on lessons learned by lectures as follows:

> *"Online teaching is also very different, that is clear. We are miles away from the classic frontal lecture. That can't work. It's about really considering how much the students can take? And then how much do you really have to apply and work in settings?" (P17:55).*

A topic mentioned repeatedly was the design of tests for distance learning. In this context, four programme directors mentioned the lecturers' concern that students use unauthorized aids in online tests (P1:34; P2:102; P14:181; P18:84). According to them, this could be counteracted by the design of the online tests. First, other types of questions had to be asked (P1:36). Second, the focus should not be on testing factual knowledge (P14:181) but instead on asking competence-oriented questions that the students cannot google (P14:181; P18:84). An ICT programme director reported that lecturers who had already created online tests before the COVID-19 Distance Learning Phase had an advantage over those who did not (P14:181). These lecturers did not ask questions in their online tests that involved factual knowledge and could therefore be googled. Occasionally, tests were changed to oral online examinations (P2:100). Three programme directors reported predominantly converting their tests to multiple-choice questions (P1:38; P2:92; P17:22). Two respondents stated that online tests required more effort when creating the test for the first time (P1:36; P2:90). In addition, lecturers found it challenging to use Moodle's test creation capabilities correctly (P3:45). A programme director from Business, Administration and Law reported that digital exam guides were developed for this purpose (P15:19), UAS supported lecturers in creating exams (P15:51; P17:105) and introduced the Safe Exam Browser to prevent the use of unauthorized aids in online exams (15:77). The lessons learned regarding tests can be illustrated by the following quote from a programme director from the field of Health and Welfare:

> *"But you can also just sum it up. Don't ask questions that can be googled. But good competence-oriented questions and then possibly mixed in such a way that everyone gets different questions. Or other cases" (P18:84).*

Programme directors gave examples of content that cannot be implemented in full distance learning or can only be implemented with a significant loss of quality. These were exercises, e.g., eye tracking, in the media centre with cameras or the laboratory (P3:105; P5:14; P18:12). This situation also applies to formats for communication in large groups such as group discussions in large rooms, world cafes, focus groups (P12:13) and negotiation settings, fishbowl settings, or large group events (P16:154). Four other programme directors believed that they could implement everything in distance learning in terms of content and added that only the social factor is missing (P5:13; P8:23; P12:65; P16:156). However, one programme director from the field of Social Sciences, Journalism, and Information questioned whether it is always an equivalent substitute for face-to-face teaching (P5:9). A programme director from Health and Welfare pointed out that some students appreciated their living room privacy in the online breakout rooms and were thus more willing to speak, which may not have been possible in face-to-face teaching (P11:35). The lessons learned regarding content that cannot be taught online can be illustrated by the following quotation from a programme director from the field of Engineering, Manufacturing and Construction:

> *"For me, digital is different in that the quality of communication gets lost. I will probably not be able to start group discussions in a large room or, for example, I would still like to have world cafes in face-to-face sessions. Or focus groups" (P12:13).*

Seven programme directors pointed out the importance of personal contact for students who suffer during full distance learning (P1:14; P5:23; P6:28; P8:37; P11:44; P19:10; P20:169). According to a programme director from Engineering, Manufacturing and Construction, the larger the group is, the more this can happen (P1:14). An ICT programme director related this more specifically to the personal contact with and among the students and the team building in the group (P6:28). Similarly, a programme director from Business, Administration and Law pointed out the difficulties students face in getting to know each other online and finding suitable groups for assignments (P19:10). A programme director from Social Sciences, Journalism and Information said that the importance of social interaction for the study programme only became apparent when it was missing through distance learning (P5:23). Two programme directors tried to promote the social factor online (P8:45; P20:169) but pointed out that this works better in face-to-face situations. One example a programme director mentioned was a virtual cocktail night (P20:169). The importance of lessons learned regarding the social factor is illustrated by a quote from an ICT programme director:

> *"Personal contact plays a huge role because I think it goes very much towards motivating the students. Because studying means self-development, self-reflection, working in a group" (P8:39).*

Eight programme directors stated that distance learning needs a variety of formats (P1:68; P3:55; P4:32; P5:31; P15:16; P16: 60; P17:53; P20:29). They referred in particular to variety during synchronous distance learning. The programme directors mentioned videos (P1:68; P17:58), course recordings (P5:32), self-study (P5:31; P20:29), and question time (P5:31) as examples of formats that bring variety to online lectures. According to a programme director from Engineering, Manufacturing and Construction, the mix of different formats must be balanced (P17:53). According to her, this also means that different types of learners are supported (P17:58). A programme director from the field of Business, Administration and Law pointed out that the use of different formats, used to engage the students, is associated with an increased amount of time for conveying the same content compared to just lecturing (P15:16). However, a programme director from Engineering, Manufacturing and Construction pointed out the difficulty of a lesson in which the technology is changed several times (P10:16). Another director from Business, Administration and Law noted that, especially at the beginning of the COVID-19 Distance Learning Phase, several lecturers did not have the technical skills to cope with changing digital formats in teaching (P16:64). Two programme directors stated that there were requests from students to reduce the number of different tools (P11:84; P19:11) to make distance learning less complex. An ICT programme director described his experience with lessons learned regarding a variety of formats as follows:

*“That this is important - I was not so aware of this at the beginning, to actually have to offer this visual variety. But we have all consumed a lot of digital [media]. And then you realize very quickly that this variety is actually needed there” (P4:32).*

Five programme directors reported learning more about using digital tools for distance learning during the COVID-19 Distance Learning Phase (P1:70; P6:75; P11:30; P19:25; P20:26). An ICT programme director attributed this to lecturers in distance learning having to take digital tools into account more than in face-to-face teaching (P6:75). Two programme directors mentioned interactive whiteboards as examples, using Miro as a tool (P19:28; P20:28). A programme director from the Engineering, Manufacturing and Construction department reported using a tablet to transfer his handwritten notes online and thus digitise the blackboard (P1:70). The lessons learned regarding tools can be illustrated by the following quotation from a programme director from the field of Health and Welfare:

*“Yes, what did you learn? Certainly, a lot of tools. So, you just learned a lot of different tools” (P11:30).*

There were different perspectives on the use of video recordings in distance learning. An ICT programme director reported that the memory used for the Moodle application had increased massively by uploading streamed courses compared to before the COVID-19 Distance Learning Phase (P6:18). Therefore, the UAS chose other storage options for the lessons, held the online classes in Teams and recorded them there (P6:22). On the other hand, a programme director from Engineering, Manufacturing and Construction thought it would be better to record one's own videos than to use YouTube videos. She also found that she can create her video faster than looking for a custom-fit video that someone else had created and made available on YouTube (P17:25). An ICT programme director explained the difference between classroom teaching and distance learning with video recordings using the metaphor of a theatre stage versus an appearance on television (P4:120). For him, face-to-face teaching was like a performance in the theatre, where the actor directly perceives the reactions of the audience. On the other hand, he compared video recordings in distance learning to an appearance on television where the actor does not see the audience. An ICT programme director described his experience with lessons learned regarding videos as follows:

> *"But above all, it is also the case that the distance to the audience is there. You no longer have a surface for interaction. Instead, you have this black wall in front of you, where there are maybe two letters. No image, no camera, no feedback. And that is the situation that classic actors have when they produce for television or the cinema. And that is a different situation than the theatre situation" (P4:122).*

Three programme directors reported that more breaks are necessary for synchronous online courses compared to face-to-face classes (P7:25; P19:99; P20:30). A programme director from Business, Administration and Law reported on the design of active breaks (P20:32). In doing so, the participants should be made aware of the importance of active breaks during which they leave the computer workstation. For this purpose, the programme director created her own break layout in her Web conference system (P20:32). Two programme directors stated that practising online in small groups was more time-consuming than in the seminar room (P7:25; P15:15). As a result, lecturers who used more interactive elements in synchronous distance learning needed longer to convey their teaching content than in face-to-face teaching; if the lecturers only used speaking, the lessons were shorter (P7:23; P15: 16). The lessons learned regarding breaks and duration of lessons can be illustrated by the following quotation from an ICT programme director:

> *"You need more breaks. Even practising, if it works online, even if it works in small groups, in Webex, or something like that is more time-consuming than when you are in the seminar room and talk about it with the students" (P7:25).*

In summary, the programme directors learned several different aspects about the design of online courses in the COVID-19 Distance Learning Phase. Especially important was the active interactivity and communication with students during online courses (P2:72; P3:29; P4:33; P6:74; P7:16; P9:18; P12:13; P13:36; P14:14; P16:61; P17:56; P18:37; P19:26; P20:51). This was followed by the urgent recommendation not to let lectures in distance learning become too long (P7; P9; P12; P14; P15; P16; P17; P19; P20). The lecturer had a different role in videos broadcast as part of distance learning. The metaphor used here was appearing on television compared to appearing in the theatre, which (P4:120) is due to reduced interactivity. Furthermore, lecturers should use various formats during distance learning (P1:68; P3:55; P4:32; P5:31; P15:16; P16: 60; P17:53; P20:29),and more breaks should be scheduled (P7:25; P19:99; P20:30). Online tests were often mentioned among the lessons learned (P1:34; P2:102; P14:181; P18:84), whereby the programme directors recommended asking competence-oriented questions that cannot be answered by using a search engine (P14:181; P18:84). Lecturers have increasingly learned how to use digital tools for teaching (P1:70; P6:75; P11:30; P19:25; P20:26). Formats that were difficult or impossible to implement in distance learning were exercises in laboratories (P3:105; P5:14; P18:12), formats for communicating with large groups (P12:13; P16:154), and negotiation techniques (P16:154). However, some programme directors believed that they could implement all subjects in distance learning, with only the social aspect missing (P5:13; P8:23; P12:65; P16:156). Several programme directors regretted the lack of personal contact with students in the COVID-19 Distance Learning Phase (P1:14; P5:23; P6:28; P8:37; P11:44; P19:10; P20:169), which is of great importance to them.

## 10.5 Changes After the COVID-19 Distance Learning Phase

One question to the UAS programme directors addressed changes they expected after the COVID-19 Distance Learning Phase for blended learning courses. Initially, it was not planned to formulate a separate research question based on the responses to this short question in the interview protocol. However, the responses from the programme directors were comprehensive, meaningful and relevant to pedagogical practice, so the following research question was developed: “What should be adopted from the COVID-19 Distance Learning Phase for blended learning study programmes at Austrian universities of applied sciences in the future?” The three subcategories that resulted inductively from the analysed interviews were (1) organisational changes, (2) changes in the form of study and (3) changes in teaching. Each of these three subcategories includes three to six codes. Between five and 20 text segments were assigned to each code, as illustrated in Table 45.

**Table 45** *Subcategories and Codes for Changes After the Distance Learning Phase*

| Subcategory | Code | Number of Codes* | n** |
|---|---|---|---|
| Organisational changes | Changes to universities of applied sciences | 20 | 6 |
| | Changes due to digitalisation | 16 | 6 |
| | Changes for blended learning | 12 | 10 |
| | Innovative changes | 12 | 6 |
| | UAS programmes as distance learning programmes | 9 | 9 |
| | Home office | 6 | 4 |
| Changes in the type of teaching approach | Changes towards more distance learning | 20 | 11 |
| | No changes in the form of study | 12 | 9 |
| | Changes in hybrid teaching | 6 | 6 |
| Changes in teaching | Practical experience in distance learning | 17 | 7 |
| | Better quality of blended learning | 15 | 7 |
| | Changes in the role of the lecturer | 10 | 5 |

* The number of codes is the total number of codes assigned. A code can be applied more than once in an interview.

** n is the number of programme directors for whom the code was assigned.

The codes developed inductively from the analyses of the transcripts for the category "changes after the Distance Learning Phase" are linked to the literature. Many authors believe that the impact of COVID-19 will change HE institutions in the long term (Ahrens & Zascerinska, 2021; Cohen & Sabag, 2020; Green et al., 2021; Pandya et al., 2021; Pokhrel & Chhetri, 2021; Stewart, 2021; Zawacki-Richter, 2021). The organisational changes include several factors, for example, the lecturer's home office (Anderson, 2020). Additionally, changes in the type of teaching approach match the needs of lecturers and students who, according to Pauschenwein and Schinnerl-Beikircher (2021), do not want to return to pure face-to-face teaching. This development would lead to a more purposeful combination of face-to-face and online teaching in the future, as García-Morales et al. (2021) consider. According to Ahrens and Zascerinska (2021), this includes using hybrid learning formats, especially in German-speaking countries. Regarding changes in teaching, Pandya et al. (2021) see significant changes in the HE sector compared to before COVID-19 in several factors, namely, (1) faculty readiness, (2) teaching methods used, (3) course content, (4) assessment strategies, and (5) technical support. Zawacki-Richter (2021) adds that lecturers and HE institutions will want to continue using the experiences and materials they have developed during the COVID-19 Distance Learning Phase. Most of the recent literature supports the assumption that there will be changes in HE after the COVID-19 Distance Learning Phase. This finding corresponds with the results of the thesis. Below, the qualitative results for the changes after the COVID-19 Distance Learning Phase are presented according to the three subcategories. All the sources mentioned are in line with the qualitative study results shown below.

### *10.5.1 Organisational Changes*

Several programme directors mentioned organisational changes that could impact UAS programmes after the COVID-19 Distance Learning Phase. This concerned (1) changes to UAS, (2) changes due to digitalisation, (3) changes for blended learning, (4) innovative changes, (5) UAS programmes as distance learning programmes and (6) home office.

Six programme directors mentioned possible changes that could affect the entire UAS sector (P4:75; P5:11; P8:105; P11:39; P12:45; P16:91). An ICT programme director suggested that one should be careful in the future not just to do things online because they are more convenient that way (P8:105), adding that it is essential to pay attention to what is best for the students (P8:110). A programme director from the Health and Welfare department was concerned about whether an increase in the proportion of distance learning could be used in the future to save space and travel costs (P11:39). She thinks it would be beneficial if events and international exchanges could continue to be possible online (P11:40). One programme director in Engineering, Manufacturing and Construction assumed that the differences between full-time and part-time programmes could blur. He attributes this to the increase in the proportion of distance learning in full-time programmes (P12:44-45). A programme director from Business, Administration and Law mentioned that the attendance requirement had been removed during COVID-19 Distance Learning (P16:166). According to him, the obligation to participate in the face-to-face phase may remain optional even after the COVID-19 Distance Learning Phase, and the students can either take part in the face-to-face course or watch the recording (P16:172). He also said that it would be necessary to adapt the examination guidelines regarding blended learning (P16:91) and the student guidelines (P16:94), both concerning the design and content of course books (P16:94) and communication with the students (P16:98). A programme director from the field of Social Sciences, Journalism and Information added that UAS programmes are subject to the conditions of accreditation of their curricula and would have to return to what was before after the COVID-19 Distance Learning Phase. However, he also noted that these accreditation conditions could be changed (P5:11). An ICT programme director said that professional e-learning after COVID-19 would be a fundamental factor for student satisfaction (P4:170). From his perspective, good video and audio quality in the transmission of courses has become a performance requirement for the students (P4:170). It would also be necessary for him to show appreciation for the development process the lecturers went through in the digitisation of teaching (P4:174). He stated that the duration of the COVID-19 Distance Learning Phase exceeded a tipping point for changes. Therefore, the universities could only revert to the period before COVID-19 with difficulty (P4:73). The tipping point was passed when teaching was exclusively digital for the third semester in a row (P4:75). If the digitisation changes are not adopted by UAS after the COVID-19 distance phase, from his point of view, other training providers will do so (P4:188). He summarised his view on changes to UAS as follows:

> *"And I said back then, so if we do the second semester digitally, then I think it will stay with us, and if we have to do the following summer semester digitally - I feel almost prophetic, that shouldn't sound selfish now, but I actually thought about it. If we do three semesters in a row digitally, then we'll stick with it" (P4:75).*

Six programme directors addressed changes due to digitalisation as part of the COVID-19 Distance Learning Phase that will affect UAS (P4:183; P12:105; P13:6; P15:88; P16:26; P19:45). An ICT programme director was concerned that after the COVID-19 Distance Learning Phase, one would go back to what was before, instead of using the experience of digitisation from this time (P4:183). Another director from the field of Business, Administration and Law hoped that digitisation would have a lasting effect on the service departments of UAS (P15:88). A programme director from Engineering, Manufacturing and Construction believed that every discipline and department at a UAS should have people with their own digital skills (P12:105) to support existing processes (P12:108). The lecturers gained much experience from digitising their working world during COVID-19, which they brought to their teaching. For example, when designing online workshops (P19:44). The schoolchildren and thus the future students had experience with distance learning in their schools. This background can impact the expectations of distance learning at universities (P16:20). A programme director from the Health and Welfare department stated that the COVID-19 Distance Learning Phase turned the virtual space into a social meeting zone (P13:6), an examination room (P13:5), a coordination room with students and lecturers (P13:75), a room for admission processes (13:11) and an information room for applicants (P13:26). He wants to keep that. The changes due to digitalisation can be illustrated by the following quote from a programme director from the field of Business, Administration and Law:

> *"Never waste a crisis. I think Barack Obama said it in 2009. And I think the great opportunity that this situation offers us, regardless of the stress, is simply to drive changes that would not have taken place before. We could ask the lecturers to do things, to give them a boost in development, to invest in their own skills that were previously thought impossible for some. They said, I never will, I am way too old to be online, and I don't feel like getting involved in it. And that was done within a few weeks" (P16:26).*

Nine programme directors addressed changes after the COVID-19 Distance Learning Phase that could influence the design of blended learning courses (P4:101, P5:22; P6:56; P7:10; P10:13; P15:20; P16:80; P19:30; P20:153). Four assumed that blended learning design after COVID-19 Distance Learning Phase would become or remain more diverse (P7:10; P10:13; P16:15; P19:30). A higher proportion of distance learning means that the programmes can become more flexible in terms of organisation, such as if a lecturer breaks a leg (P15:20), or involve foreign lecturers (P6:56). Three programme directors assumed that the proportion of distance learning in courses would increase throughout the entire advanced studies sector (P5:22; P16:78; P19:152) because future students already have experience with online teaching at school (P16:80). An ICT programme director also suspected that the COVID-19 Distance Learning Phase would lead to face-to-face teaching being perceived more as a valuable interaction space (P4:101). The assumption that there will be changes in blended learning can be illustrated by the following quote from a programme director from the field of Business, Administration and Law:

*"Yes, the old logic was that those who had organised their studies in a face-to-face setting did not even think of doing anything else. So, there were a number of study programmes, and I'm pretty sure that no one could go back to a 100 percent attendance, how do you say it? form of study" (P16:78).*

Six programme directors came up with new ideas that would lead to significant changes at UAS after the COVID-19 Distance Learning Phase (P4:214; P11:193; P12:48; P16:104; P17:124; P18:61). An ICT programme director mentioned TEL. According to him, the application content should be automatically transferred into the syllabus and the structure of the e-learning courses. A similar project had been launched by a programme director from the Business, Administration and Law department (P16:122). Other innovative changes included applications in artificial intelligence and virtual reality applications, such as mechanics (P17:126) and virtual laboratories, for example, in the life science area (P18:63). Another topic mentioned by four programme directors was splitting up the year and course structure (P4:218; P11:193; P12:48; P16:162) towards a more flexible system that enables more innovations, for example, in the form of modules. Finally, a programme director from Business, Administration and Law argued that the lecturers should not be paid per semester hour taught, but the ECTS. This would make the lecturer more flexible in designing synchronous and asynchronous teaching, and they could concentrate on achieving the students' skills (P16:100). An example of a topic for innovative changes was given by an ICT programme director:

*"One thing is ultimately the topic of agility, so we still think in terms of degree courses and study programmes, cycles and years, etc. and there I actually imagine, at the research level, that we will end up with being much more agile, in terms of how we acquire these individual learning objectives, and there I see great parallels between software development where there are different agile process models, one is called Scrum that works with cycles" (P4:214).*

Nine programme directors who had already managed blended learning programmes before the COVID-19 Distance Learning Phase vehemently pointed out that their programmes are not, and they would not like them to become, distance learning programmes (P2:10; P4:101; P7:89; P9:115; P10:108; P11:48; P14:121; P17:63; P20:43). On the other hand, not a single person interviewed expressed the wish to conduct their degree programme in full distance learning. A programme director from Business, Administration and Law pointed out the importance of close face-to-face contact with students (P17:63). Another ICT programme director reported that his students say they study at a UAS to meet people and would like to return to this model (P7:89). A programme director from the field of Social Sciences, Journalism and Information noted that the audience of fully online courses is different from that of blended learning courses (P17:110). According to him, students of online-only programmes are often in socially, geographically or culturally external positions but still want to acquire knowledge (P17:112). He thought, therefore, that changing the form of study from blended to full distance learning would entail a change in target groups and that these target groups have different needs and rhythms for learning (P17:115). Another Engineering, Manufacturing and Construction programme director stated that online-only programmes are often more up-to-date than face-to-face programmes. From his perspective, there should be an apparent reason to study face-to-face at a university and not fully online: the interaction between lecturers and students (P12:126). A programme director from the field of Business, Administration and Law described her perspective on UAS programmes as distance learning programmes as follows:

> *"Well, I think we want to go back there. We really want to go back to a blended format. Online doesn't correspond to our philosophy either" (P20:43).*

Four heads of study programmes assumed that there would be more home offices in the future (P5:21; P12:63; P13:117; P16:27), on the one hand, in society as a whole (P5:21; P12:63) and on the other hand, at UAS (P13:117; P16:27). A programme director from Health and Welfare explained that the home office has become an accepted, additional setting at his UAS (P13:113). The assumption that the possibilities of working in a home office will change can be illustrated by the following quote from a programme director from the field of Business, Administration and Law:

> *"But the colleagues my age, who were not now surrounded by small children, really appreciated the fact that they could now simply work from home and conduct their courses in peace. And they will also see this as an enrichment of their everyday work in the future" (P16:27).*

In summary, several programme directors thought that the digitisation in the context of the COVID-19 Distance Learning Phase at the UAS would have a long-term impact (P4:183; P12:105; P13:6; P15:88; P16:26; P19:45). This assumption was attributed to the fact that lecturers had to teach exclusively online for several semesters, which meant that the change process took longer (P4:75). Some programme directors believed that distance learning would be more diverse after the COVID-19 Distance Learning Phase (P7:10; P10:13; P16:15; P19:30). From their perspective, the organisation will be more straightforward and flexible (P15:20), with more integration of foreign lecturers (P6:56). Overall, several programme directors expected the proportion of distance learning to increase throughout the UAS sector (P5:22; P16:78; P19:152). However, they did not wish to convert to full distance learning after COVID-19, which means that the heads of study programmes do not see their programmes as distance learning programmes (P2:10; P4:101; P7:89; P9:115; P10:108; P11:48; P14:121; P17:63; P20:43). They did expect more home offices in the future (P5:21; P12:63; P13:117; P16:27). According to the respondents, innovations that could influence teaching in the future were TEL, artificial intelligence and virtual reality (P16:122; P17:126; P18:63). In addition, there could be some developments at UAS towards more flexible structures, away from annual and course structures (P4:218; P11:193; P12:48; P16:162).

