Designing Social Micro-Learning Interventions for Blended Learning Scenarios in Higher Education: Mixed Methods Case Study at Macromedia University of Applied Sciences

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Social Micro-Learning Interventions for Blended Learning in Higher Education: Mixed Methods Case Study at Macromedia University of Applied Sciences

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This dissertation is not the product of a single person. It is built on the knowledge, dedication, and wisdom of renowned researchers worldwide. It was created on the shoulders of giants, based on the most current research theories from the last century. The writing and research were conducted in close collaboration with the researcher's PhD supervisors in Germany, Professor Dr Tamara Ranner, and in England, Professor Dr Gunter Saunders. Thank you for your time, knowledge, and trust.

Writing a scientific thesis on this scale is impossible without a stable social environment, a supportive family, best friends, colleagues, and mentors.

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A note for future doctoral candidates

A dissertation is a work for life. It challenges you like nothing else, while your everyday life – work, family, friends, leisure – goes on alongside it with all its ups and downs. To get through this, you have no choice but to develop, organise, and prioritise in all areas of your life. Above all, it means persevering. No matter how hard some days will feel. I promise you it is worth it.

Therefore, try to enjoy this incredible journey of learning, growing, and evolving. Do not miss out on living and be proud of yourself and every step of your development. Be it the moment you made the significant decision to write a thesis and for everything you have achieved so far.

I am proud of you right here and now.

Abstract

This doctoral thesis explores the role of social micro-learning in enhancing blended learning within higher education. Addressing the shift towards digital and competency-based teaching, the main research question was formulated as follows: **"How valuable is it for higher education to support blended learning with social micro-learning interventions?"**

The research, conducted as a mixed-methods case study, begins with an examination of current practices at Macromedia University in Germany. A specially developed survey provides information about students' experiences and perceptions of blended learning. Pedagogical measures to improve the blended learning environment are then developed and implemented using the ADDIE model. A comparative analysis of student surveys from different semesters evaluates the impact of these interventions. Results reveal that social micro-learning significantly enhances student engagement and learning outcomes. The findings further highlight the importance of considering both didactic and digital transformation in university teaching and provide a theoretical framework for future research in this field.

Overall, this work contributes to the broader discourse on effectively integrating technology and learner-centric approaches in higher education. It will provide valuable insights into the current state of blended learning in higher education and the potential impact of social micro-learning interventions on student learning experiences and outcomes. The work emphasises the evolving nature of higher education teaching and highlights the need to adapt pedagogical strategies to incorporate both digital innovations and best pedagogical practices.

Keywords: Media Studies, Social Sciences, Higher Education, Blended Learning, Micro-Learning, Social Learning, Generation Z, Learning Experiences, Focus, Interaction, Learning Outcomes, Learning Success, Competencies, Future Skills

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List of Abbreviations

ADDIE	