### *10.5.2 Changes in the Type of Teaching Approach*

Some of the programme directors announced changes in the type of teaching approach after the COVID-19 Distance Learning Phase. This subcategory included the codes (1) changes towards more distance learning, (2) no changes in the form of study and (3) changes in hybrid teaching.

Eleven programme directors plan to increase the percentage of distance learning compared to before the COVID-19 Distance Learning Phase (P1:16; P2:10; P4:69; P6:47; P10:21; P12:70; P15:23; P16:152; P17:134; P18:19; P13:62). One programme director from Business, Administration and Law felt that a higher online proportion would make it easier for part-time students to complete their studies (P2:12). Two programme directors referred to the future demand from students for more distance learning as part of their studies (P12:68; P18:15). A programme director from the field of Business, Administration and Law summarised her view on changes toward more distance learning as follows:

*"Well, what is already clear to me, in any case, is that I will or would like to increase the online component in the future, especially now for the upcoming re-accreditation. I don't think 100%, no, we are not a provider of distance learning, but, and this is now an absolutely non-representative survey, but I just asked my first semester, they were all very satisfied with the online teaching, and the feedback was, now really more on-demand, that they would like more online teaching to the extent of 40 to 50%" (P2:10).*

Nine programme directors did not plan to change the proportion of distance learning that existed before the COVID-19 Distance Learning Phase (P3:19; P5:12; P7:39; P8:46; P9:125; P11:44; P14:110; P19:31; P20:45). Two stated that students demanded and missed face-to-face teaching (P20:43; P14:110) and in another case, they also missed socialising (P11:44). A programme director from Social Sciences, Journalism and Information stated that he does not want to increase the proportion of distance learning in his course but expects an overall increase in the proportion of blended learning in the HE sector (P9:125). The assumption that there will be no changes in the form of study can be illustrated by the following quote from a Business, Administration and Law programme director :

*"In terms of intensity or percentage, I don't want to change. Because we are still of the opinion that the social component in the course is very important for the exchange and advancement in the course, so in percent, 30 percent, maximum 50 percent I would keep" (P19:31).*

Table 46 arranges the codes "changes towards more distance learning" and "no changes in the form of study" according to the percentage of distance learning before the COVID-19 Distance Learning Phase in the UAS programmes surveyed.

**Table 46** *Existing Percentage of Distance Learning Before and Planned Proportion of Distance Learning After the COVID-19 Distance Learning Phase*

| Percent of distance learning before COVID-19 | More distance learning anticipated | No change in distance learning |
|---|---|---|
| < 30% distance learning (P4:7) | (P4:69) | |
| < 30% distance learning (P6:4) | (P6:47) | |
| < 30% distance learning (P12:8) | (P12:70) | |
| < 30% distance learning (P15:6) | (P15:23) | |
| < 30% distance learning (P16:9) | (P16:152) | |
| < 30% distance learning (P17:18) | (P17:134) | |
| < 30% distance learning (P18:6) | (P18:19) | |
| ≈ 30% distance learning (P1:8) | (P1:16) | |
| ≈ 30% distance learning (P2:8) | (P2:10) | |
| ≈ 30% distance learning (P3:10) | | (P3:19) |
| ≈ 30% distance learning (P7:8) | | (P7:39) |
| ≈ 30% distance learning (P10:8) | (P10:21) | |
| ≈ 30% distance learning (P13:13) | (P13:62) | |
| ≈ 30% distance learning (P14:10) | | (P14:110) |
| ≈ 50% distance learning (P9:4) | | (P9:125) |
| ≈ 50% distance learning (P11:24) | | (P11:44) |
| ≈ 50% distance learning (P19:6) | | (P19:31) |
| ≥ 70% distance learning (P5:12) | | (P5:12) |
| ≥ 70% distance learning (P8:19) | | (P8:46) |
| ≥ 70% distance learning (P20:8) | | (P20:45) |

According to the statements of their programme directors, the seven degree programmes that offered less than 30% of their teaching in distance learning before the COVID-19 Distance Learning Phase are planning to increase the proportion of distance learning after the COVID-19 Distance Learning Phase (P4:69; P6:47; P12:70; P15:23; P16:152; P17:134; P18:19). Among the seven programmes with around 30% distance learning before the COVID-19 Distance Learning Phase, the picture is heterogeneous: four want to offer more distance learning in the future (P1:16; P2:10; P10:21; P13:62), while three do not (P3:19; P7:39; P14:110). No changes in the percentage of distance learning are planned by the programmes that offered about 50% (P9:125; P11:44; P19:31) or more than 70% distance learning before the COVID-19 Distance Learning Phase (P5:12; P8:46; P20:45).

In addition to the changes in the percentage of distance learning, the programme managers described the use of a new hybrid between distance learning and face-to-face teaching. Six programme directors reported using hybrid teaching in the future (P4:81; P6:62; P12:67; P15:21; P16:17; P20:41). For a programme director from Business, Administration and Law, hybrid means that face-to-face courses are streamed, and students can participate face-to-face and online (P20:41). According to an ICT programme director, the format is particularly suitable for lectures. The lecturers can also work with AB teaming, i.e. the participants are divided into two groups, one of which is present (P6:62). However, a programme director from Engineering, Manufacturing and Construction pointed out the special challenges of hybrid teaching (P12:67). The assumption that there will be changes in hybrid teaching can be illustrated by the following quote from a programme director from the field of Business, Administration and Law:

> *"Whether the students stay at home or are in the lecture hall and the whole thing is streamed is still open. But we did all the variations; it works well. Also, the variant, a student is not there but participates in a hybrid way via streaming. We will maintain that, but within bounds" (P15:21).*

In summary, the changes to the use of blended learning formats from the perspective of the interviewees can be described as follows: Study programmes that conducted less than 30% distance learning before COVID-19 planned to increase it (P4:69; P6:47; P12:70; P15:23; P16:152; P17:134; P18:19). Degree programmes with around a 30% share of distance learning wanted to increase this (P1:16; P2:10; P10:21; P13:62) or maintain it (P3:19; P7:39; P14:110). None of the surveyed programme directors of courses with distance learning shares of around 50% (P9:125; P11:44; P19:31) or more than 70% (P5:12; P8:46; P20:45) wanted to make any changes to the existing share of distance learning. Furthermore, several programme directors (P4:81; P6:62; P12:67; P15:21; P16:17; P20:41) expected a wider use of hybrid teaching after the COVID-19 Distance Learning Phase.

### *10.5.3 Changes in Teaching*

On the subject of changes in teaching after COVID-19, programme directors of the UAS degree programmes expected changes through (1) practical experience in distance learning, (2) better quality of blended learning and (3) changes in the role of the lecturer.

Seven programme directors reported practical experiences that the lecturers had gained during the COVID-19 Distance Learning Phase that would also impact UAS courses after COVID-19 (P2:86; P3:55; P4:103; P7:12; P11:31; P16:12; P19:31). For two programme directors, this included practical experience using video conference systems (P2:19; P20:38). A programme director from the field of Social Sciences, Journalism and Information stated that a broader range of tools had been used in distance learning and would be used in the future (P3:20). According to a programme director from Health and Welfare, many lecturers have reduced their fear of using digital tools in the COVID-19 Distance Learning Phase (P11:31). A programme director from the field of Business, Administration and Law believed that the COVID-19 Distance Learning Phase was an impetus for many lecturers to take a closer look at distance learning (P2:84). In the view of two programme directors, what will remain is that one can also do practical exercises online (P7:12; P19:42). One said that the lecturers learned how to interact with and involve students online (P7:13). One stated that the students have also learned to collaborate online (P19:26). Overall, the assessment was that the lecturers would take what they did in the COVID-19 Distance Learning Phase with them afterwards (P7:78). The COVID-19 Distance Learning Phase boosted practical experience with distance learning and online education (P16:12). A programme director from the field of Social Sciences, Journalism and Information expressed his perspective on the practical experience in distance learning by saying:

> *"However, what you can see is that distance learning, online teaching has inevitably become more diverse, uses a lot more instruments, uses a lot more tools, the existing platforms are also used much more intensively, and we will continue to do so" (P3:20).*

Seven programme directors reported a higher quality of distance learning developed during the COVID-19 Distance Learning Phase and that they assume this will continue after the COVID-19 Distance Learning Phase (P3:21; P4:69; P5:36; P9:8; 13:56; P16:12; P19:25). Three thought there would be more conscious planning by lecturers for blended learning because they will more consciously decide which elements to teach in distance learning and which to impart face-to-face (P4:101; P9:10; P16:22). According to a programme director from Social Sciences, Journalism and Information, lecturers have planned their online courses by designing the relationship and knowledge transfer aspects differently (P5:36). Another director from the same subject area felt there would be a qualitative boost in distance learning because the lecturers in the COVID-19 Distance Learning Phase used more variety and higher quality in distance learning (P3:21). According to a programme director from Health and Welfare, improved equipment in the lecturers' home offices will also positively affect the quality of distance learning in the future (P13:57), as will the more proficient use of digital media (P9:77; P19:25). Two programme directors stated that distance learning will become less in terms of quantity but should remain at the current level in terms of quality (P4:69; P9:99), with the aim of professionalising teaching in blended learning in the future (P4:81). The assumption that there will be a better quality of blended learning can be illustrated by the following quote from a programme director from the field of Social Sciences, Journalism and Information:

> *"Simply the versatile, differentiated, dramaturgically improved and tool-wise improved handling of distance learning. And the demand for higher-quality teaching with digital means. That has come to stay. And it was already somewhat lower in average before" (P9:102).*

Five programme directors believed that the lecturer's role had changed during the COVID-19 Distance Learning Phase (P4:176; P9:8; P13:103; P16:86; P16:86). They assumed that this change would also impact teaching after COVID-19. A programme director from Business, Administration and Law stated that the lecturers' essential attitude toward distance learning has changed and hopes it will stay that way (P15:18). Two programme directors mentioned that some lecturers will not want to come back to the UAS after the COVID-19 Distance Learning Phase and see themselves primarily as distance learning lecturers (P9:8; P13:103). Another ICT programme director saw a fundamental change in the role of the lecturer towards becoming experts who are independent of the university (P4:107). Thus, the increasing digitalisation offers a professional context that no longer makes lecturers dependent on the organisation (P4:106). The reach of experts offering their courses in distance education has increased due to digitalisation, which enables broader visibility of the lecturers (P4:110). This situation could lead to more competitive pressure and require a high level of professionalisation (P4:112) that could change the educational landscape in the next five years (P4:176). Another programme director from the Business, Administration and Law department saw the COVID-19 Distance Learning Phase as a boost towards a role change for the lecturer (P16:87) from a lecturer to a facilitator of learning (P16:93). For the lecturers, this would no longer only require planning the input in the attendance phases but also detailed planning of the design of the activities in between (P16:93). He summarised his view on changes in the role of the lecturer as follows:

> *"But this learning guidance and this organising of the learning process, the understanding that I am responsible for that, not for the input, but for what is going on in the mind. And what matters in the end. That is being massively strengthened at the moment. And with everyone" (P16:86).*

In summary, the programme directors expected several effects on future teaching from the COVID-19 Distance Learning Phase: on the one hand, more proficient use of distance learning due to the practical experience of the lecturers during this time (P2:86; P3:55; P4:103; P7:12; P11:31; P16:12; P19:31), and on the other hand, an improvement in the quality of the blended learning design (P3:21; P4:69; P5:36; P9:8; 13:56; P16:12; P19:25) through a more conscious design of the combination of face-to-face and distance learning (P4:101; P9:10; P16:22) and a higher quality of distance learning compared to the time before the COVID-19 Distance Learning Phase (P4:69; P9:99). Another change that programme directors expected was related to the role of the lecturer. After the COVID-19 Distance Learning Phase, individual lecturers might no longer want to teach face-to-face at the UAS and primarily see themselves as distance learning lecturers (P9:8; P13:103). A more profound change would be for the teaching staff to become experts independent of the UAS (P4:107) who can market themselves due to digital possibilities (P4:110). A change in the role of the lecturer towards becoming a learning facilitator in face-to-face and distance learning was another assumed change (P16:86).

# 11 Discussion

Before this thesis, little data was available regarding lecturers' media use in blended learning formats at Austrian UAS, and this was even more true for the differences and relationships among the teaching staff. The synchronous and asynchronous use of media in blended learning courses has received equally limited attention in the literature. This is not the case for the impacts of the COVID-19 Distance Learning Phase in HE institutions caused by the pandemic. However, there is also a lack of research on which lessons learned and changes are expected, especially for blended learning programmes in Austrian UAS. The following discussion will answer the research questions posed in the introduction. They are addressed in four areas: (1) the TPACK of lecturers, (2) the media use of lecturers, (3) support and training for lecturers and (4) lessons learned and expected changes after the COVID-19 Distance Learning Phase. Discussion of the research questions is followed by recommendations for further research and a presentation of the findings' limitations and pedagogical implications. Overall, the following discussion should explain and interpret the significance of the results.

## 11.1 TPACK of Lecturers

Factors that influence the TPACK of lecturers at Austrian UAS were tested to confirm five hypotheses. In the following section, these results are explained, with reference to the literature and interpreted. This is followed by a section in which the results of all five hypotheses are combined and discussed together.

### *11.1.1 Differences in Lecturers' TPACK Based on Their Fields of Education*

The first hypothesis stated that “There is a statistically significant difference in the level of technological, pedagogical and content knowledge (TPACK) of lecturers teaching in blended learning study programmes based on ISCED fields of education of universities of applied sciences in Austria.” The hypothesis is supported. The analysis of the quantitative survey of lecturers indicates significant differences in all measured TPACK areas based on the field of education. The measured TPACK areas include the Technological Pedagogical Content Knowledge, i.e. TPACK as a whole model, and three subareas: TCK, Web-TK (which is a specific form of technological knowledge), and TPK. The quantitative survey measured the differences in the TPACK areas for nine different fields of education. Participants from

Education score highest on TPK and TPACK, those from Natural Sciences, Mathematics and Statistics highest in TCK, and ICT lecturers highest in Web-TK.

The qualitative investigation confirmed the findings of the quantitative study. Programme directors interviewed identified notable differences in teaching between their lecturers, which they attributed to the fields of education. On the one hand, these differences between lecturers were attributed to the subject being taught and different specialisations. This result is in line with the findings of a study by Cubeles and Riu (2018), who also concluded that the TPACK of teachers differs by subject area. However, it contradicts several other studies that found no relationship between teachers' subject areas and their TPACK levels (Alzahrani, 2014; Fabian et al., 2019; Lye, 2013; Rienties et al., 2013; Voithofer et al., 2019). Castéra et al. (2020) point out that the TPACK of teachers and its relationships to other factors may differ depending on the country and the group of teachers studied. Even though the outcome of the thesis shows that the lecturers' subject area does have an influencing factor on TPACK, and while this is only partly in line with the literature, which admittedly is contradictory, it corresponds to the practical experiences of the programme directors and the experiences of the author.

The quantitative survey measured the individual TPACK levels. Most participants scored highest in Web-TK and lowest in TCK. This result is surprising because technology factors are typically lower in TPACK studies (Cubeles & Riu, 2018; Fabian et al., 2019; Jang & Tsai, 2012; Kushner Benson & Ward, 2013). An interpretation of these results must include the groups of lecturers examined. Most TPACK studies have been carried out with teachers in schools or educational faculties of universities, but not in non-educational faculties (Herring et al., 2016; Rodríguez Moreno et al., 2019). Herring et al. (2016) conducted a literature review concerning the TPACK development of staff in HE. They referred to several studies on TPACK in HE that did not cover teacher education but concluded, like Kushner Benson and Ward (2013), that TPACK is not widely discussed outside of teacher education. The sample of this thesis includes lecturers predominantly from non-educational faculties, who primarily teach part-time at Austrian UAS. This framework means they have less pedagogical training but more technological skills from their full-time jobs. For these lecturers, the connection between their TK and their CK and thus their TCK is less pronounced than their Web-TK. The fact that the findings show that lecturers at Austrian UAS scored higher in some of the TPACK subareas than most other groups studied so far is relevant. It highlights the fact that teaching staff at these institutions are different from those at other HE institutions, particularly in teacher education. Therefore, it is important to design specific measures to address the TPACK of these lecturers.

In detail, the results of the first research question further show significant differences between ICT lecturers and those from four other subject areas, i.e. Natural Sciences, Mathematics and Statistics, Engineering, Manufacturing and Construction, Health and Welfare and Business, Administration and Law. Participants from ICT also had the highest Web-TK. The qualitative results confirm the results from the quantitative survey. ICT programme directors saw themselves as pioneers in using digital media and technologies in teaching. These assessments were attributed to better technical infrastructure for teaching in the home office and decades of experience of ICT lecturers in dealing with digital technologies. Mercader and Gairín (2020) also reported that teachers in the technology department had the fewest barriers to integrating digital technologies into their lessons. The finding that ICT lecturers differ from other lecturers in their TPACK is plausible. This result could be mainly due to their TK. Nevertheless, HE institutions' further training and support offers are usually designed similarly for all lecturers. The results of this thesis suggest that it would be reasonable to design individual offers for ICT lecturers.

#### *11.1.2 Differences in Lecturers' TPACK Based on Their Education, Gender, Age and Years of Service*

The second hypothesis stated that “There is a statistically significant difference in self-assessments of TPACK based on lecturers' education, gender, age and years of service, in blended learning study programmes at universities of applied sciences in Austria.” The hypothesis is not supported. The quantitative results show no statistically significant interaction effect between these factors and Web-TK, TPK, TCK and TPACK. These results also apply to the main effect of education, gender, age and years of service of the lecturers on the combined and individual dependent TPACK variables.

These quantitative outcomes are consistent with the qualitative study findings; 11 out of 20 programme directors shared this point of view. They could not identify differences within their groups of lecturers. Others saw differences between engineers and other lecturers, differences by subject field and differences in openness to new things as distinguishing characteristics. However, the most frequently mentioned difference between lecturers was the status of full-time and part-time lecturers. A separate hypothesis is dedicated to this topic.

Chai et al. (2016) noted different results about demographic factors and their influence on TPACK. Castéra et al. (2020) found no differences in TPACK based on gender. On the other hand, the results of several studies showed differences in TPACK based on gender (Jang & Tsai, 2013; Koh et al., 2010; Lin et al., 2013; Scherer et al., 2017; Yaghi, 2001). The same applies to studies in the field of age, where several study results indicate different TPACK levels depending on age (Alzahrani, 2014; Blackburn, 2014; Cheng & Xie, 2018; Koh et al., 2010; Lee & Tsai, 2010; Lin et al., 2013; Yaghi, 2001). Other studies, however, found no relationship between age or teaching experience and TPACK levels (Guo et al., 2008; Jang & Tsai, 2012; Voithofer et al., 2019). The fact that educational level, gender, age, and years of service did not affect lecturers' TPACK does not reflect the results presented in the majority of the literature, which is inconsistent in and of itself, but it does match the programme directors' and author's experiences. The outcome could be due to the heterogeneous staff, which makes categorisation into larger subgroups difficult. Other elements, particularly the subject area and full-time or part-time status, addressed in separate hypotheses, are the most important distinguishing aspects surrounding the TPACK of lecturers at Austrian UAS. As a result, the findings of this hypothesis can assist those responsible for developing staff TPACK to focus on factors that are of greater influence.

#### *11.1.3 Differences in Lecturers' TPACK Based on Their Full-time or Adjunct Status*

The fourth hypothesis stated that “There is a statistically significant difference in lecturers' TPACK based on their full-time or adjunct status in blended learning study programmes at universities of applied sciences in Austria.” The hypothesis is supported. The quantitative survey results show that lecturers with full-time positions scored significantly higher in TCK, TPK and TPACK. However, this was not the case with Web-TK. Fabian et al. (2019) also documented higher TCCK (the combination of TCK and TPK) scores for full-time teachers but not for TK. This also applies to Chukwuemeka and Iscioglu (2016), who found higher TPACK perceptions among full-time teachers. In this case, the exceptions were that part-time lecturers rated their TK higher than full-time lecturers did. The qualitative interviews add to the understanding of the findings. Part-time lecturers, according to several programme directors, have less didactic training than full-time staff. This assessment is in line with the quantitative study results, which reveal that part-time lecturers more often have no didactic training compared with full-time lecturers. Full-time lecturers must attend basic didactic training and take advantage of further training during their working hours. Less or no didactic training leads to comparatively lower TPACK scales. However, programme directors positively emphasised the practical experience and hands-on approach to real-world examples that external lecturers bring into their lessons. This suggests that the results of the hypothesis tested, the literature referred to in this paragraph, and the findings of the qualitative interviews are all consistent, and all indicate that TPACK scores for full-time and part-time lecturers are different, but not in the technological component of Web-TK. This finding could be attributed to lecturers' prior technological experience from their regular work.

Full-time and adjunct lecturers at Austrian UAS thus differ in their TPACK values. Full-time lecturers have higher scores in areas related to PK, while part-time lecturers rate their Web-TK more highly. UAS should address both of these points by offering more support. External lecturers could receive more didactic and full-time lecturers more technical support and training. The content and types of this support will be dealt with in more detail in further research questions.

#### *11.1.4 Differences in Lecturers' TPACK Based on Their Level of Media Infusion in the Teaching Process*

The fifth hypothesis stated that “There is a statistically significant difference in lecturers' TPACK based on their teaching with media infusion in blended learning study programmes at universities of applied sciences in Austria.” The hypothesis is supported for lecturers' print media infusion and visual and audio media infusion. The hypothesis is not supported for asynchronous Web-based activities, synchronous Web-based activities, or social networking sites and messengers. The use of media by the lecturers was assigned to three categorical levels: low, medium and high. The findings suggest that print media infusion and visual and audio media infusion affect TPACK. Remarkably, only the use of these two traditional media types in teaching has an impact on TPACK. In this respect, especially those lecturers who have a high visual and audio media infusion have a lower TPACK than lecturers with other media use. Those with medium visual and audio media infusion have a higher TPACK than those with high or low visual and audio media infusion.

For lecturers with low visual and audio media infusion, TPACK increases with the increasing use of print media.

The quantitative survey of Austrian UAS lecturers was carried out between 31 May 2020 and 12 July 2020. This period was in the first semester of the COVID-19 Distance Learning Phase. The qualitative interviews with the programme directors took place between 10 February 2021 and 22 March 2021, at the end of the second and the beginning of the third distance learning semesters. Some of the programme directors surveyed believed that the lecturers' media use had changed during the COVID-19 Distance Learning Phase. The increased use of video conference systems was particularly emphasised. Therefore, many of them shared the view that there are no longer any lecturers with low media use at Austrian UAS. They attributed this to the fact that lecturers had to adapt to distance learning semesters through increased media use. The literature confirms this view. Babbar and Gupta (2021) conducted an inter-country comparison of the response of education institutions to COVID-19. They described a radical shift to digital pedagogy that led to the technological empowerment of teachers. Blömer et al. (2020) reported a short-term development of digital teaching formats at universities. Cohen and Sabag (2020) also saw this in Israel in various technologies used in distance learning. Stewart (2021) reviewed studies on ERT during COVID-19. The studies in his article often found that teachers were forced to teach differently in distance learning. This means that both the qualitative results and the literature (Babbar & Gupta, 2021; Blömer et al., 2020; Cohen & Sabag, 2020; Stewart, 2021) show that lecturers' media use has changed as a result of the COVID-19 Distance Learning Phase, which is consistent with pedagogical practice.

#### *11.1.5 Relationships Between Lecturers' TPACK and LMS Use*

The seventh hypothesis stated that “there is a significant relationship between TPACK and technology use in blended learning.” The hypothesis is not supported. To ascertain the technology use, the most widespread technology at Austrian UAS was surveyed. This technology is the universities' LMS; in most cases, it is Moodle.

Two constructs were examined for the LMS: on the one hand, the lecturers' use behaviour (UB) concerning the LMS, i.e. precisely which LMS tools they use and how often, and on the other hand, the perceived ease of use (PEOU) of the LMS, i.e. the lecturers' assessment of how effortlessly they can use the LMS. Both constructs, UB and PEOU, are part of the Technology Acceptance Model (TAM). The influence of the TPACK factors of lecturers at Austrian UAS on their UB and their PEOU of the LMS is relatively low because the TPACK factors as a group only explained 20.1% of the variance of the UB and 12.6% of the variance of the PEOU. Only TPACK as a single factor made a significant unique contribution to UB. Study results on similar topics vary. TPACK influenced the PEOU of teaching with the technology of Korean preservice teachers, but not their intention to use technology (Joo et al., 2018). However, Mayser and Girwidz (2019) found no direct influence of TPACK variables on the PEOU of multimedia applications in their study with physics teachers. Surprisingly, lecturers' UB and PEOU of the LMS had only a minor impact on their TPACK, which is partially consistent with the literature cited earlier. Consequently, the question arises as to how well lecturers at Austrian UAS know and use the functions of their LMS.

The most frequently used Moodle tools at Austrian UAS are posting announcements, sharing content and teaching material, providing the syllabus, making assignments, and giving feedback. The calendar function and the eBook function of the LMS are the least used functions. This finding agrees with Sinclair and Aho (2018), who also found that most lecturers at one British and one Finnish university only used the essential functions of the LMS. Rahrough et al. (2018) also found that most college instructors in Abu Dhabi only used three out of 12 Moodle tools: uploading teaching material, announcements and assignments. The quantitative survey results and the literature summarised in this paragraph (Aho, 2018; Rahrough et al., 2018) indicate that lecturers at Austrian UAS use similar Moodle tools more frequently than lecturers at other universities and that the use of various LMS tools in HE is not widespread. To increase the number of Moodle tools used in HE, institutions could offer further training and support. Several programme directors also suggested this in the qualitative interviews. The topics they recommended for further training were Moodle basic training, how to build a course quickly and easily, activities and elements, tests related to question forms, and Moodle advanced.

### *11.1.6 Factors Influencing Lecturers' TPACK at Austrian UAS*

The factors impacting the TPACK of lecturers at Austrian UAS are one of the main results of this thesis. The tests of the thesis hypotheses revealed that three factors significantly influence the TPACK of lecturers at Austrian UAS: full-time or part-time status, fields of education and media infusion. Concerning media infusion, only print media infusion and visual and audio media infusion influence TPACK. There is no significant influence on the TPACK of lecturers at Austrian UAS based on their level of education, gender, age, years of service, or LMS use.

## 11.2 Media Use of Lecturers

Two hypotheses tested the relationship between lecturers' didactic education and media infusion and the difference in synchronous and asynchronous media use based on the lecturer's field of education. Following these results, a research question was formulated for the qualitative study of this thesis to explore the factors influencing synchronous and asynchronous media use. The next part describes the findings, relates them to the literature, and draws conclusions. This is followed by a discussion of the research questions on lecturers' media use and the combined-findings of the hypotheses.

### *11.2.1 Relationships Between Lecturers' Didactic Education and Media Infusion in the Teaching Process*

The third hypothesis stated that “There is a statistically significant relationship between lecturer's didactic education and their media use in blended learning study programmes at universities of applied sciences in Austria.” The hypothesis is supported. The evaluations show that use of some media increases if the lecturers have a higher didactic education. A higher didactic education mainly affects the increased use of lecturers' print media, synchronous Web-based activities and asynchronous Web-based activities.

To measure media use, a classification of educational media was developed within the framework of the present study. It was used to measure the media use of lecturers at Austrian UAS. The survey results show that visual and audio media were used by more than half of the lecturers in each teaching unit, while print media were used by about a third. Asynchronous Web-based activities and synchronous Web-based activities were used somewhat less frequently in each teaching unit, 30.5% and 22.9%, respectively. Not surprisingly, social networking sites and messengers were the least used in teaching at Austrian UAS compared to other media, which is consistent with findings in the literature for other HE institutions (Manca & Ranieri, 2016).

A total of 90.4% of lecturers at Austrian institutions of applied sciences have completed didactic training. Further training and support for lecturers are offered throughout the HE sector to increase their didactic qualifications (Mürmann et al., 2016; Riewerts et al., 2016). These offers were switched to online offers and expanded during the COVID-19 Distance Learning Phase (Bakhmat et al., 2021; Troidl & Simon, 2020). Compared to the full-time teaching staff, the part-time teaching staff at Austrian UAS are more likely to have no didactic training. This view was confirmed by the programme directors interviewed in the qualitative study. Lecturers who teach part-time participate less in continuing education programmes offered by UAS. The reason given for this was that they have little time. Therefore, the programme directors suggested offering short online events for them after work. Interestingly, greater use of lecturers' print media, synchronous Web-based activities, and asynchronous Web-based activities is the only effect of higher didactic education. However, this does not apply to the media that are most frequently used in teaching, such as visual and audio media, and those that are used least, namely, networking sites and messengers. On the other hand, it suggests that enhanced didactic education can increase the use of relevant media being used in blended learning courses.

### *11.2.2 Differences in Lecturers' Synchronous and Asynchronous Media Use Based on Their Fields of Education*

The sixth hypothesis stated that “There is a statistically significant difference in the frequency of use of synchronous or asynchronous media in the online part of blended learning based on the ISCED fields of education of UAS in Austria.” The hypothesis is supported for asynchronous media but not for synchronous media. The quantitative findings reveal that the frequency of use of synchronous and asynchronous media varies by field of education. Lecturers from Education used the most synchronous media, while those from Health and Welfare used the fewest. Generic Programmes and Qualifications lecturers most frequently used asynchronous media, and those from Natural Sciences, Mathematics and Statistics least of all. There is also a difference in the use of asynchronous media between lecturers of Engineering, Manufacturing and Construction and lecturers from three other disciplines. The influence of the fields of education is a recurring theme in both the TPACK of lecturers and their media use. It is a crucial factor influencing differences between lecturers at Austrian UAS.

Overall, 89.1% of the lecturers used synchronous Web-based activities in their teaching. The proportion of lecturers using asynchronous Web-based activities was even higher, at 98.0%. It is not surprising that synchronous and even more asynchronous Web-based activities are frequently used in blended learning courses. They are a necessary part of designing blended learning courses. Instead, the question is how the few lecturers who do not use these media plan their online classes. For Bower et al. (2015), Ho (2017), Picciano (2009), and Smits and Voogt (2016), both synchronous and asynchronous elements are essential for blended learning in addition to face-to-face teaching. Several programme directors assumed that the use of synchronous online media will remain at increased levels after the COVID-19 Distance Learning Phase compared to before. Some also presumed an increase in the use of asynchronous media. On the other hand, some programme directors assumed that the ratio of synchronous and asynchronous media would remain the same.

### *11.2.3 Synchronous and Asynchronous Media Use in Blended Learning*

A research question was formulated based on the findings of the testing of two hypotheses to determine the influences on the use of synchronous and asynchronous media by lecturers in blended learning study programmes at Austrian UAS. In the qualitative interviews, the programme directors mentioned several reasons why the lecturers would use synchronous and asynchronous media. Beckwith (2020) assumes that teachers should combine synchronous and asynchronous media in online learning to maximise their respective advantages and minimise their disadvantages. These findings are consistent with real-world teaching experience, implying a useful combination rather than a singular focus on one of the two types.

Concerning these findings, programme directors stated that teaching with asynchronous media is more time-consuming for lecturers due to the effort required to create courses, develop tasks, and provide feedback. However, teaching with asynchronous media can also be less time-consuming for lecturers than teaching with synchronous media, if the former is understood to mean only self-study by the students. Consequently, temporal aspects particularly influence asynchronous media use. Asynchronous media allow lecturers and students time independence in teaching and learning. Hrastinski (2008), Ho (2017) and Serdyukov (2020) also highlight the temporal independence that asynchronous learning allows students. In some degree programmes, lecturers cannot decide for themselves what proportion of online teaching they will design with synchronous or asynchronous media, as there are guidelines in this respect.

The decision to use synchronous or asynchronous media may also depend on the task. Synchronous media are beneficial when interaction between participants is required, for example, for group work, feedback, project work, case studies or work in virtual labs. Serdyukov (2020) also sees the strength of synchronicity in participation. On the other hand, asynchronous media are particularly suitable for students to exercise or apply their knowledge in practice. Other factors influencing the choice of synchronous and asynchronous media in teaching are the lecturer's personality and the lecturer's desire not to be captured on camera.

The programme directors cited another reason for using synchronous media not mentioned in the literature. According to them, synchronous media are easier to deal with because the lecturers are used to them. From their point of view, synchronous media are utilised by lecturers who have little teaching experience in e-learning and would like to reproduce their usual seminar situation online one-to-one. This assumption by some programme directors does not match the results of Research Question 6, which show that lecturers from the field of education use the most synchronous media. These lecturers have extensive didactic education and usually a lot of teaching experience since teaching is their primary job, unlike many other lecturers at UAS. One interpretation of these different perspectives could be that lecturers with little or no experience in online teaching primarily use synchronous media when they are forced to teach online, for example, due to COVID-19. This could be because the lecturers can use synchronous media to create online lessons that are didactically similar to face-to-face classes. However, lecturers from the education field may permanently use synchronous media in the online part of blended learning.

### *11.2.4 Factors Influencing Media Use in Teaching at Austrian UAS*

The factors influencing media infusion in teaching at Austrian UAS are one of the thesis's primary findings. The tests of the hypotheses indicated that more didactic education of lecturers at Austrian UAS leads to more use of print media, synchronous Web-based activities and asynchronous Web-based activities in teaching. The field of education influences how asynchronous Web-based activities are used in teaching. Furthermore, the frequency of use varies; for example, lecturers from the field of Education use synchronous media the most in their classrooms.

In addition, it can be stated that synchronous and asynchronous Web-based activities in blended learning settings should be used in combination and well-balanced. Time factors strongly influence the use of asynchronous Web-based activities in teaching. They enable time independence, requiring more time if supervised lecturing is carried out or less time if the students conduct self-study unaccompanied. On the other hand, synchronous Web-based activities can be didactically similar to face-to-face teaching, which is not always beneficial for the quality of education. It is most suitable for interaction between participants.

## 11.3 Support and Training of Lecturers

The findings of this thesis have highlighted the importance of support and training of lecturers at Austrian UAS. Concerning the hypotheses already discussed, it was found that lecturers with higher didactic training use more media in teaching and that part-time lecturers have a lower TPACK. Nevertheless, this is particularly underlined by the subsequent difficulties of technology use of the lecturers. To develop these results further, two research questions were formulated for the qualitative part of the study that surveyed the appropriate types and contents for support and training at Austrian UAS. At the end of this section, these findings are presented visually.

### *11.3.1 Relationships Between Lecturers' Fields of Education and Difficulties in Technology Use*

The eighth hypothesis stated that "There is a significant relationship between difficulties of technology use and ISCED fields." The hypothesis is not supported. The results of this study show no significant relationship between the difficulties of technology use and the lecturers' subject areas. This result was unexpected since the first research question did reveal differences in TPACK depending on the fields of education. However, these relationships do not apply to the difficulties in technology use examined. This result can be explained by the frequent mention of obstacles. Only three out of 11 difficulties in technology use were named as obstacles partially or a lot by slightly more than 50% of the lecturers at Austrian UAS. These barriers are insufficient internet bandwidth or speed

(55.2%), the lack of pedagogical models for how to use technology for learning (53.2%), and insufficient pedagogical support for lecturers (51.3%). The result is interesting in that it differs clearly from the results of Austrian teachers at schools (ISCED Levels 1 to 3).

For the quantitative study of the thesis, the questions on difficulties in technology use were taken from the second survey of schools implemented by the European Commission (2019) and adapted. This survey was carried out all over Europe, including in Austria. On this basis, it is possible to compare the assessment of obstacles in technology use between Austrian teachers and lecturers at UAS. The most notable difference lies in the assessment of the insufficient number of computers. This topic was perceived as an obstacle by 64.9% of the teachers at Austrian schools and 19.8% of the lecturers at Austrian UAS. The lack of pedagogical models for how to use technology for learning was another big obstacle, both for teachers (57.2%) and lecturers at universities (53.2%). This situation also applies to the insufficient internet bandwidth or speed, which was seen as an obstacle by 62.9% of schoolteachers and 55.2% of lecturers at UAS. The third difficulty in technology use listed by more than 50% of lecturers at UAS was insufficient pedagogical support for teachers. It was stated as an obstacle by 47.0% of teachers at schools and by 51.3% of lecturers. The direct comparison of Austrian teachers and lecturers at UAS reveals significant disparities in their assessments of technological barriers. This could be because Austrian schools are not nearly as well equipped as UAS. In contrast, the only obstacle ranked higher by lecturers at UAS than by teachers at schools was insufficient pedagogical support. This finding shows a clear picture of what UAS should focus on when it comes to the difficulties the staff has with technology use.

Studies on the most common barriers to using technology in HE have identified various other obstacles. For Mercader and Gairín (2020) in their study of Spanish universities, these were in particular lack of training, lack of knowledge about teaching approaches to digital technologies, lack of planning, excessive workload, lack of time, generational differences, technophobia, lack of assessment, and lack of incentives. Walker et al. (2017) found further barriers in their study in UK HE. These were lack of time, department or school culture, lack of internal sources to support development, lack of money and lack of academic staff commitment. The studies presented in this paragraph identified further difficulties of technology use for HE institutions than the obstacles addressed in this thesis. A survey of these factors could lead to results that vary from the results of the present study.

The difficulties of technology use identified in the quantitative study (“lack of pedagogical models on how to use technology for learning” and “insufficient pedagogical support for lecturers”) were also surveyed in the qualitative research. Some programme directors felt that their lecturers were not familiar with any pedagogical models for using technologies in teaching. However, others did not share this view. Those lecturers who are aware of pedagogical models have learned about them in further education. Therefore, UAS could achieve awareness of pedagogical models on how to use technology for learning through increased further training, especially for part-time lecturers. The programme directors expressed positive views concerning the existing pedagogical support in the interviews. However, they had several suggestions for design and optimisation. These views contradict the quantitative results of this thesis. Therefore, it can be assumed that the lecturers who participated in the quantitative survey see more obstacles in pedagogical support than the programme directors do. This fact could be due to pedagogical support by Austrian UAS but possibly also to its visibility and accessibility. The findings, however, suggest that the demand for instructional support at Austrian UAS is underestimated.

#### *11.3.2 Lecturers' Perspectives on Pedagogical Support and Further Training*

The theme of pedagogical support and the further training of the lecturers was a recurring topic in testing the hypothesis related to the quantitative study; this applies to Hypotheses 3, 4 and 8. Therefore, questions related to pedagogical support were formulated for the qualitative interviews to explain it in more detail. The results are documented in Research Questions 10 and 11. The tenth research question concerns the views of the programme directors, who are also lecturers, on pedagogical support.

The programme directors are supposed to be aware of all offers for lecturers at their institution and possibly also assess them positively. They expressed their satisfaction with the existing pedagogical support and further training. This view is not in line with the quantitative results, where the lecturers indicated insufficient technical support for lecturers as one of the greatest difficulties of technology use. Lecturers may have a more limited overview of what is available or unsuitable for them. Despite different perspectives on this topic, what is certain is that during the COVID-19 Distance Learning Phase, the need for internal training increased. Lecturers also received more individual coaching during this period. Other Austrian UAS reported increased support offers for their lecturers (Breinbauer & Schiessl-Foggensteiner, 2021; Pauschenwein & Schinnerl-Beikircher, 2021).

A recurring detail in the descriptions of the programme directors is the role of part-time lecturers, who participate less in further training than internal lecturers do. This situation is attributed to the fact that part-time lecturers have little time. According to the quantitative results of this study, they also have lower TPACK scores in the areas related to PK. Several programme directors suggested making further training compulsory; all lecturers should regularly take part in further training courses and produce mandatory certification. Another suggestion was introducing a point system for the further training of full-time lecturers, who should receive points for further training courses. Each lecturer should then achieve a minimum number of points per year.

The different perspectives on pedagogical support are also reflected in the various wishes as to the form in which UAS should offer this support. From the standpoint of the programme directors, they should support the lecturers in individual coaching or coaching of small groups. The aim is to meet lecturers where they are in terms of content and offer tailored support. Sanders and Georg (2017) also cited a needs-based programme as the first factor that leads to more effective teacher training. Best or good practice examples should be available to provide lecturers with a holistic view of teaching. Sanders and Georg (2017) also highlight role models' impact on effective further training of teachers. In addition, there should also be a systematic exchange of experience between lecturers, for example, in the form of lecturer meetings. This exchange can also take place through observation: Two lecturers should participate in each other's lessons, and a third person with a pedagogical education should moderate and comment on the process.

If there is training for all lecturers, it should be short and online. This framework is necessary because part-time lecturers have little time. For them, short online training offered either in the mornings or evenings, i.e. after their regular work, is ideal. If there are longer training sessions, they should be in a blended learning format for lecturers in blended learning programmes. In this way, the lecturers should experience the format as participants and get to know each other in the face-to-face sessions. Videos are an essential format for lecturers' support and further training, e.g. through video tutorials. In addition, recordings of further training should be made available to lecturers. Furthermore, there should be training courses on creating teaching and learning videos. Another way of providing pedagogical support are tutorials and regular tips to lecturers, such as a blog they can subscribe to. The types proposed by the programme directors for lecturer support are numerous. However, the focus on coaching and individualised formats that usually only reach a small group of lecturers is striking. Offers for all lecturers should primarily be delivered online. If the UAS implemented the results of this thesis, it would lead to more needs-based support, as recommended in the literature (Sanders & Georg, 2017).

### *11.3.3 Content of Further Training for Lecturers*

Similar to the tenth research question, the eleventh research question is dedicated to educational support, particularly further training. These topics are essential for the thesis as they played an important role several times in the quantitative results, especially for Hypotheses 3, 4 and 8. The previous research question showed the perspectives and desired formats for these areas. The eleventh research question deals with the content of the further training, specifically what knowledge lecturers in blended learning study programmes of Austrian UAS need to be taught to use media effectively for teaching. This research question was inspired by the quantitative survey results and the literature. In their article “TPACK - time to reboot?” Saubern et al. (2020) state, “All TPACK research should have one fundamental purpose: to understand the knowledge that teachers need to use technology effectively for teaching and learning” (p. 6). By this, they meant that the focus should be on the primary purpose of TPACK, which is to understand how to teach effectively with technology. Therefore, the eleventh research question addressed the content of further training for lecturers who teach in blended learning programmes at Austrian UAS.

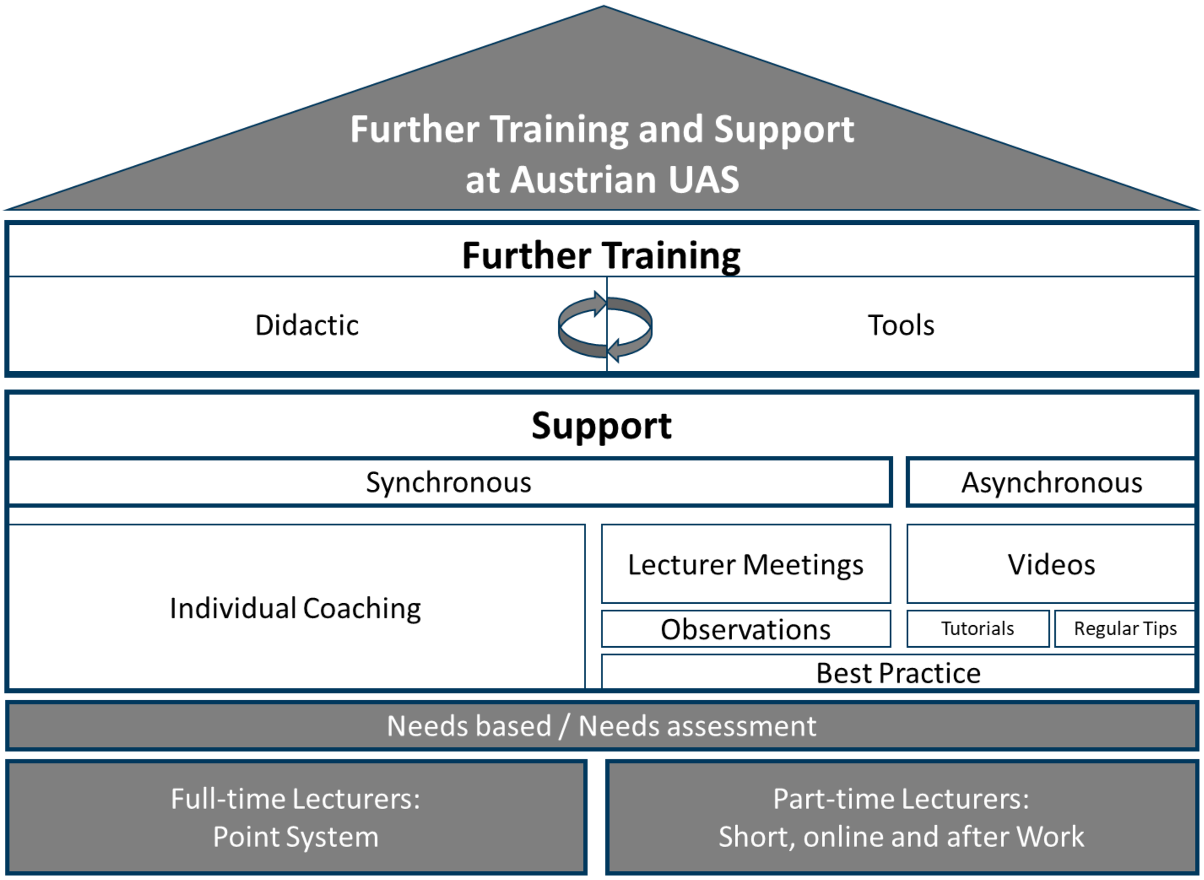
Not surprisingly, further training for lecturers should include didactic topics. The quantitative part of the study also supports these findings, where lecturers referred to the difficulties of technology use. The lack of pedagogical models on how to use technology for learning was named as one of the main obstacles. These models should be taught in work-related training at Austrian UAS. This study result aligns with practical experience and the literature (Sanders & Georg, 2017). However, lecturers' training for teaching in blended learning courses should include more specific requirements. Lecturers should receive support to plan blended learning courses, learning objectives and didactic design. This assistance includes the combination of synchronous and asynchronous media, which should be taught together, not separately. It is also essential to learn how to design online teaching as part of blended learning. Here, there should be a focus on the use of the camera.

The programme directors believed that lecturers should be offered comprehensive tool training, in particular, on the use of Moodle. For them, the most important topics were Moodle basic training, how to build a course quickly and easily, activities and elements, Moodle advanced, and question forms for tests. The creation of tests, e.g. in Moodle, should also be taught, for example, how to set up tests online, what types of questions are possible online, how to check competencies with an online test and how to design multiple-choice test questions. In contrast, the mere teaching of knowledge about tools is viewed critically in the literature (Kirkwood & Price, 2013; Sanders & Georg, 2017). This opinion makes sense concerning the TPACK model (Mishra & Koehler, 2006). Training for teaching tools such as Moodle should be conducted in a pedagogical context.

### *11.3.4 Recommendations for Further Training and Support at Austrian UAS*

The author produced recommendations for future training and assistance to instructors at UAS based on the findings of this thesis and summarised them in Figure 26.

**Figure 24** *Recommendations for Further Training and Support at Austrian Universities of Applied Sciences*




Further training and support at Austrian UAS should be explicitly directed at full-time lecturers and part-time lecturers. For full-time lecturers, a point system is recommended, in which lecturers should be able to choose a certain number of further training points per year from a wide range of further training and support offers. For part-time lecturers, on the other hand, training should be short, online and take place outside work hours. For both groups, needs-based offers are essential and should be accompanied by regular needs assessments. Support for lecturers should have a strong focus on individual coaching. Other recommended synchronous support for lecturers are lecturer meetings, observations and best practices. Best practice can be offered both synchronously by a lecturer and asynchronously in the form of recordings. The essential asynchronous support for lecturers comes in the form of videos, whereby regular tutorials and tips can also be used. In addition to support, continuous further training for lecturers is necessary. This should include further training on didactic topics and the use of tools in teaching. However, it is crucial to ensure that no pure tool training is offered, but rather that the pedagogical context of the tools used is always emphasised.

## 11.4 Lessons Learned and Expected Changes After the COVID-19 Distance Learning Phase

This thesis was conducted during the Distance Learning Phase caused by COVID-19. Therefore, excluding this topic was impossible, especially in the qualitative study, which included interviews with programme directors who had already led study programmes in the blended learning format before 2019. Due to the extensive and relevant answers, a planned minor inclusion of the topic turned into two separate research questions, which are discussed in the following section.

### *11.4.1 Lessons Learned from the COVID-19 Distance Learning Phase*

The twelfth research question was only created during the evaluation of the qualitative interviews. The interviews started with what the programme directors learned from the COVID-19 Distance Learning Phase. The question was initially intended as an icebreaker and served this purpose. However, respondents talked extensively and openly about their experiences, giving insightful and knowledgeable answers. The responses were grouped into three areas: the transition to distance learning, the different teaching formats, and the design of online courses.

The qualitative study results indicate that it is easier to switch study programmes to full distance learning if parts of the teaching have already been conducted online beforehand, and this view is confirmed by Crawford et al. (2020). It is not surprising that experience with online teaching facilitates online teaching. However, from this point of view, the multitude of support offered for the change from blended learning to pure online teaching that the UAS have provided to their lecturers and students is surprising. The change seems to have been easier but still needed intensive support.

The programme directors reported different experiences with synchronous online teaching concerning the different teaching formats. Regarding asynchronous teaching, they felt that its importance had increased. Programme directors also felt that after the COVID-19 Distance Learning Phase the role of face-to-face teaching might change towards a more conscious use with more interaction during teaching. They also reported experiences with hybrid teaching. Although they spoke of challenges with this form of teaching, they felt that it would become more common in the future. Murphy (2020) argues that hybrid or blended forms help traditional HE institutions to improve the quality of face-to-face teaching by outsourcing the delivery of content and allowing face-to-face lecturers to focus on teaching students actively. Interviewees learned most about synchronous distance learning and hybrid teaching during the Distance Learning Phase, as they used these types more frequently in the COVID-19 Distance Learning Phase than in the past. Therefore, increased use of these formats can also be expected in the future.

The qualitative study results revealed that online-only courses need to be designed differently from face-to-face classes to avoid a loss of quality in the learning experience. Pokhrel and Chhetri (2021) shared this assessment. Particularly long monologues lead to a loss in the quality of teaching online. Cooperation can be done in different ways, for example, through online assignments in which students work together on an online document or an online whiteboard and are assigned to an online breakout room. A further possibility is by asking direct questions to students, for example, in chat or by using surveys. Greenhow et al. (2021) emphasise that a high level of interaction is necessary for online live teaching to achieve learner engagement. Furthermore, this work has shown that the programme directors believed the vast majority of content can also be taught online, whereby the social factor suffers, except for (1) exercises in laboratories, (2) formats for communicating with large groups, and (3) negotiation techniques.

Interaction in synchronous online courses is related to the change of different formats to offer the participants visual variety; e.g. formats like videos, course recordings, self-study, and question time. However, the blend of different formats must be balanced, and the total number of various tools used must be kept low to avoid overwhelming the students. Programme directors reported that students gave negative feedback when lecturers used too many different tools in online teaching. This finding is in line with the experience from pedagogical practice, which had shown that usually when students had to log into another new online tool during a synchronous online course, the number of participants decreased. This is because participants repeatedly experienced problems with passwords or having to create an account. Nevertheless, they are sometimes not attentive and miss the change to a new tool. Lecturers can deal with this situation by using tools that support a variety of formats, for example, the different functions of video conferencing systems or online whiteboards.

Furthermore, having more breaks during online events in comparison to face-to-face ones is essential. More breaks, combined with more interactivity and more frequent changes of formats, often lead to more time being needed to convey content in online courses. In contrast, online presentations require less time than face-to-face teaching presentations because students show less initiative and ask fewer questions in online presentations. Online tests were another aspect of designing online education, with numerous instructors worrying that students might cheat more frequently. According to the programme directors, this can be counteracted by the lecturers asking test questions that do not require pure factual knowledge: Competency-oriented questions that students cannot look up swiftly by entering them into an internet search engine (e.g. Google) significantly reduce the possibilities of cheating. Babbar and Gupta (2021) also reported on modified and alternative assessments in their inter-country comparison of the responses of educational institutions to the COVID-19 pandemic. The qualitative study results on lessons learned are valid for online teaching in general and correlate to pedagogical practice obtained throughout the COVID 19 Distance Learning Phase.

#### *11.4.2 Changes Through the COVID-19 Distance Learning Phase*

The qualitative interviews were conducted during the COVID-19 Distance Learning Phase, which impacted the answers of the programme directors to the interview questions. This was especially true for the last research question, which was dedicated to the topic of what should be adopted from the COVID-19 Distance Learning Phase for blended learning study programmes in the future. This research question emerged from the qualitative study and is explained based on the qualitative interviews and the literature analysis.

One programme director remarked that HE institutions had reached a tipping point and that the changes were difficult to reverse after teaching three semesters via online learning. The COVID-19 crisis has accelerated developments that would otherwise not have been possible at this pace. The digitalisation that it has sparked, according to programme directors, will have long-term consequences for UAS.

These results from the qualitative study are consistent with results found in the literature (Ahrens & Zascerinska, 2021; Cohen & Sabag, 2020; Green et al., 2021; Pandya et al., 2021; Pokhrel & Chhetri, 2021; Stewart, 2021; Zawacki-Richter, 2021), indicating that it is expected that the COVID-19 Distance Learning Phase will drive digitalisation at HE institutions. In addition, programme directors predict that opportunities for working from home will increase compared to before COVID-19. Anderson (2020) stated that HE institutions urgently need to address the issue of home office infrastructure for lecturers. These findings are in keeping with the current situation, as many HE institutions have implemented more extensive home office agreements than before COVID-19.

Programme directors are, however, concerned that in the future, online learning could be used to save money on seminar rooms and travel. The distinctions between full-time and part-time study programmes are also blurring, and mandatory attendance at UAS may continue to be suspended. It is also believed that student satisfaction with e-learning may be a success factor for UAS. Blended learning courses are expected to become more diverse in the future, according to programme directors, and the share of blended learning is expected to increase in the entire UAS sector. To apply blended learning more widely in the future, the examination guidelines, the student guidelines and the curricula would have to be adapted concerning blended learning. In their survey, Pauschenwein and Schinnerl-Beikircher (2021) discovered that the vast majority of lecturers and students do not want to return to 100% face-to-face instruction. To maximise the potential of existing resources and meet students' expectations, Garca-Morales et al. (2021) believe that HE institutions should develop a sophisticated combination of face-to-face and online teaching. The programme directors, on the other hand, do not believe that their study programmes will be totally online in the future. A higher proportion of online teaching would result in organisational changes for HE institutions and students. These results are less mentioned in the literature but can be traced back to the interview partners' experience with an increased share of online teaching. As a result, this thesis emphasises that as the percentage of online teaching increases, particular changes will occur for both the institution and the participants. Even if there is no empirical evidence to support this conclusion, it is important because it can help HE institutions to measure the impact of changes in the share of online instruction.

The interviews revealed a clear picture concerning the development of the online share in blended learning study programmes. All of the programme directors interviewed who ran blended learning programmes that applied less than 30% online teaching before the COVID-19 Distance Learning Phase announced that they would increase the online share of teaching. Programme directors with a distance learning share of around 30% indicated that they would like to keep or increase this share. All programme directors of study programmes with an online share of 50% or more than 70% said that after the COVID-19 Distance Learning Phase, they would like to return to their previous online share in teaching. The results on how the programme directors of Austrian blended learning programmes at UAS plan the extent of their online share in the future are precise and a result that so far is only presented in this thesis. Based on these findings, it is reasonable to assume that many study programmes will increase their share in online teaching. Concerning hybrid teaching, the results of this study are in line with the literature (Ahrens & Zascerinska, 2021), whereby increased use is expected in both cases in the future. Both points appear reasonable since universities have gained extensive experience with pure online teaching and hybrid teaching, which will make it easier for them to continue to use these formats.

Programme directors assume that the practical experience with online teaching gained by lecturers in the Distance Learning Phase will also influence the UAS after COVID-19, for example, through higher quality in the design of online teaching and the more conscious use of the possibilities of blended learning, meaning the combination of face-to-face and online teaching. Pandya et al. (2021) perceive considerable changes in HE concerning faculty preparation, teaching methods, course material, assessment strategies, and technical assistance compared to before COVID-19. Lecturers at HE institutions, according to Zawacki-Richter (2021), will want to utilise the resources and experiences they developed during the COVID-19 Distance Learning Phase later. As a result of these findings, it is assumed that the lecturers have gained experience with online teaching during the COVID-19 Distance Learning Phase that they will also use in the future. This postulation is plausible, given the length and intensity of the COVID-19 Distance Learning Phase.

This effect is reinforced by better equipment for lecturers in the home office and lecturers' skills in dealing with digital media. From the perspective of programme directors, however, the role of lecturers in the COVID-19 Distance Learning Phase has also changed. This change can take different forms. For example, some lecturers see themselves primarily as online lecturers or experts who become more independent of the educational institution through the digital possibilities and as learning facilitators in face-to-face and online teaching. The Distance Learning Phase induced by COVID-19 could promote the shift from teaching to learning and change the role of lecturers. From a critical standpoint, this appears to be a long-held desire of the respondents, as it would necessitate changes in lecturer behaviour rather than in the media.

### *11.4.3 Expected Changes and Lessons Learned to Consider for Austrian UAS*

One of the most important findings of the qualitative study part of this thesis is the accumulation of several lessons learned and expected changes after COVID-19 that are relevant for Austrian UAS. Of the lessons learned, those for the design of synchronous online courses are particularly noteworthy. Synchronous online courses should include the use of different formats and interactions and regular breaks. Both long monologues and the use of too many different tools are disadvantageous. In any case, the social factor suffers in distance learning. Most content can still be taught online, except for exercises in laboratories, formats for communicating with large groups and negotiation techniques. Concerning organisational changes, most of the changes to be expected result almost automatically from a higher proportion of online teaching. On the part of the HE institution, a higher proportion of distance learning leads to the need for fewer seminar rooms, a reduction of travel costs and an adjustment of curricula. For the students, removal of compulsory attendance and the blurring of the differences between part-time and full-time studies are expected. A particularly remarkable result is the expected future development of the proportion of distance learning at Austrian UAS. An increase in this proportion is expected for study programmes that have offered less than 30% of their teaching in distance learning. Study programmes with a distance learning share of around 30% will either increase this share or maintain it. A constant share of distance learning is expected for degree programmes with a distance learning share of around 50% or more than 70%.

## 11.5 Recommendations for Future Research

The quantitative survey for this thesis was conducted at the beginning of the COVID-19 Distance Learning Phase, the qualitative survey more than a semester later. It would be exciting to run a quantitative study with the same group after the Distance Learning Phase caused by COVID-19. The results from the quantitative and qualitative studies conducted so far could be incorporated into the creation of this survey. It would be interesting to compare the results from the beginning of the COVID-19 Distance Learning Phase with the situation after COVID-19. This research could lead to a longitudinal study on the development of TPACK among lecturers at Austrian UAS. This study seems to be worthwhile in terms of the findings that can be expected.

Following Saubern et al.'s (2020) point that TPACK research should focus on understanding the knowledge lecturers need to use technology effectively in teaching and learning, the field of research activities is wide. The present work addressed, among other points, the forms and content that pedagogical support should take for lecturers, especially part-time lecturers, to teach more effectively in blended learning settings. Based on the present work results, it could be assumed that the knowledge individual lecturers need varies depending on the subject area, especially for ICT lecturers. On the one hand, further research to determine the exact differences between the subject areas would be interesting. On the other hand, it would be interesting to develop pedagogical support and further training that considers the requirements of lecturers from the various subject areas.

The study surveyed the contents and types of further training and support for lecturers in blended learning programmes at Austrian UAS. Further research could compare the current status of the further training offered with the services requested by the programme directors. On this basis, gaps and development potentials for further training and support of lecturers could be identified. In the qualitative part of the study, the differences between part-time lecturers and full-time lecturers were examined based on the findings of the quantitative part. Part-time lecturers play a disproportionately large role in Austrian UAS, as they usually make up more than half of the teaching staff. Another quantitative study could clarify whether the assumptions about the design of pedagogical support and further training for part-time lecturers made in the qualitative part are shared by them. Such work would aim to provide support and training that meet the needs of part-time lecturers to help them design their blended learning courses effectively. In another qualitative part of the study, factors that influence the use of synchronous and asynchronous elements were identified. Further quantitative research would be helpful to determine whether the lecturers at HE institutions also perceive these factors.

The findings of this thesis included expected changes for Austrian blended learning UAS study programmes after the Distance Learning Phase caused by COVID-19. These results refer in particular to the expectation that the share of online teaching will increase for degree programmes with a share of distance learning of less than 30%, an increased digitalisation of teaching, and more home office for lecturers. Further research could be conducted after the Distance Learning Phase caused by COVID-19 to ascertain whether these assumptions were correct. It would be worthwhile systematically to research the factors that are directly affected by an increased online share of teaching, for example, the experience with online teaching by lecturers and students, the need for rooms, the reduction of travel costs, the mandatory attendance of students, or the home office. Two additional aspects concerning the expected changes identified in this study are a more careful combination of face-to-face and online phases for blended learning courses and a shift from teaching to learning. Future research should seek to address these issues because they directly impact the quality of teaching, even if they are more challenging to measure.

### 11.6 Limitations

The study was conducted during the COVID-19 Distance Learning Phase so its results must be seen in this light. The thesis offers insight into the use of media at the beginning of the COVID-19 Distance Learning Phase and qualitative processing of these results after two semesters of lockdown at the universities. No statement can be made about how these findings apply to the regular teaching situation at Austrian UAS concerning blended learning.

Another limitation of the quantitative study resulting from its design is that the lecturers underwent self-assessment in the online survey. Therefore, the findings are based on self-reported perceptions of knowledge and may be biased. Moreover, this study focused on the lecturer's perspective and largely excluded the student's point of view due to the narrowing of the research field. However, it is important to emphasise that the primary focus of educational research is not the lecturer but the students' learning success.

The research was limited to lecturers who teach at Austrian UAS in a blended learning setting. Several specific framework conditions are associated with this that influence the results of this work. More than half of Austrian UAS lecturers are part-time lecturers who teach alongside their primary job. This background gives the UAS a strong practical orientation and flexibility and leads to atypical teaching staff for HE institutions. Furthermore, most of the UAS study programmes are targeted at part-time students, which applies to all of the blended learning study programmes examined. This situation leads to mostly older, working students atypical for HE institutions. These students are mainly taught in small groups; large lecture groups are rare. In terms of content, UAS offer theory-based, practice-oriented education linked to research. However, their organisational structure is not typical for HE institutions, especially in German-speaking countries. Thus, the results of this work or subsequent studies do not apply to all types of HE institutions.

## 11.7 Pedagogical Implications

This thesis offers insight into the TPACK and media use of lecturers teaching in a blended learning setting. The results can support study programmes that are considering switching to this format. In addition, existing study programmes in this field will gain more knowledge about their lecturers. The thesis revealed that programme directors are satisfied with the pedagogical support provided but the lecturers surveyed in the quantitative study see insufficient pedagogical support for lecturers as an obstacle. Therefore, the Austrian UAS should review their support offers and whether the lecturers know about them. Most of the lecturers at UAS have taken part in one or more pedagogical pieces of training. Of the few who do not have didactic education, most are part-time lecturers. They have less TPACK, less time for further training and could not be reached with the offers so far. Therefore, the UAS should optimise their programmes to reach part-time lecturers better, for example, with short, online training in the mornings or evenings.

This thesis indicates that the individual coaching of lecturers is perceived as particularly important. The development and use of individualised formats, such as one-to-one coaching, small-group coaching, and observations, can further increase the quality of teaching but are also associated with a relatively high investment of resources. However, it seems worthwhile for UAS to strengthen the individual support of lecturers, especially when these individual formats are combined with online offerings such as video tutorials and regular short tips. Another result of this work is the proposal to increase and individualise the incentive for further training, especially for full-time lecturers, with a points system. Each lecturer should acquire a certain number of points per year from freely selectable training, which would raise further training quotas. These points should be awarded for face-to-face training, online formats, and individual coaching.

Lecturers have learned much about synchronous online teaching and hybrid teaching during the COVID-19 Distance Learning Phase, which may lead to more frequent use of these formats in the future. This thesis offers concrete recommendations for designing synchronous online courses for pedagogical practice. They should include interaction with students, different formats and regular breaks. However, the results also show that study programmes should rely on face-to-face teaching for laboratory exercises, formats for communicating with large groups, and negotiation techniques. One result of this thesis are factors influencing the use of synchronous and asynchronous elements in teaching. These findings can support programme directors and HE officials if they want to better understand or influence the use of synchronous and asynchronous media.

According to the results of this study, the programme directors of blended learning study programmes assume an increased share of blended learning in the UAS sector. This prediction is consistent with those in the literature for the entire HE sector. This assumption is based on the belief that lecturers, students and HE institutions have gained sufficient positive experience with online teaching in the COVID-19 Distance Learning Phase to want to continue it. This thesis highlights that the longer the prescribed COVID-19 Distance Learning Phase lasts, the more intensified this development will become. However, one should be aware that such changes cause several organisational implications, as the qualitative part of the study has shown. Direct effects on full-time lecturers are expected in a higher proportion of home office hours. Both the programme directors interviewed and the literature see such a development. This assumption is in line with the current trends, as several UAS have already issued new home office agreements for their staff. A higher proportion of online teaching would also lead to organisational changes for educational institutions and students. HE institutions would have to adapt their curricula but would need fewer seminar rooms and fewer travel expenses. On the other hand, students would find the differences between part-time and full-time study programmes blurred and have less or no compulsory attendance in lectures.

The requirements that digitalisation brings are the need to prepare students for a digital working world and the desire to capitalise on the potential of digital tools to make teaching more effective. In addition, the concern that events that make ERT and thus full distance learning necessary again could occur soon plays a role. The COVID-19 crisis showed that the HE sector was not ready for ERT. A shift towards more digital pedagogy is necessary even in regular study times to prepare for unforeseen circumstances. If part of the teaching is done online, which means that a blended learning setting is chosen, the shift to full distance learning is more manageable. In this case, lecturers and students are already used to online teaching, its processes, and its tools. They also had to equip themselves with the necessary technical infrastructure. A blended learning format for study programmes is recommended to prepare for future ERT. This should involve teaching with asynchronous and synchronous media so that lecturers and students regularly practise using both forms.

# 12 Conclusion

This thesis researched the use of media by lecturers in blended learning at Austrian UAS. Based on a quantitative survey with 419 participating lecturers and a qualitative study with 20 programme directors, it concluded which factors influence the TPACK and the media use of lecturers, what recommendations are for further training and support for them, and which lessons learned and changes are expected for blended learning after the COVID-19 Distance Learning Phase. The strengths of this study include having data from a large group of lecturers teaching in blended learning formats who were previously not researched and building upon this data, collecting qualitative insights from outstanding experts in the practical implementation of blended learning. This design is reflected in the results and adds to the significance of the thesis. The thesis was also the first survey of lecturers at all Austrian UAS. Therefore, the outcomes add to the research of a population that has not yet been studied, lecturers at UAS who teach in blended learning settings.

TPACK is one of the most researched theoretical models in blended learning and educational technology. The results of this thesis contribute to the identification of factors influencing the TPACK of lecturers who teach in non-pedagogical faculties at HE institutions. The tests of the hypotheses revealed three factors that influence the TPACK of lecturers teaching in blended learning settings at Austrian UAS: full-time or part-time status, subject area and media infusion. Concerning media infusion, only print media and visual and audio media infusion influence TPACK. Other factors that do not influence lecturers' TPACK are education, gender, age, years of service and LMS use. These findings help to explore the previously unknown factors that influence the TPACK of UAS lecturers teaching in blended learning environments. Another benefit of this work is knowing which TPACK factors should be researched further. For the pedagogical practice, this means the factors that can be influenced and have a substantial impact are known.

This thesis substantially contributes to identifying factors influencing the use of synchronous and asynchronous Web-based activities in teaching. The tests of the hypotheses led to the conclusion that better didactic training of lecturers at Austrian UAS leads to more intensive use of print media, synchronous Web-based activities and asynchronous Web-based activities in teaching. The field of education in which lecturers teach also influences the frequency of use of synchronous Web-based activities and asynchronous Web-based activities; for example, lecturers from Education use the most synchronous media in their teaching. The qualitative study and the literature showed other factors influencing media use. Time factors influence asynchronous Web-based activities in teaching: Their use allows more time independence for lecturers and students but also requires more time for the lecturer when teaching students under supervision, or less time when students engage in self-study. In contrast, synchronous Web-based activities are best suited for interaction between participants and can be designed didactically similar to face-to-face teaching, which usually does not improve the quality of teaching. These results can be a starting point for further research into the little-explored area of synchronous and asynchronous Web-based activities in teaching. However, they can also be utilised to influence them to achieve a more balanced application in blended learning settings.

This work is novel in that it is the first to compare the difficulties of technology use between Austrian teachers in schools and lecturers at UAS. The comparison is based on the second survey of schools implemented by the European Commission, which was also carried out in Austrian schools (ISCED Levels 1 to 3). The same questions were asked in this thesis's questionnaire. The direct comparison shows noticeable differences in the assessment of obstacles in technology use between these two groups. This applies particularly to difficulties in the area of infrastructure, which are rated higher by schoolteachers. The only obstacle that is rated higher by the UAS lecturers than by the teachers at schools, on the other hand, is insufficient pedagogical support. This issue should be considered in the future. Therefore, one of the purposes of this thesis's qualitative study was to identify pedagogical support types and content that underpin the media use of lecturers teaching in blended learning formats. The pedagogical support should offer different formats: primarily individual coaching but also best practice, lecturer meetings, observation, tutorials, regular tips, and especially videos. Further training, in particular for part-time lecturers, should be short, online, and take place in the mornings or evenings; full-time lecturers should participate in a points system where they must regularly collect points for further training. In terms of content, the programme directors of study programmes in the blended learning format suggest further training for their lecturers in didactics and tools, for example, pedagogical models, didactic design, learning objectives and the planning of blended learning courses. In the tools area, the programme manager indicated support and advanced training for the LMS Moodle. Nevertheless, it is crucial that no pure tool training is offered, but that the pedagogical context of the tools is always emphasised. Concerning pedagogical practice, the results of the thesis make an essential contribution to the types and content for the support and training of lecturers at UAS. HE officials and policymakers can get more insight into this topic, so the results can contribute to the planning and design of a more needs-based further education and support for lecturers.

The results of this thesis can support lecturers in pedagogical practice in designing their blended learning courses. Among the findings, lecturers must plan courses for online learning differently than they do for face-to-face classes. In synchronous online courses, frequent breaks, regular format changes, and interaction with students are essential. Lecturers should avoid long monologues and the use of too many tools. However, implementing these points will impact the time needed to cover the teaching content. The results can also guide the lecturer when they should use face-to-face teaching, that is, for laboratory exercises, formats for communicating with large groups, and negotiation techniques. Another finding is that study programmes that conduct part of their teaching online, i.e. in a blended learning format, find it easier to switch to full distance learning. Therefore, blended learning study programmes are better prepared for further ERT.

The thesis also contributes to the growing body of evidence that the COVID-19 Distance Learning Phase will have a long-term impact on teaching. It documents the changes to be expected after COVID-19 for blended learning formats at Austrian UAS. However, many of these assumptions can also be found in the literature for HE institutions. Viewed from a distance, many of these expected changes arise from the increased online share of teaching as a side effect of the ongoing digitalisation of the educational system. For the institutions, a higher proportion of online teaching lowers the need for seminar rooms and travel costs and leads to an adjustment of the curricula. For the students, the development toward more online teaching could be connected with the permanent removal of compulsory attendance and the blurring of the differences between part-time and full-time studies. Nevertheless, one of the strengths of this study is the detailed and concise results regarding the development of the online portion in existing blended learning programmes at Austrian UAS. Study programmes with an online share of less than 30% before COVID-19 plan to increase this share. For the study programmes that had an online share of 30% in the past, some programme directors plan to increase the amount of online teaching, while others would like to maintain it. Study programmes that offered 50% or more than 70% online teaching would like to keep this proportion. Overall, the programme directors expect a higher proportion of blended learning study programmes in the UAS sector and more hybrid programmes. The findings of this thesis may have important implications for existing study programmes and influence the planning of new curricula and the revision of existing ones.

# 13 References

Adelstein, D., & Barbour, M. K. (2016). Redesigning design: Field testing a revised design rubric based on iNACOL quality course standards. *International Journal of E-Learning & Distance Education, 31*(2).

Ahrens, A., & Zascerinska, J. (2021). Post-COVID-19 university governance in germany. *Education Reform: Education Content Research and Implementation Problems, 2*, 7-16. https://doi.org/10.17770/er2020.2.5336

Alammary, A., Sheard, J., & Carbone, A. (2014). Blended learning in higher education: Three different design approaches. *Australasian Journal of Educational Technology, 30*(4). https://doi.org/10.14742/ajet.693

Allen, I., & Seaman, J. (2010). *Class differences: Online education in the united states.* https://files.eric.ed.gov/fulltext/ED529952.pdf

Alzahrani, A. A. (2014). *The effects of instructor's technological pedagogical and content knowledge (TPACK) on online courses (doctoral dissertation).* http://hdl.handle.net/2346/58720

Amemado, D. (2014). Integrating technologies in higher education: The issue of recommended educational features still making headline news. *Open Learning, 29*(1), 15-30. https://doi.org/10.1080/02680513.2014.908700

Amhag, L., Hellström, L., & Stigmar, M. (2019). Teacher educators' use of digital tools and needs for digital competence in higher education. *Journal of Digital Learning in Teacher Education, 35*(4), 203-220. https://doi.org/10.1080/21532974.2019.1646169

Anderson, A., Barham, N., & Northcote, M. (2013). Using the TPACK framework to unite disciplines in online learning. *Australasian Journal of Educational Technology, 29*(4). https://doi.org/10.14742/ajet.24

Anderson, T., & Rivera-Vargas, P. (2020). A critical look at educational technology from a distance education perspective. *Digital Education Review,* (37), 208-229. https://doi.org/10.1344/der.2020.37.208-229

Anderson, V. (2020). A digital pedagogy pivot: Re-thinking higher education practice from an HRD perspective. *Human Resource Development International, 23*(4), 452-467. https://doi.org/10.1080/13678868.2020.1778999

Archambault, L. (2016). Exploring the use of qualitative methods to examine TPACK. In M. C. Herring, P. Mishra & M. J. Koehler (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educators* (pp. 65-85). Taylor and Francis. https://doi.org/10.4324/9781315771328

Archambault, L., & Barnett, J. H. (2010). Revisiting technological pedagogical content knowledge: Exploring the TPACK framework. *Computers & Education, 55*(4), 1656-1662. https://doi.org/110.1016/j.compedu.2010.07.009

Baacke, D. (1999). "Medienkompetenz": Theoretisch erschließend und praktisch folgenreich. *Medien + Erziehung, 43*(1), 7-12.

Babbar, M., & Gupta, T. (2021). Response of educational institutions to COVID-19 pandemic: An inter-country comparison. *Policy Futures in Education, 0*(0), 1-23. https://doi.org/10.1177/14782103211021937

Bacsich, P. (2009). Benchmarking e-learning in UK universities: Lessons from and for the international context. Paper presented at the *23rd ICDE World Conference on Open Learning and Distance Education.*

Badenhorst, J. J. C. (2015). Extent of e-learning at universities of technology – our strength for our future? *Journal for New Generation Sciences, 1*(13), 1-18.

Baddeley, A. (2010). Working memory. Current Biology, 20(4), R136-R140. https://doi.org/https://doi.org/10.1016/j.cub.2009.12.014

Bakhmat, L., Babakina, O., & Belmaz, Y. (2021). Assessing online education during the COVID-19 pandemic: A survey of lecturers in ukraine. *Journal of Physics. Conference Series, 1840*(1), 12050. https://doi.org/10.1088/1742-6596/1840/1/012050

Banihashem, S. K., & Aliabadi, K. (2017). Connectivism: Implications for distance education. *Interdisciplinary Journal of Virtual Learning in Medical Sciences, 8*(3), 1-7. https://doi.org/10.5812/ijvlms.10030

Beckwith, E. (2020). The importance of synchronous sessions in online asynchronous classes. In C. M. Sistek-Chandler (Ed.), *Exploring online learning through synchronous and asynchronous instructional methods* (pp. 34-51). IGI Global. https://doi.org/10.4018/978-1-7998-1622-5

Beetham, H., & Sharpe, R. (2013). *Rethinking pedagogy for a digital age: Designing for 21St century learning*. Taylor & Francis Group.

Bilici, S. C., Yamak, H., Kavak, N., & Guzey, S. S. (2013). Technological pedagogical content knowledge self-efficacy scale (TPACK-SeS) for pre-service science teachers: Construction, validation, and reliability. *Eurasian Journal of Educational Research, 52*, 37-60.

Blackburn, H. A. (2014). *A mixed methods study: Assessing and understanding technology pedagogy and content knowledge among college level teaching faculty (doctoral dissertation).* Available from ProQuest Dissertations & Theses Full Text: The Humanities and Social Sciences Collection. https://search.proquest.com/docview/1562250625

Blömeke, S. (2000). *Medienpädagogische Kompetenz. Theoretische und empirische Fundierung eines zentralen Elements der Lehrerausbildung*. KoPäd-Verl.

Blömeke, S. (2003). Neue Medien in der Lehrerausbildung. Zu angemessenen (und unangemessenen) Zielen und Inhalten des Lehramtsstudiums. *MedienPädagogik: Zeitschrift für Theorie und Praxis der Medienbildung, 2003 (Occasional Papers)*, 1-29. https://doi.org/10.21240/mpaed/00/2003.01.11.X

Blömeke, S. (2017). Erwerb medienpädagogischer Kompetenz in der Lehrerausbildung. Modell der Zielqualifikation, Lernvoraussetzungen der Studierenden und Folgerungen für Struktur und Inhalte des medienpädagogischen Lehramtsstudiums. *MedienPädagogik: Zeitschrift für Theorie Und Praxis Der Medienbildung 3(3)*, 231-244. https://doi.org/10.21240/mpaed/retro/2017.07.13.X

Blömer, L., Voigt, C., & Hoppe, U. (2020). Corona-Pandemie als Treiber digitaler Hochschullehre. *DELFI 2020–Die 18.Fachtagung Bildungstechnologien der Gesellschaft für Informatik eV.*

Boekaerts, M. (1991). Subjective competence, appraisals and self-assessment. *Learning and Instruction, 1*(1), 1-17. https://doi.org/10.1016/0959-4752(91)90016-2

Bond, M., Marín, V. I., Dolch, C., Bedenlier, S., & Zawacki-Richter, O. (2018). Digital transformation in german higher education: Student and teacher perceptions and usage of digital media. *International Journal of Educational Technology in Higher Education, 15*(1), 1-20. https://doi.org/10.1186/s41239-018-0130-1

Bostancıoğlu, A., & Handley, Z. (2018). Developing and validating a questionnaire for evaluating the EFL 'Total PACKage': Technological pedagogical content knowledge (TPACK) for english as a foreign language (EFL). *Computer Assisted Language Learning, 31*(5-6), 572-598. https://doi.org/10.1080/09588221.2017.1422524

Bower, M., Dalgarno, B., Kennedy, G. E., Lee, M. J. W., & Kenney, J. (2015). Design and implementation factors in blended synchronous learning environments: Outcomes from a cross-case analysis. *Computers & Education, 86*, 1-17. https://doi.org/10.1016/j.compedu.2015.03.006

Bower, M., & Vlachopoulos, P. (2018). A critical analysis of technology-enhanced learning design frameworks. *British Journal of Educational Technology, 49*(6), 981-997. https://doi.org/10.1111/bjet.12668

Bozkurt, A. (2020). Educational technology research patterns in the realm of the digital knowledge age. *Journal of Interactive Media in Education. JiME, 2020*(1), 18. https://doi.org/10.5334/jime.570

Brandhofer, G. (2015). *Die Kompetenzen der Lehrenden an Schulen im Umgang mit digitalen Medien und die Wechselwirkungen zwischen Lehrtheorien und mediendidaktischem Handeln* [Doctoral Disseration, Universität Dresden]. Saechsische Landesbibliothek- Staats- und Universitaetsbibliothek Dresden.

Brandhofer, G., Kohl, A., Miglbauer, M., & Nárosy, T. (2016). digi.kompP – Digitale Kompetenzen für Lehrende: Das digi.kompP-Modell im internationalen Vergleich und in der Praxis der österreichischen Pädagoginnen- und Pädagogenbildung. *Open Online Journal for Research and Education, 6*, 38-51.

Bratengeyer, E., Steinbacher, H., & Friesenbichler, M. (2016). *Die österreichische Hochschul-E-Learning-Landschaft*. BoD - Books on Demand.

Breinbauer, A., & Schiessl-Foggensteiner, E. (2021). Vom Krisenmodus zum agil-stabilen Management: Wie Corona die Lehre an Hochschulen verändert hat und verändern wird. In U. Dittler & C. Kreidl (Eds.), *Wie Corona die Hochschullehre verändert* (pp. 375-391). Springer.

Brown, M., McCormack, M., Reeves, J., Brooks, C. D., Grajek, S., Alexander, B., Bali, M., Bulger, S., Dark, S., Engelbert, N., Gannon, K., Gauthier, A., Gibson, D., Gibson, R., Lundin, B., Veletsianos, G., & Weber, N. (2020). *2020 EDUCAUSE horizon report, teaching and learning edition*. EDUCAUSE.

Brown, V. S., Lewis, D., & Toussaint, M. (2018). Students' perceptions of quality across four course development models. *Online Learning, 22*(2), 173-196. https://doi.org/10.24059/olj.v22i2.1213

Bundes-Verfassungsgesetz (1999). *StF: BGBl. nr. 1/1930 (WV) idF BGBl. I nr. 194/1999 (DFB)*

Butler, D., Leahy, M., Hallissy, M., & Brown, M. (2017). Different strokes for different folks: Scaling a blended model of teacher professional learning. *Interactive Technology and Smart Education, 14*(3), 230-245. https://doi.org/10.1108/ITSE-01-2017-0011

Caravias, V. (2015). Literature review in conceptions and approaches to teaching using blended learning. *International Journal of Innovation in the Digital Economy, 6*(3), 46-73. https://doi.org/10.4018/ijide.2015070104

Castéra, J., Marre, C. C., Yok, M. C. K., Sherab, K., Impedovo, M. A., Sarapuu, T., Pedregosa, A. D., Malik, S. K., & Armand, H. (2020). Self-reported TPACK of teacher educators across six countries in asia and europe. *Education and Information Technologies, 25*(4), 3003-3019. https://doi.org/10.1007/s10639-020-10106-6

Çetinkaya, M. (2016). Design of personalized blended learning environments based on web-assisted modelling in science education. *International Journal of Evaluation and Research in Education, 5*(4), 323-330. https://doi.org/10.11591/ijere.v5i4.5960

Chai, C. S., & Koh, J. H. L. (2017). Changing teachers' TPACK and design beliefs through the scaffolded TPACK lesson design model (STLDM). *Learning: Research and Practice, 3*(2), 114-129. https://doi.org/10.1080/23735082.2017.1360506

Chai, C. S., Koh, J. H. L., & Teo, Y. H. (2019). Enhancing and modeling teachers' design beliefs and efficacy of technological pedagogical content knowledge for 21st century quality learning. *Journal of Educational Computing Research, 57*(2), 360-384. https://doi.org/10.1177/0735633117752453

Chai, C. S., Koh, J. H. L., & Tsai, C. (2013). A review of technological pedagogical content knowledge. *Journal of Educational Technology & Society, 16*(2), 31-51.

Chai, C. S., Koh, J. H. L., & Tsai, C. (2016). A review of the quantitative measures of technological pedagogical content knowledge (TPACK). In P. Mishra, M. C. Herring & M. J. Koehler (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educators* (pp. 87-106). Routledge. https://doi.org/10.4324/9781315771328-13

Chai, C. S., Koh, J. H. L., Tsai, C., & Tan, L. L. W. (2011). Modeling primary school pre-service teachers' technological pedagogical content knowledge (TPACK) for meaningful learning with information and communication technology (ICT). *Computers & Education, 57*(1), 1184-1193. https://doi.org/10.1016/j.compedu.2011.01.007

Chai, C. S., Ng, E. M., Li, W., Hong, H., & Koh, J. H. L. (2013). Validating and modelling technological pedagogical content knowledge framework among asian preservice teachers. *Australasian Journal of Educational Technology, 29*(1), 41-53. https://doi.org/10.14742/ajet.174

Chai, C. S., Tan, L., Deng, F., & Koh, J. H. L. (2017). Examining pre-service teachers' design capacities for web-based 21st century new culture of learning. *Australasian Journal of Educational Technology, 1*(33), 1-20. https://doi.org/10.14742/ajet.3013

Chen, L. (2016). A model for effective online instructional design. *Literacy Information and Computer Education Journal, 7*(2). https://doi.org/10.20533/licej.2040.2589.2016.0304

Cheng, S., & Xie, K. (2018). The relations among teacher value beliefs, personal characteristics, and TPACK in intervention and non-intervention settings. *Teaching and Teacher Education, 74*, 98-113. https://doi.org/10.1016/j.tate.2018.04.014

Chukwuemeka, E. J., & Iscioglu, E. (2016). An examination of lecturers' technological pedagogical content knowledge perceptions at the faculty of education in EMU in cyprus. *Croatian Journal of Education, 18*(4), 999-1034. https://doi.org/10.15516/cje.v18i4.1845

Churchill, D. (2007). Towards a useful classification of learning objects. *Educational Technology Research and Development, 55*(5), 479-497. https://doi.org/10.1007/s11423-006-9000-y

Cleary, T. J. (2018). *The self-regulated learning guide: Teaching students to think in the language of strategies*. Routledge. https://doi.org/10.4324/9781315693378

Cohen, J. (2009). *Statistical power analysis for the behavioral sciences* (2nd ed.). Psychology Press.

Cohen, S., & Sabag, Z. (2020). The influence of corona epidemic on teaching methods of higher education institutions in israel. *Journal of Research in Higher Education, 4*(1), 44-71. https://doi.org/10.24193/JRHE.2020.1.4

Crawford, J., Butler-Henderson, K., Rudolph, J., & Glowatz, M. (2020). COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *Journal of Applied Learning & Teaching, 3*(1), 9-28. https://doi.org/10.37074/jalt.2020.3.1.7

Cowan, N. (2014). Working Memory Underpins Cognitive Development, Learning, and Education. Educational Psychology Review, 26(2), 197-223. https://doi.org/10.1007/s10648-013-9246-y

Crompton, H. (2017). *ISTE standards for educators: A guide for teachers and other professionals*. International Society for Technology in Education.

Cronje, J. (2016). Learning technology in higher education. In N. J. Rushby & D. W. Surry (Eds.), *The wiley handbook of learning technology* (1st ed., pp. 131-144). Wiley Blackwell. https://doi.org/10.1002/9781118736494

Croxall, B. (2013). *Digital pedagogy? A digital pedagogy unconference.* https://www.briancroxall.net/digitalpedagogy/what-is-digital-pedagogy/

Cubeles, A., & Riu, D. (2018). The effective integration of ICTs in universities: The role of knowledge and academic experience of professors. *Technology, Pedagogy and Education, 27*(3), 339-349. https://doi.org/10.1080/1475939x.2018.1457978

D'Annunzio-Green, N., & Ramdhony, A. (2019). It's not what you do; it's the way that you do it. *International Journal of Contemporary Hospitality Management, 31*(10), 3992-4020. https://doi.org/10.1108/IJCHM-11-2018-0905

Dao, D. V. (2015). Social media classification scheme in online teaching and learning activities: A consideration for educators. *International Journal of Education and Social Science, 4*(2), 85-94.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 982-1003. https://doi.org/10.1287/mnsc.35.8.982

De Castell, S., Bryson, M., & Jenson, J. (2002). Object lessons: Towards an educational theory of technology. *First Monday, 7*(1). https://doi.org/10.5210/fm.v7i1.923

De Jong, T. (2010). Cognitive load theory, educational research, and instructional design: Some food for thought. *Instructional Science, 38*(2), 105-134. https://doi.org/10.1007/s11251-009-9110-0

Deci, E. L., & Ryan, R. M. (1993). Die Selbstbestimmungstheorie der Motivation und ihre Bedeutung für die Pädagogik. *Zeitschrift für Pädagogik, 39*(2), 223-238. https://doi.org/0111-pedocs-111739

Delere, M. (2020). Konzepte medienpädagogischer Kompetenz von Lehramtsstudierenden in deutschsprachigen und internationalen Studien – ein systematisches Literaturreview. *Medienimpulse, 58*(2). https://doi.org/10.21243/mi-02-20-16

Deubel, P. (2003). An investigation of behaviorist and cognitive approaches to instructional multimedia design. *Journal of Educational Multimedia and Hypermedia, 12*(1), 63-90.

Drysdale, J. S., Graham, C. R., Spring, K. J., & Halverson, L. R. (2013). An analysis of research trends in dissertations and theses studying blended learning. *The Internet and Higher Education, 17*, 90-100. https://doi.org/10.1016/j.iheduc.2012.11.003

Dziuban, C., Hartman, J., Cavanagh, T. B., & Moskal, P. D. (2011). Blended courses as drivers of institutional transformation. In A. Kitchenham (Ed.), *Blended learning across disciplines: Models for implementation* (pp. 17-37). IGI Global. https://doi.org/10.4018/978-1-60960-479-0.ch002

Ebner, M., Schön, S., Braun, C., Ebner, M., Grigoriadis, Y., Haas, M., Leitner, P., & Taraghi, B. (2020). COVID-19 epidemic as E-learning boost? Chronological development and effects at an austrian university against the background of the concept of "e-learning readiness". *Future Internet, 12*(6), 94. https://doi.org/10.3390/fi12060094

Emerson, R. M., Fretz, R. I., & Shaw, L. L. (1995). Processing fieldnotes: Coding and memoing. In R. M. Emerson, R. I. Fretz & L. L. Shaw (Eds.), *Writing ethnographic fieldnotes* (pp. 142-168). Univ. of Chicago Press.

Endberg, M. (2019). *Professionswissen von Lehrpersonen der Sekundarstufe I zum Einsatz digitaler Medien im Unterricht. Eine Untersuchung auf Basis einer repräsentativen Lehrerbefragung*. Waxmann.

Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 26*(2), 43-71. https://doi.org/10.1002/piq.21143

Eun, B. (2018). Adopting a stance: Bandura and vygotsky on professional development. *Research in Education, 105*(1), 74-88. https://doi.org/10.1177/0034523718793431

European Comission. (2006). *Recommendation of the european parliament and of the council of 18 december 2006 on key competences for lifelong learning (2006/962/EC)*. European Parliament, Council of the European Union.

European Commission. (2019). *2nd survey of schools: ICT in education*. Publications Office.

Fabian, K., Clayes, E., & Kelly, L. (2019). Putting design into practice: An investigation of TPACK scores of lecturers in a networked institution. *Research in Learning Technology, 27.* https://doi.org/10.25304/rlt.v27.2296

Fachhochschul-Studiengesetz – FHStG. (1993). *BGBl. Nr. 340/1993 vom 28. Mai 1993.* https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10009895

Ferrari, A. (2012). *Digital competence in practice: An analysis of frameworks. JRC technical reports*. Institute for Prospective Technological Studies, European Commission.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Addison-Wesley.

García-Morales, V. J., Garrido-Moreno, A., & Martín-Rojas, R. (2021). The transformation of higher education after the COVID disruption: Emerging challenges in an online learning scenario. *Frontiers in Psychology, 12*, 616059. https://doi.org/10.3389/fpsyg.2021.616059

Garrison, D. R. (2009). Blended learning as a transformative design approach. In P. Rogers (Ed.), *Encyclopedia of distance learning* (2nd ed., pp. 200-204). IGI Global. https://doi.org/10.4018/978-1-60566-198-8

Garrison, D. R., Anderson, T., & Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2*(2-3), 87-105. https://doi.org/10.1016/s1096-7516(00)00016-6

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education, 7*(2), 95-105. https://doi.org/10.1016/j.iheduc.2004.02.001

Gerjets, P., Scheiter, K., & Cierniak, G. (2009). The scientific value of cognitive load theory: A research agenda based on the structuralist view of theories. *Educational Psychology Review, 21*(1), 43-54. https://doi.org/110.1007/s10648-008-9096-1

Grafe, S. (2011). "Media literacy" und "media (literacy) education" in den USA - ein Brückenschlag über den Atlantik. *MedienPädagogik, 20*, 59-80.

Graham, C. R. (2005). Blended learning systems: Definition, current trends and future directions. In C. J. Bonk, C. R. Graham, J. Cross & M. G. Moore (Eds.), *The handbook of blended learning* (pp. 3–21). Peiffer.

Graham, C. R. (2011). Theoretical considerations for understanding technological pedagogical content knowledge (TPACK). *Computers & Education, 57*(3), 1953-1960. https://doi.org/10.1016/j.compedu.2011.04.010

Graham, C. R., Burgoyne, N., Cantrell, P., Smith, L., Clair, L. S., & Harris, R. (2009). TPACK development in science teaching: Measuring the TPACK confidence of inservice science teachers. *TechTrends, 53*(5), 70-79. https://doi.org/10.1007/s11528-009-0328-0

Graham, C. R., Woodfield, W., & Harrison, J. B. (2013). A framework for institutional adoption and implementation of blended learning in higher education. *The Internet and Higher Education, 18*, 4-14. https://doi.org/10.1016/j.iheduc.2012.09.003

Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. *British Journal of Educational Technology, 50*(5), 2572-2593. https://doi.org/10.1111/bjet.12864

Green, C., Mynhier, L., Banfill, J., Edwards, P., Kim, J., & Desjardins, R. (2021). Preparing education for the crises of tomorrow: A framework for adaptability. *International Review of Education, 66*(5-6), 857-23. https://doi.org/10.1007/s11159-020-09878-3

Greenhow, C., Lewin, C., & Staudt Willet, K. B. (2021). The educational response to covid-19 across two countries: A critical examination of initial digital pedagogy adoption. *Technology, Pedagogy and Education, 30*(1), 7-25. https://doi.org/10.1080/1475939X.2020.1866654

Guo, R. X., Dobson, T., & Petrina, S. (2008). Digital natives, digital immigrants: An analysis of age and ict competency in teacher education. *Journal of Educational Computing Research, 38*(3), 235-254. https://doi.org/10.2190/ec.38.3.a

Gysbers, A. (2008). *Lehrer, Medien, Kompetenz. Eine empirische Untersuchung zur medienpädagogischen Kompetenz und Performanz niedersächsischer Lehrkräfte*. Vistas.

Hack, G. (2016). An instructional design model for blended higher education. *Journal of Learning and Teaching in Digital Age, 1*(2), 2-9.

Hadwin, A. F., Järvelä, S., & Miller, M. (2011). Self-regulated, co-regulated, and socially shared regulation of learning. In B. J. Zimmerman & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 65-84). Routledge. https://doi.org/10.4324/9780203839010.ch5

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage Learning, EMEA.

Halverson, L. R., Graham, C. R., Spring, K. J., & Drysdale, J. S. (2012). An analysis of high impact scholarship and publication trends in blended learning. *Distance Education, 33*(3), 381-413. https://doi.org/10.1080/01587919.2012.723166

Halverson, L. R., Graham, C. R., Spring, K. J., Drysdale, J. S., & Henrie, C. R. (2014). A thematic analysis of the most highly cited scholarship in the first decade of blended learning research. *The Internet and Higher Education, 20*, 20-34. https://doi.org/10.1016/j.iheduc.2013.09.004

Harasim, L. (2017). *Learning theory and online technologies* (2nd ed.). Routledge. https://doi.org/10.4324/9781315716831

Harris, J., Phillips, M., Koehler, M. J., & Rosenberg, J. M. (2017). TPCK/TPACK research and development: Past, present, and future directions. *Australasian Journal of Educational Technology, 33*(3), i-viii. https://doi.org/10.14742/ajet.3907

Harris, J., & Wildman, A. (2019, November 10). TPACK newsletter issue #42: November 2019 [electronic mailing list message]. http://bit.ly/TPACKNewslettersArchive

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. Routledge. https://doi.org/110.4324/9780203887332

Hauser, W. (2019). *FHStG Kurzkommentar Fachhochschul-Studiengesetz*. Verlag Österreich GmbH.

Hauser, W., & Schweighofer, C. (2017). *Großkommentar FHStG*. Verlag Österreich GmbH.

Heinen, R., & Kerres, M. (2015). *Individuell fördern mit digitalen Medien. Handlungsfelder für die systematische, lernförderliche Integration digitaler Medien in Schule und Unterricht*. Verl. Bertelsmann-Stiftung.

Hemingway, P., & Brereton, N. (2009). What is a systematic review? *Hayward Medical Communications, 2*, 1-8.

Herring, M. C., Meacham, S., & Mourlam, D. (2016). TPACK development in higher education. In M. C. Herring, M. J. Koehler & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educators* (pp. 207-224). Routledge.

Herzig, B. (2007). Medienpädagogik als Element professioneller Lehrerausbildung. In W. Sesink, M. Kerres & H. Moser (Eds.), *Medienpädagogik - Standortbestimmung einer erziehungswissenschaftlichen Disziplin* (pp. 283-297). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-90544-0_14

Herzig, B., & Martin, A. (2017). Lehrerbildung in der digitalen Welt. Konzeptionelle und empirische Aspekte. In S. Ladel, J. Knopf & A. Weinberger (Eds.), *Digitalisierung und Bildung* (pp. 89-113). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-18333-2_6

Herzig, B., Martin, A., Schaper, N., & Ossenschmidt, D. (2015). Modellierung und Messung medienpädagogischer Kompetenz. In B. Koch-Priewe, A. Köker, J. Seifried & E. Wuttke (Eds.), *Kompetenzerwerb an Hochschulen: Modellierung und Messung. Zur Professionalisierung angehender Lehrerinnen und Lehrer sowie frühpädagogischer Fachkräfte* (pp. 153-177). Klinkhardt.

Herzig, B., Schaper, N., Martin, A., & Osssenschmidt, D. (2015). *Verbund: M³K - Modellierung und Messung medienpädagogischer Kompetenz. Teilprojekt: Medienerzieherische und mediendidaktische Facetten und handlungsleitende Einstellungen. Schlussbericht : Berichtszeitraum: 01.06.2012-30.09.2015.* Universität Paderborn. https://doi.org/10.2314/gbv:870179926

Hew, K. F., Lan, M., Tang, Y., Jia, C., & Lo, C. K. (2019). Where is the "theory" within the field of educational technology research? *British Journal of Educational Technology, 50*(3), 956-971. https://doi.org/10.1111/bjet.12770

Hinkelman, D. (2018). *Blending technologies in second language classrooms* (2nd ed.). Palgrave Macmillan.

Hlynka, D., & Jacobsen, M. (2010). What is educational technology, anyway? A commentary on the new AECT definition of the field. *Canadian Journal of Learning and Technology, 35*(2). https://doi.org/10.21432/t2n88p

Ho, W. Y. (2017). A review of blended synchronous learning. *International Journal of Social Media and Interactive Learning Environments, 5*(4), 278. https://doi.org/10.1504/IJSMILE.2017.10012111

Hoch, A. (2020). *Die Entwicklung des technologisch-pädagogischen Inhaltswissen (TPACK) bei Lehramtsstudierenden im Bachelorstudium Primarstufe an der PH Wien [Unpublished master thesis].* Fachhochschule Burgenland.

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *Educause Review Online.* https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning

Howell, J. (2012). *Teaching with ICT: Digital pedagogies for collaboration and creativity*. Oxford University Press.

Hrastinski, S. (2008). Asynchronous and synchronous E-learning. *EDUCAUSE Quarterly, 31*(4), 51-55.

Hsu, C. Y., Liang, J. C., Chai, C. S., & Tsai, C. C. (2013). Exploring preschool teachers' technological pedagogical content knowledge of educational games. *Journal of Educational Computing Research, 49*(4), 461-479. https://doi.org/10.2190/ec.49.4.c

Huang, R., Ma, D., & Zhang, H. (2008). Towards a design theory of blended learning curriculum. In J. Fong, R. Kwan & F. L. Wang (Eds.), *Hybrid learning and education: First international conference, ICHL 2008* (pp. 66-78). Springer. https://doi.org/10.1007/978-3-540-85170-7_6

IBM Corp. (2019). IBM SPSS Statistics for Windows, Version 26.0. IBM Corp.

Ivankova, N. V., Creswell, J. W., & Stick, S. L. (2006). Using mixed-methods sequential explanatory design: From theory to practice. *Field Methods, 18*(1), 3-20. https://doi.org/10.1177/1525822X05282260

Ivers, K. S., & Barron, A. E. (2006). *Multimedia projects in education: Designing, producing, and assessing* (3rd ed.). Libraries Unlimited.

Jang, S., & Tsai, M. (2012). Exploring the TPACK of taiwanese elementary mathematics and science teachers with respect to use of interactive whiteboards. *Computers and Education, 59*(2), 327-338. https://doi.org/10.1016/j.compedu.2012.02.003

Jang, S., & Tsai, M. (2013). Exploring the TPACK of taiwanese secondary school science teachers using a new contextualized TPACK model. *Australasian Journal of Educational Technology, 29*(4), 566-580. https://doi.org/10.14742/ajet.282

Januszewski, A., & Molenda, M. (2008). *Educational technology: A definition with commentary*. Erlbaum. https://doi.org/10.4324/9780203054000

Jonassen, D. H. (1991). Evaluating constructivistic learning. *Educational Technology, 31*(9), 28-33.

Jones, C., & Czerniewicz, L. (2011). Theory in learning technology. *Research in Learning Technology, 19*(3), 173-177. https://doi.org/10.1080/21567069.2011.632491

Joo, Y. J., Park, S., & Lim, E. (2018). Factors influencing preservice teachers’ intention to use technology: TPACK, teacher self-efficacy, and technology acceptance model. *Educational Technology & Society, 21*(3), 48-59.

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of social media. *Business Horizons, 53*, 59-68. https://doi.org/10.1016/j.bushor.2009.09.003

Keller, J. M. (1987). Development and use of the ARCS model of instructional design. *Journal of Instructional Development, 10*(3), 2-10. https://doi.org/10.1007/bf02905780

Kennedy, J. (2015). Using TPCK as a scaffold to self-assess the novice online teaching experience. *Distance Education, 36*(1), 148-154. https://doi.org/10.1080/01587919.2015.1019964

Keplinger, M. (2018). *2018 Statistisches Taschenbuch*. Bundesministeriums für Bildung, Wissenschaft und Forschung.

Kiendl-Wendner, D., Pollinger, M., & Egger, R. (Eds.). (2014). *Hochschuldidaktische Weiterbildung an Fachhochschulen: Durchführung - Ergebnisse - Perspektiven*. Springer. https://doi.org/10.1007/978-3-658-01497-1

Kimmons, R. (2020). Current trends (and missing links) in educational technology research and practice. *TechTrends, 64*, 803-809. https://doi.org/10.1007/s11528-020-00549-6

Kintu, M. J., Zhu, C., & Kagambe, E. (2017). Blended learning effectiveness: The relationship between student characteristics, design features and outcomes. *International Journal of Educational Technology in Higher Education, 14*(1), 1-20. https://doi.org/10.1186/s41239-017-0043-4

Kirkwood, A. (2015). Teaching and learning with technology in higher education: Blended and distance education needs ‘joined-up thinking’ rather than technological determinism. *Open Learning, 29*(3), 206-221. https://doi.org/10.1080/02680513.2015.1009884

Kirkwood, A., & Price, L. (2013). Missing: Evidence of a scholarly approach to teaching and learning with technology in higher education. *Teaching in Higher Education, 18*(3), 327-337. https://doi.org/10.1080/13562517.2013.773419

Kirschner, P. A. (2015). Do we need teachers as designers of technology enhanced learning? *Instructional Science, 43*(2), 309-322. https://doi.org/10.1007/s11251-015-9346-9

Kivunja, C. (2013). Embedding digital pedagogy in pre-service higher education to better prepare teachers for the digital generation. *International Journal of Higher Education, 2*(4). https://doi.org/10.5430/ijhe.v2n4p131

Kizito, R. N. (2016). Connectivism in learning activity design: Implications for pedagogically-based technology adoption in african higher education contexts. *International Review of Research in Open and Distributed Learning, 17*(2), 19-39. https://doi.org/10.19173/irrodl.v17i2.2217

Koehler, M. J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research, 32*(2), 131-152. https://doi.org/10.2190/0EW7-01WB-BKHL-QDYV

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education, 9*(1), 60-70.

Koh, J. H. L., Chai, C. S., Hong, H., & Tsai, C. (2015). A survey to examine teachers' perceptions of design dispositions, lesson design practices, and their relationships with technological pedagogical content knowledge (TPACK). *Asia-Pacific Journal of Teacher Education, 43*(5), 378-391. https://doi.org/10.1080/1359866X.2014.941280

Koh, J. H. L., Chai, C. S., & Lim, W. Y. (2017). Teacher professional development for TPACK-21CL: Effects on teacher ICT integration and student outcomes. *Journal of Educational Computing Research, 55*(2), 172-196. https://doi.org/10.1177/0735633116656848

Koh, J. H. L., Chai, C. S., & Tsai, C. C. (2010). Examining the technological pedagogical content knowledge of singapore pre-service teachers with a large-scale survey. *Journal of Computer Assisted Learning, 26*(6), 563-573. https://doi.org/10.1111/j.1365-2729.2010.00372.x

Koh, J. H. L., Chai, C. S., & Tsai, C. (2013). Examining practicing teachers' perceptions of technological pedagogical content knowledge (TPACK) pathways: A structural equation modeling approach. *Instructional Science, 41*(4), 793-809. https://doi.org/10.1007/s11251-012-9249-y

Krause, K., McEwan, C., & Blinco, K. (2009). E-learning and the first year experience: A framework for best practice. Paper presented at the *Educause Australasia Conference,* 1-13.

Krauskopf, K., Foulger, T. S., & Williams, M. K. (2018). Prompting teachers' reflection of their professional knowledge. A proof-of-concept study of the graphic assessment of TPACK instrument. *Teacher Development, 22*(2), 153-174. https://doi.org/10.1080/13664530.2017.1367717

Kuckartz, U. (2018). *Qualitative Inhaltsanalyse. Methoden, Praxis, Computerunterstützung* (4. ed.). Beltz Juventa.

Kushner Benson, S. N., & Ward, C. L. (2013). Teaching with technology: Using TPACK to understand teaching expertise in online higher education. *Journal of Educational Computing Research, 48*(2), 153-172. https://doi.org/10.2190/EC.48.2.c

Lamnek, S., & Krell, C. (2016). *Qualitative Sozialforschung* (6. ed.). Beltz.

Laurillard, D. (2002). *Rethinking university teaching: A conversational framework for the effective use of learning technologies* (2nd ed.). Taylor & Francis.

Law, N. (2009). Mathematics and science teachers' pedagogical orientations and their use of ICT in teaching. *Education and Information Technologies, 14*(4), 309-323. https://doi.org/10.1007/s10639-009-9094-z

Lee, M., & Tsai, C. (2010). Exploring teachers' perceived self efficacy and technological pedagogical content knowledge with respect to educational use of the world wide web. *Instructional Science, 38*(1), 1-21. https://doi.org/10.1007/s11251-008-9075-4

Leitner, E. (2004). Die österreichischen Fachhochschulen: Entwicklung und Strukturen eines marktorientierten Hochschulsektors. *Beiträge zur Hochschulforschung, 26*(4), 94-113.

Liao, H., & Wang, Y. (2008). Applying the ARCS motivation model in technological and vocational education. *Contemporary Issues in Education Research (CIER), 1*(2), 53-58.

Limarutti, A., Flaschberger, S. S., & Mir, E. (2021). Wo steht mir der Kopf? – Herausforderungen von berufsbegleitend Studierenden während der COVID-19-Pandemie. *HeilberufeSCIENCE, 12*(1-2), 39-47. https://doi.org/10.1007/s16024-021-00351-1

Lin, T., Tsai, C., Chai, C. S., & Lee, M. (2013). Identifying science teachers' perceptions of technological pedagogical and content knowledge (TPACK). *Journal of Science Education and Technology, 22*(3), 325-336. https://doi.org/10.1007/s10956-012-9396-6

Lorenz, R., Bos, W., Endberg, M., Eickelmann, B., Grafe, S., & Vahrenhold, J. (2017). *Schule digital - der Länderindikator 2017*. Waxmann.

Loyens, S. M. M., & Gijbels, D. (2008). Understanding the effects of constructivist learning environments: Introducing a multi-directional approach. *Instructional Science, 36*(5-6), 351-357. https://doi.org/10.1007/s11251-008-9059-4

Lye, L. T. (2013). Opportunities and challenges faced by private higher education institution using the TPACK model in malaysia. *Procedia, Social and Behavioral Sciences, 91*, 294-305. https://doi.org/0.1016/j.sbspro.2013.08.426

Mahrer, H. (2017). *Beantwortung der Parlamentarischen Anfrage zur Personalstruktur der Fachhochschulen – beantwortet durch 12456/AB, 12457/AB, 12458/AB, 12459/AB, 12460/AB, 12461/AB, 12462/AB, 12463/AB, 12464/AB, 12465/AB, 12466/AB, 12467/AB, 12468/AB, 12469/AB, 12470/AB, 12471/AB, 12472/AB, 12473/AB, 12474/AB, 12475/AB, 12476/AB* . Parlamentsdirektion. https://www.parlament.gv.at/PAKT/JMAB/index.shtml?jsMode=&xdocumentUri=&filterJq=&view=&NRBR=NR&anwenden=Anwenden&GP=XXV&JMAB=AB_ABPR_ABM&VHG2=ABMIN&MIN=84308&SUCH=Personalstruktur&listeId=105&FBEZ=FP_005

Malhotra, Y., Galletta, D. F., & Kirsch, L. J. (2008). How endogenous motivations influence user intentions: Beyond the dichotomy of extrinsic and intrinsic user motivations. *Journal of Management Information Systems, 25*(1), 267-300.

Manca, S., & Ranieri, M. (2016). Facebook and the others. Potentials and obstacles of social media for teaching in higher education. *Computers and Education, 95*, 216-230. https://doi.org/10.1016/j.compedu.2016.01.012

Marshall, S. (2012). E-learning and higher education: Understanding and supporting organisational change in new zealand. *Journal of Open, Flexible, and Distance Learning, 16*(1), 141-145.

Mascha, G., & Diem, H. (2012). *Fachhochschul-Studiengesetz (FHStG)*. Bundesministerium für Wissenschaft und Forschung.

Mayer, P., & Girwidz, R. (2019). Physics teachers' acceptance of multimedia Applications—Adaptation of the technology acceptance model to investigate the influence of TPACK on physics teachers' acceptance behavior of multimedia applications. Paper presented at the *Frontiers in Education, 4*. https://doi.org/10.3389/feduc.2019.00073

Mayer, R. E. (2014). Cognitive theory of multimedia learning. *The cambridge handbook of multimedia learning* (pp. 43-71). Cambridge University Press. https://doi.org/10.1017/CBO9781139547369.005

Mayrberger, K. (2012). Medienpädagogische Kompetenz im Wandel - Vorschlag zur Gestaltung des Übergangs in der Lehrerbildung am Beispiel mediendidaktischer Kompetenz. In R. Schulz-Zander, B. Eickelmann, H. Moser, H. Niesyto & P. Grell (Eds.), *Jahrbuch Medienpädagogik 9* (pp. 389-412). Springer VS. https://doi.org/10.1007/978-3-531-94219-3_17

Mayrberger, K., & Kumar, S. (2014). Mediendidaktik und Educational Technology. Zwei Perspektiven auf die Gestaltung von Lernumgebungen mit digitalen Medien. In K. Rummler (Ed.), *Lernräume gestalten - Bildungskontexte vielfältig denken* (pp. 44-55). Waxmann.

Mayring, P. (2015). *Qualitative Inhaltsanalyse: Grundlagen und Techniken* (12. ed.). Beltz.

McGee, P., & Reis, A. (2012). Blended course design: A synthesis of best practices. *Online Learning, 16*(4), 7. https://doi.org/10.24059/olj.v16i4.239

McMillan, J. H. (2016). *Fundamentals of educational research* (7th ed.). Pearson.

Meier, R. (2011). *Praxis E-Learning*. Norderstedt: GABAL.

Mercader, C., & Gairín, J. (2020). University teachers' perception of barriers to the use of digital technologies: The importance of the academic discipline. *International Journal of Educational Technology in Higher Education, 17*(1), 1-14. https://doi.org/10.1186/s41239-020-0182-x

Merriënboer, J. J. G., & Ayres, P. (2005). Research on cognitive load theory and its design implications for e-learning. *Educational Technology Research and Development, 53*(3), 5-13. https://doi.org/10.1007/bf02504793

Mertler, C. A., & Reinhart, R. V. (2017). *Advanced and multivariate statistical methods: Practical application and interpretation* (6th ed.). Routledge. https://doi.org/10.4324/9781315266978

Meyer, K. A., & Murrell, V. S. (2014). A national study of theories and their importance for faculty development for online teaching. *Online Journal of Distance Learning Administration, 17*(2).

Mierau, J. (2020). Lernen in digitalen Medien in der Lehramtsausbildung im Unterrichtsfach Sport. In B. Fischer & A. Paul (Eds.), *Lehren und Lernen mit und in digitalen Medien im Sport* (pp. 247-262). Wiesbaden: Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-25524-4_13

Mishra, P. (2019). Considering contextual knowledge: The TPACK diagram gets an upgrade. *Journal of Digital Learning in Teacher Education, 35*(2), 76-78. https://doi.org/10.1080/21532974.2019.1588611

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Molenda, M. (2003). In search of the elusive ADDIE model. *Performance Improvement, 42*(5), 34-36. https://doi.org/10.1002/pfi.4930420508

Moreno, R. (2006). Does the modality principle hold for different media? A test of the method-affects-learning hypothesis. *Journal of Computer Assisted Learning, 22*(3), 149-158.

Moreno, R., & Mayer, R. (2007). Interactive multimodal learning environments: Special issue on interactive learning environments: Contemporary issues and trends. *Educational Psychology Review, 19*(3), 309-326. https://doi.org/10.1007/s10648-007-9047-2

Morrison, A. D., Clemens, M., & Ribble, E. A. M. (2015). Characteristics of effective multimedia for teaching: Applying cognitive theories of multimedia learning to complex content. Paper presented at the *Teaching and Learning with Technology Symposium, Denver, Colorado,* 1-12.

Morrison, G. R., Ross, S., Morrison, J. R., & Kalman, H. K. (2019). *Designing effective instruction* (8th ed.). Wiley.

Mozelius, P., & Hettiarachchi, E. (2017). Critical factors for implementing blended learning in higher education. *International Journal of Information and Communication Technologies in Education, 6*(2), 37-51. https://doi.org/10.1515/ijicte-2017-0010

Mürmann, M., Wildt, B., & Wildt, J. (2016). Weiterbildung und Beratung hochschuldidaktischer Professionals – Konzepte, Erfahrungen und Perspektiven. In M. Merkt, C. Wetzel & N. Schaper (Eds.), *Professionalisierung der Hochschuldidaktik* (pp. 112-123). W. Bertelsmann Verlag.

Murphy, M. P. A. (2020). COVID-19 and emergency eLearning: Consequences of the securitization of higher education for post-pandemic pedagogy. *Contemporary Security Policy, 41*(3), 492-505. https://doi.org/10.1080/13523260.2020.1761749

Newbury, R. (2013). Student outcomes and design elements in blended learning courses. *International Journal of Technology in Teaching and Learning, 9*(2), 139-158.

Niegemann, H. M., Hessel, S., Hochscheid-Mauel, D., Aslanski, K., Deimann, M., & Kreuzberger, G. (2004). *Kompendium E-Learning*. Springer. https://doi.org/10.1007/978-3-642-18677-6

Noour, A. T., & Hubbard, N. (2015). Self-determination theory: Opportunities and challenges for blended e-learning in motivating egyptian learners. *Procedia, Social and Behavioral Sciences, 182*, 513-521. https://doi.org/10.1016/j.sbspro.2015.04.836

Nortvig, A., Petersen, A. K., & Hattesen Balle, S. (2018). A literature review of the factors influencing e-learning and blended learning in relation to learning outcome, student satisfaction and engagement. *Electronic Journal of E-Learning, 16*(1), 46-55.

Núñez, J. L., & León, J. (2015). Autonomy support in the classroom: A review from self-determination theory. *European Psychologist, 20*(4), 275.

Omodara, O. D., & Adu, E. I. (2014). Relevance of educational media and multimedia technology for effective service delivery in teaching and learning processes. *IOSR Journal of Research & Method in Education (IOSRJRME), 4*(2), 48-51. https://doi.org/10.9790/7388-04214851

Ouyang, F., & Scharber, C. (2018). Adapting the TPACK framework for online teaching within higher education. *International Journal of Online Pedagogy and Course Design (IJOPCD), 8*(1), 42-59. https://doi.org/10.4018/IJOPCD.2018010104

Owston, R. (2013). Blended learning policy and implementation: Introduction to the special issue. *The Internet and Higher Education, 18*, 1-3. https://doi.org/10.1016/j.iheduc.2013.03.002

Ozkan, S., & Koseler, R. (2009). Multi-dimensional evaluation of e-learning systems in the higher education context: An empirical investigation of a computer literacy course. Paper presented at the *39th IEEE Frontiers in Education Conference,* 1-6. https://doi.org/10.1109/FIE.2009.5350590

Pandya, B., Patterson, L., & Cho, B. (2021). Pedagogical transitions experienced by higher education faculty members – "Pre-covid to covid". *Journal of Applied Research in Higher Education, ahead-of-print* (ahead-of-print). https://doi.org/10.1108/JARHE-01-2021-0028

Park, B., Plass, J. L., & Brünken, R. (2014). Cognitive and affective processes in multimedia learning. *Learning and Instruction, 29*, 125-127. https://doi.org/10.1016/j.learninstruc.2013.05.005

Pauschenwein, J., & Schinnerl-Beikircher, I. (2021). Online-Lehre – funktioniert ja : Unterricht in Zeiten des Lockdown an der FH JOANNEUM. In U. Dittler & C. Kreidl (Eds.), *Wie Corona Die Hochschullehre Verändert: Erfahrungen und Gedanken Aus der Krise Zum Zukünftigen Einsatz Von ELearning* (pp. 159-177). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-32609-8_11

Perveen, A. (2016). Synchronous and asynchronous e-language learning: A case study of virtual university of pakistan. *Open Praxis, 8*(1), 21-39. https://doi.org/10.5944/openpraxis.8.1.212

Petermandl, M. (2009). Optimale Voraussetzungen für den Lerntransfer in berufsbegleitenden Studien. *Zeitschrift für Hochschulentwicklung, 4*(2). https://doi.org/10.3217/zfhe-4-02/01

Petko, D., & Döbeli Honegger, B. (2011). Digitale Medien in der schweizerischen Lehrerinnen- und Lehrerbildung: Hintergründe, Ansätze und Perspektiven. *Beiträge zur Lehrerbildung, 29*(2), 155-171. https://doi.org/0111-pedocs-137754

Picciano, A. G. (2009). Blending with purpose: The multimodal model. *Journal of Asynchronous Learning Networks, 13*(1), 7-18.

Pima, J., Odetayo, M., Iqbal, R., & Sedoyeka, E. (2018). A thematic review of blended learning in higher education. *International Journal of Mobile and Blended Learning (IJMBL), 10*(1), 1-11. https://doi.org/10.4018/IJMBL.2018010101

Pokhrel, S., & Chhetri, R. (2021). A literature review on impact of COVID-19 pandemic on teaching and learning. *Higher Education for the Future, 8*(1), 133-141. https://doi.org/10.1177/2347631120983481

Prestridge, S. (2012). The beliefs behind the teacher that influences their ICT practices. *Computers and Education, 58*(1), 449-458. https://doi.org/10.1016/j.compedu.2011.08.028

Radinger, R., & Sommer-Binder, G. (Eds.). (2020). *Bildung in Zahlen 2018/19 - Schlüsselindikatoren und Analysen*. Statistik Austria.

Rahrouh, M., Taleb, N., & Mohamed, E. A. (2018). Evaluating the usefulness of e-learning management system delivery in higher education. *International Journal of Economics and Business Research, 16*(2), 162-181. https://doi.org/10.1504/IJEBR.2018.094010

Rapanta, C., Botturi, L., Goodyear, P., Guàrdia, L., & Koole, M. (2020). Online university teaching during and after the covid-19 crisis: Refocusing teacher presence and learning activity. *Postdigital Science and Education, 2*, 1-23. https://doi.org/10.1007/s42438-020-00155-y

Redecker, C. (2017). *European framework for the digital competence of educators: DigCompEdu*. Publications Office of the European Union. https://doi.org/10.2760/159770

Redecker, C., & Punie, Y. (2017). *European framework for the digital competence of educators. DigCompEdu.* (No. 28775). Joint Research Centre (European Commission).

Reeve, J. (2012). *A self-determination theory perspective on student engagement*. Springer US. https://doi.org/10.1007/978-1-4614-2018-7_7

Reeves, T. C. (1998). The impact of media and technology in schools. *The Journal of Art and Design Education, 2*, 58-63.

Rienties, B., Brouwer, N., & Lygo-Baker, S. (2013). The effects of online professional development on higher education teachers' beliefs and intentions towards learning facilitation and technology. *Teaching and Teacher Education, 29*, 122-131. https://doi.org/10.1016/j.tate.2012.09.002

Riewerts, K., Paulsteiner-Doms, C., & Weiß, P. (2016). Qualifizierung für die eigene Lehrpraxis und darüber hinaus. In M. Merkt, C. Wetzel & N. Schaper (Eds.), *Professionalisierung der Hochschuldidaktik* (pp. 147-156). W. Bertelsmann Verlag.

Rodríguez Moreno, J., Agreda Montoro, M., & Ortiz Colón, A. (2019). Changes in teacher training within the TPACK model framework: A systematic review. *Sustainability, 11*(7), 1870. https://doi.org/10.3390/su11071870

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Rosenberg, J. M., & Koehler, M. J. (2015). Context and technological pedagogical content knowledge (TPACK): A systematic review. *Journal of Research on Technology in Education, 47*(3), 186-210. https://doi.org/10.1080/15391523.2015.1052663

Rudolph, M. (2017). Cognitive theory of multimedia learning. *Journal of Online Higher Education, 1*(2).

Rushby, N. J., & Surry, D. W. (2016). *The wiley handbook of learning technology* (1st ed.). Wiley Blackwell. https://doi.org/10.1002/9781118736494

Sanders, M., & George, A. (2017). Viewing the changing world of educational technology from a different perspective: Present realities, past lessons, and future possibilities. *Education and Information Technologies, 22*(6), 2915-2933. https://doi.org/10.1007/s10639-017-9604-3

Saubern, R., Henderson, M., Heinrich, E., & Redmond, P. (2020). TPACK – time to reboot? *Australasian Journal of Educational Technology, 36*(3), 1-9. https://doi.org/10.14742/ajet.6378

Schaumburg, H., & Issing, L. J. (2004). Interaktives Lernen mit Multimedia. In R. Mangold, P. Vorderer & G. Bente (Eds.), *Lehrbuch der Medienpsychologie* (pp. 717-742). Hogrefe.

Scherer, R., Tondeur, J., & Siddiq, F. (2017). On the quest for validity: Testing the factor structure and measurement invariance of the technology-dimensions in the technological, pedagogical, and content knowledge (TPACK) model. *Computers and Education, 112*, 1-17. https://doi.org/10.1016/j.compedu.2017.04.012

Schmid, M., & Petko, D. (2020). ‹Technological Pedagogical Content Knowledge› als Leitmodell medienpädagogischer Kompetenz. *MedienPädagogik, Zeitschrift MedienPädagogik 17 (Jahrbuch Medienpädagogik)*, 121-140. https://doi.org/10.21240/mpaed/jb17/2020.04.28.X

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK) the development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education, 42*(2), 123-149. https://doi.org/10.1080/15391523.2009.10782544

Schmidt-Hertha, B., Rott, K. J., Bolten, R., & Rohs, M. (2020). Messung medienpädagogischer Kompetenz von Lehrenden in der Weiterbildung. *Zeitschrift für Weiterbildungsforschung - Report, 43*(2), 313-329. https://doi.org/110.1007/s40955-020-00165-0

Schubert, B., Kern, M., Montag, T., Nauck, F., Reigber, H., Schuler, U., Voltz, R., Radbruch, L. (2021). Der Einfluss der Corona-Pandemie auf die Aus-, Fort- und Weiterbildung: Ein Erfahrungsbericht aus der Palliativversorgung. *Zeitschrift für Palliativmedizin, 22*(2), 72-76. https://doi.org/10.1055/a-1320-9194

Schunk, D. H. (2020). *Learning theories: An educational perspective* (8th ed.). Pearson.

Schweighofer, C. (2011). Der leitende Angestellte im Fachhochschul-Sektor. *Zeitschrift für Hochschulrecht, Hochschulmanagement und Hochschulpolitik, 10*(5), 156-168. https://doi.org/10.1007/s00741-011-0024-x

Scott, L. C. (2009). *Through the wicked spot: A case study of professors' experiences teaching online.* Available from ProQuest Dissertations & Theses Full Text: The Humanities and Social Sciences Collection

Serdyukov, P. (2020). Asynchronous/synchronous learning chasm. In C. M. Sistek-Chandler (Ed.), *Exploring online learning through synchronous and asynchronous instructional methods* (pp. 1-33). IGI Global. https://doi.org/10.4018/978-1-7998-1622-5

Shea, P., & Bidjerano, T. (2009). Community of inquiry as a theoretical framework to foster “epistemic engagement” and “cognitive presence” in online education. *Computers & Education, 52*(3), 543-553.

Shelton, C. (2017). Giving up technology and social media: Why university lecturers stop using technology in teaching. *Technology, Pedagogy and Education, 26*(3), 303-321. https://doi.org/10.1080/1475939x.2016.1217269

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14. https://doi.org/10.3102/0013189X015002004

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning, 1*(2), 1-13.

Sinclair, J., & Aho, A. (2018). Experts on super innovators: Understanding staff adoption of learning management systems. *Higher Education Research and Development, 37*(1), 158-172. https://doi.org/10.1080/07294360.2017.1342609

Smaldino, S. E., Lowther, D. L., Mims, C., & Russell, J. D. (2019). *Instructional technology and media for learning*. Pearson.

Smits, A., & Voogt, J. (2016). Elements of satisfactory online asynchronous teacher behaviour in higher education. *Australasian Journal of Educational Technology,* https://doi.org/10.14742/ajet.2929

Sorden, S. D. (2012). The cognitive theory of multimedia learning. *Handbook of Educational Theories, 1*(2012), 1-22.

Spante, M., Hashemi, S. S., Lundin, M., & Algers, A. (2018). Digital competence and digital literacy in higher education research: Systematic review of concept use. *Cogent Education, 5*(1), 1519143. https://doi.org/10.1080/2331186X.2018.1519143

Spector, J. M. (2016). *Foundations of educational technology*. Routledge. https://doi.org/10.4324/9781315764269

Spence, P., & Brandao, R. (2020). Critical digital pedagogies in modern languages – a tutorial collection. *Modern Languages Open, 1*(38). https://doi.org/10.3828/mlo.v0i0.343

Spencer, K. (2017). *The psychology of educational technology and instructional media*. Taylor and Francis. https://doi.org/10.4324/9781315200835

Stewart, W. H. (2021). A global crash-course in teaching and learning online: A thematic review of empirical emergency remote teaching (ERT) studies in higher education during year 1 of COVID-19. *Open Praxis, 13*(1), 89-102. https://doi.org/10.5944/openpraxis.13.1.1177

Stiller, K. D., Schworm, S., & Gruber, H. (2020). Learning with and from illustrations: Cognitive, motivational, affective, social and metacognitive processes. In D. E. Delarue & C. Wagner (Eds.), *Challenging the Iconic turn–Den Iconic Turn Neu Denken. Wilhelm Fink Verlag.*

Stosic, L. (2015). The importance of educational technology in teaching. *International Journal of Cognitive Research in Science, Engineering and Education, 3*(1), 111-114.

Strobl, B. (2020). *Einführung eines TPACK Unterrichtsmodells anhand digitalen Storytellings und Einführung von handlungsorientierter Grammatik im Englischunterricht [Unpublished master thesis].* Fachhochschule Burgenland.

Subedi, D. (2016). Explanatory sequential mixed method design as the third research community of knowledge claim. *American Journal of Educational Research, 4*(7), 570-577. https://doi.org/10.12691/education-4-7-10

Sun, P., Tsai, R. J., Finger, G., Chen, Y., & Yeh, D. (2008). What drives a successful e-learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers and Education, 50*(4), 1183-1202. https://doi.org/10.1016/j.compedu.2006.11.007

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257-285. https://doi.org/10.1016/0364-0213(88)90023-7

Sweller, J. (2016). Working memory, long-term memory, and instructional design. *Journal of Applied Research in Memory and Cognition, 5*(4), 360-367. https://doi.org/10.1016/j.jarmac.2015.12.002

Taber, K. S. (2018). The use of cronbach's alpha when developing and reporting research instruments in science education. *Res Sci Educ, 48*, 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Thompson, A. D., & Mishra, P. (2007). Editors' remarks. Breaking news: TPCK becomes TPACK. *Journal of Computing in Teacher Education, 24*(2), 38-64. https://doi.org/10.1080/10402454.2007.10784583

Tiede, J. (2020a). Editorial: Media-related educational competencies of german and US preservice teachers. *MedienPädagogik, Media-related Edu. Competencies*(Juli), 1-37. https://doi.org/10.21240/mpaed/diss.jt/2020.07.05.X

Tiede, J. (2020b). Part I: Modeling media-related educational competencies. *MedienPädagogik, Media-related Edu. Competencies* (Juli), 38-100. https://doi.org/10.21240/mpaed/diss.jt/2020.07.01.X

Tobin, T. J., & Behling, K. T. (2018). *Reach everyone, teach everyone: Universal design for learning in higher education*. West Virginia University Press.

Tondeur, J., van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: A systematic review of qualitative evidence. *Educational Technology Research and Development, 65*(3), 555-577. https://doi.org/10.1007/s11423-016-9481-2

Troidl, K., & Simon, F. (2020). Lehrveranstaltungen in Zeiten von Covid-19. *Gefässchirurgie, 25*(7), 575-578. https://doi.org/10.1007/s00772-020-00700-w

Tulodziecki, G. (1998). Entwicklung von Medienkompetenz als Erziehungs- und Bildungsaufgabe. *Pädagogische Rundschau, 52*(6), 639-709.

Tulodziecki, G., Herzig, B., & Grafe, S. (2010). *Medienbildung in Schule und Unterricht*. Klinkhardt.

UNESCO. (2012). *International standard classification of education, ISCED 2011*. UNESCO Institute for Statistics.

UNESCO. (2014). *ISCED fields of education and training 2013 (ISCED-F 2013)*. UNESCO Institute for Statistics.

UNESCO. (2018). *UNESCO ICT competency framework for teachers* (Version 3 ed.). United Nations Educational, Scientific and Cultural Organization.

United Nations. (2020). *Policy brief: Education during COVID-19 and beyond.* https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/08/sg_policy_brief_covid-19_and_education_august_2020.pdf

Väätäjä, J. O., & Ruokamo, H. (2021). Conceptualizing dimensions and a model for digital pedagogy. *Journal of Pacific Rim Psychology, 15*, 1834490921995395. https://doi.org/10.1177/1834490921995395

Vallaster, C., & Sageder, M. (2020). Verändert Covid-19 die Akzeptanz virtueller Lehrformate in der Hochschulausbildung? Implikationen für die Hochschulentwicklung. *Zeitschrift für Hochschulentwicklung, 15*(4), 281-301. https://doi.org/10.3217/zfhe-15-04/16

Valtonen, T., Sointu, E. T., Mäkitalo-Siegl, K., & Kukkonen, J. (2015). Developing a TPACK measurement instrument for 21st century pre-service teachers. *Seminar.Net, 11*(2), 87–100.

Valverde-Berrocoso, J., & Fernández-Sánchez, M. R. (2020). Instructional design in blended learning: Theoretical foundations and guidelines for practice. *Blended learning: Convergence between technology and pedagogy* (pp. 113-140). Springer International Publishing. https://doi.org/10.1007/978-3-030-45781-5_6

VanderStoep, S. W., & Johnston, D. D. (2009). *Research methods for everyday life: Blending qualitative and quantitative approaches* (1st ed.). Jossey-Bass.

VERBI Software. (2019). MAXQDA 2020 [computer software]. VERBI Software. Available from maxqda.com.

Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences, 39*(2), 273-315. https://doi.org/10.1111/j.1540-5915.2008.00192.x

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186-204. https://doi.org/10.1287/mnsc.46.2.186.11926

Voithofer, R., Nelson, M. J., Han, G., & Caines, A. (2019). Factors that influence TPACK adoption by teacher educators in the US. *Educational Technology Research and Development, 67*(6), 1427-1453. https://doi.org/10.1007/s11423-019-09652-9

Voogt, J., Fisser, P., Roblin, N. P., Tondeur, J., & van Braak, J. (2013). Technological pedagogical content knowledge - a review of the literature. *Journal of Computer Assisted Learning, 29*(2), 109-121. https://doi.org/10.1111/j.1365-2729.2012.00487.x

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wadmany, R., & Kliachko, S. (2014). The significance of digital pedagogy: Teachers' perceptions and the factors influencing their abilities as digital pedagogues. *Journal of Educational Technology, 11*(3), 22-33. https://doi.org/10.26634/jet.11.3.3007

Wadsack, I., & Kasparovsky, H. (2007). *Das österreichische Hochschulsystem*. Bundesministerium für Wissenschaft und Forschung.

Walker, R., Jenkins, M., & Voce, J. (2017). The rhetoric and reality of technology-enhanced learning developments in UK higher education: Reflections on recent UCISA research findings (2012–2016). *Interactive Learning Environments, 26*(7), 858-868. https://doi.org/10.1080/10494820.2017.1419497

Wang, W., Schmidt-Crawford, D., & Jin, Y. (2018). Preservice teachers' TPACK development: A review of literature. *Journal of Digital Learning in Teacher Education, 34*(4), 234-258. https://doi.org/10.1080/21532974.2018.1498039

Wasserkampf, A., & Kleinert, J. (2016). Organismic integration as a dynamic process: A systematic review of empirical studies on change in behavioral regulations in exercise in adults. *International Review of Sport and Exercise Psychology, 9*(1), 65-95.

Watson, W. R., & Watson, S. L. (2007). An argument for clarity: What are learning management systems, what are they not, and what should they become? *TechTrends, 51*(2), 28-34. https://doi.org/10.1007/s11528-007-0023-y

Willermark, S. (2018). Technological pedagogical and content knowledge: A review of empirical studies published from 2011 to 2016. *Journal of Educational Computing Research, 56*(3), 315-343. https://doi.org/10.1177/0735633117713114

Yaghi, H. M. (2001). Subject matter as a factor in educational computing by teachers in international settings. *Journal of Educational Computing Research, 24*(2), 139-154. https://doi.org/10.2190/9YWV-DDUL-7G4F-6QVX

Yamagata-Lynch, L. C. (2014). Blending online asynchronous and synchronous learning. *The International Review of Research in Open and Distributed Learning, 15*(2). https://doi.org/10.19173/irrodl.v15i2.1778

Yilmaz, K. (2011). The cognitive perspective on learning: Its theoretical underpinnings and implications for classroom practices. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 84*(5), 204-212.

Yurdakul, I. K., Odabasi, H. F., Kilicer, K., Coklar, A. N., Birinci, G., & Kurt, A. A. (2012). The development, validity and reliability of TPACK-deep: A technological pedagogical content knowledge scale. *Computers and Education, 58*(3), 964-977. https://doi.org/10.1016/j.compedu.2011.10.012

Zawacki-Richter, O. (2021). The current state and impact of Covid-19 on digital higher education in germany. *Human Behavior and Emerging Technologies, 3*(1), 218-226. https://doi.org/10.1002/hbe2.238

Zhang, W., & Zhu, C. (2017). Review on blended learning: Identifying the key themes and categories. *International Journal of Information and Education Technology, 7*(9), 673-678. https://doi.org/10.18178/ijiet.2017.7.9.952

Zhao, Y., Lei, J., Yan, B., Lai, C., & Tan, H. S. (2005). What makes the difference? A practical analysis of research on the effectiveness of distance education. *Teachers College Record, 107*(8), 1836-1884. https://doi.org/10.1111/j.1467-9620.2005.00544.x

Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology, 81*(3), 329-339. https://doi.org/10.1037/0022-0663.81.3.329

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13-40). Academic Press. https://doi.org/10.1016/b978-012109890-2/50031-7

# Appendix A: Questionnaire

## Questionnaire

### 1 Homepage

Dear lecturer,

This questionnaire aims to survey the current situation regarding blended learning at higher education institutions in order to improve your blended learning conditions.

ALL INFORMATION will be kept ANONYMOUS and CONFIDENTIAL.

If you would like to discuss aspects of this questionnaire, please contact me. Thank you in advance for your support!

With kind regards,

Barbara Geyer-Hayden

University of Applied Sciences Burgenland, Programme Director E-Learning and Knowledge Management (Master),
Head of Instructional Design, Campus 1, 7000 Eisenstadt, barbara.geyer-hayden@fh-burgenland.at

### 2 Demography

**What is your gender?**

- ○ Male
- ○ Female
- ○ Other

**What is your age?**

Please enter a number in the field.

**What is the highest degree you have completed?**

- ○ Secondary School Certificate or equivalent
- ○ Bachelor or equivalent
- ○ Master or equivalent
- ○ Doctoral or equivalent
- ○ Habilitation or equivalent

**What level of didactic training and further education do you have?**

**Please select one answer.**

- ○ No didactic training
- ○ 1 to 3 didactic seminars
- ○ More than 3 didactic seminars
- ○ One didactic seminar programme with certificate of completion
- ○ A didactic education

**In which field of education do you primarily teach?**

**Please select one answer.**

○ Education

○ Arts and humanities

○ Social sciences, journalism and information

○ Business, administration and law

○ Natural sciences, mathematics and statistics

○ Information and Communication Technologies

○ Engineering, manufacturing and construction

○ Agriculture, forestry, fisheries and veterinary

○ Health and welfare

○ Services

○ Generic programmes and qualifications

## 3 Higher education

**Do you work full-time or adjunct at the higher education institution?**

○ full-time

○ adjunct

**How many years have you been teaching in higher education?**

**Please fill a number in the box.**

**How many years have you been teaching in blended learning settings (a combination of online and face-to-face course units)?**

**Please fill a number in the box.**

**In which sector of Austria's higher education system do you teach?**

☐ Public university

☐ University of applied sciences

☐ Private university

☐ University college of teacher education

**In which federal states are the higher education institutions located where you teach?**

☐ Burgenland

☐ Carinthia

☐ Lower Austria

- ☐ Upper Austria
- ☐ Salzburg
- ☐ Styria
- ☐ Tyrol
- ☐ Vorarlberg
- ☐ Vienna

**4 Media**

**Please indicate the use of the following media in your lessons.**

| | Every lesson | One a week | 1-2 times a month | A few times per semester | Once a semester | Never |
|---|---|---|---|---|---|---|
| Print Media (e.g. books, textbooks, articles ...) | ○ | ○ | ○ | ○ | ○ | ○ |
| Visual and audio media (e.g. beamer, e-books, videos, podcasts ...) | ○ | ○ | ○ | ○ | ○ | ○ |
| Asynchronous web-based activities (e.g. E-Mail to students, digital task submission, online tests ...) | ○ | ○ | ○ | ○ | ○ | ○ |
| Synchronous web-based activities (e.g. Video/web conferencing with Skype, WebEx, Zoom, virtual social worlds, virtual game worlds ...) | ○ | ○ | ○ | ○ | ○ | ○ |
| Social networking sites and messengers (e.g. Facebook Messenger, Twitter, WhatsApp ...) | ○ | ○ | ○ | ○ | ○ | ○ |

**5 TPACK**

**Please select the number which most corresponds to your agreement or disagreement with each statement.**

| | Strongly disagree | Disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| I am able to use communication tools (e.g., MS Teams, Zoom, WebEx, Skype, Online-Chat ...). | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I am able to use social media (e.g., Blog, Facebook, Twitter, LinkedIn ...). | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I am able to use web-based | | | | | | | |

| | Strongly disagree | Disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| collaboration tools (e.g., Wiki, Google Docs, Etherpad ...). | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I am able to use technology to help my students to reflect on their learning strategies (e.g. Forum, Blogs as reflective journals ...). | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I am able to guide my students to construct representations of knowledge using technology (e.g. Mindmaps, online Whiteboard ...). | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I am able to use technology to guide my students to manage their own learning (e.g. card index box , OneNote, Evernote ...). | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I know about the technologies that I have to use for the research of my content area (z. B. Zotero, RefWorks, SPSS, R ...). | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I can use the software that is created specifically for my content area (e.g., e-dictionary/corpus for language; Geometric sketchpad for Maths ...). | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I can use appropriate technologies (e.g., multimedia resources, simulation) to represent my content area. | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I can design ICT-based activities to address students' misconceptions about the content knowledge (e.g. online test, online quiz ...). | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I can create self-directed learning activities of the content knowledge with appropriate ICT tools (e.g., Blog, Webquest). | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I can design inquiry activities to guide students to make sense of the content knowledge with | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

appropriate ICT tools (e.g., simulations, web-based materials).

| | Strongly disagree | Disagree | Somewhat disagree | Neither agree or disagree | Somewhat agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| I can structure activities to help students to construct different representations of the content knowledge using appropriate ICT tools (e.g., Mindmaps, Wiki). | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I can use technology to support students' self-reflection about their learning strategies for the content area (e.g. guided discussions in Forums, Social Networks as a reflection tool, h5p ...) | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I can formulate in-depth discussion topics about the content knowledge and facilitate students' online collaboration with appropriate tools (e.g., Google Sites, online Whiteboards ...). | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

## 6 LMS

**Please select the statement which most corresponds to your agreement or disagreement in regard to a learning management system (LMS, e.g. Moodle) with each statement.**

| | Every lesson | One a week | 1-2 times a month | A few times per semester | Once a semester | Never |
|---|---|---|---|---|---|---|
| I use the LMS to post announcements. | ○ | ○ | ○ | ○ | ○ | ○ |
| I use the LMS to make assignments and give feedback. | ○ | ○ | ○ | ○ | ○ | ○ |
| I use the grade book within the LMS. | ○ | ○ | ○ | ○ | ○ | ○ |
| I use the LMS to share content and teaching material. | ○ | ○ | ○ | ○ | ○ | ○ |
| I use the LMS to administer tests. | ○ | ○ | ○ | ○ | ○ | ○ |
| I use the discussion forums of the LMS. | ○ | ○ | ○ | ○ | ○ | ○ |
| I use the eBook-function of the LMS. | ○ | ○ | ○ | ○ | ○ | ○ |
| I use the calendar function of the LMS | ○ | ○ | ○ | ○ | ○ | ○ |

| | | | | | | |
|---|---|---|---|---|---|---|
| I use the LMS to provide the syllabus. | ○ | ○ | ○ | ○ | ○ | ○ |

**Please select the statement which most corresponds to your agreement or disagreement in regard to a learning management system (LMS, e.g. Moodle) with each statement.**

| | strongly disagree | moderately disagree | somewhat disagree | neutral (neither disagree nor agree) | somewhat agree | moderately agree | strongly agree |
|---|---|---|---|---|---|---|---|
| My interaction with the LMS is clear and understandable. | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Interacting with the LMS does not require a lot of my mental effort. | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I find the LMS to be easy to use. | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I find it easy to get the LMS to do what I want it to do. | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

## 7 Obstacles

**Is your use of technology in teaching and learning adversely affected by the following?**

**Please select one answer for each item.**

| | A lot | Partially | A little | Not at all | Don't know/Prefer not to say |
|---|---|---|---|---|---|
| Insufficient number of computers | ○ | ○ | ○ | ○ | ○ |
| Insufficient Internet bandwidth or speed | ○ | ○ | ○ | ○ | ○ |
| Insufficient technical support for lecturers | ○ | ○ | ○ | ○ | ○ |
| Insufficient pedagogical support for lecturers | ○ | ○ | ○ | ○ | ○ |
| Lack of adequate content/material for teaching | ○ | ○ | ○ | ○ | ○ |
| Lack of pedagogical models on how to use technology for learning | ○ | ○ | ○ | ○ | ○ |

| | A lot | Partially | A little | Not at all | Don't know/Prefer not to say |
|---|---|---|---|---|---|
| University time organisation (fixed lesson time, etc.) | ○ | ○ | ○ | ○ | ○ |
| University space organisation (room size and furniture, etc.) | ○ | ○ | ○ | ○ | ○ |
| Pressure to prepare students for exams and tests | ○ | ○ | ○ | ○ | ○ |
| Lack of interest of lecturers | ○ | ○ | ○ | ○ | ○ |

| | | | | | |
|---|---|---|---|---|---|
| Lack of interest of lecturers | ○ | ○ | ○ | ○ | ○ |
| No or unclear benefit to use technology for teaching | ○ | ○ | ○ | ○ | ○ |

**8 End page**

**Thank you for your participation!**

## Appendix B: Interview Protocol

Background Information

- How long have you been working in the position of programme director?
- What was the percentage of distance learning in your degree programme during pre-COVID-19 times?

Report

- What did you learn from the COVID-19 Distance Learning Phase?
- What changes in the design of blended learning can you imagine for the time after COVID-19 compared to blended learning before COVID-19?
- What determines the differences between the lecturers in your study programme?
- What determines the differences between full-time and adjunct lecturers regarding their teaching?
- How should pedagogical support for lecturers look in the future?
- Which contents should be taught in further training courses for lecturers?
- Which types of further training courses for lecturers should be used to teach pedagogical models?
- Are the lecturers in your degree programme aware of pedagogical models for using technology for learning?
- In which ways did the COVID-19 Distance Learning Phase change the use of media by lecturers?
- What content should be taught in further training to increase lecturers' use of synchronous and asynchronous media?
- What makes some lecturers use more and others less synchronous and asynchronous media in their teaching?
- Are there any specific challenges for lecturers with low media use?

## Appendix C: Curriculum Vitae

Barbara-Christine Geyer was born in Vienna, Austria, on 22 December 1978. She studied at the University of Applied Sciences Burgenland, where she received a graduate degree in library and information sciences. After her studies, she stayed with the UAS Burgenland as a research assistant for the subject of knowledge management.

Afterwards, she worked in the IT industry, where she was responsible for project development of knowledge management projects at “uma information technology”. After that, she founded “howknow” – a knowledge management consulting company, which she ran for more than seven years. During this time, she offered knowledge management advice, held many continuing education courses and taught at various universities and institutions of higher education in Austria and the Czech Republic.

Since 2015 she has been the programme director of the master's programme “E-Learning and Knowledge Management” and from 2019 on she has been chair of instructional design at the University of Applied Sciences Burgenland. Her research interests include Blended Learning, E-Learning in Higher Education, Knowledge Transfer and Instructional Design.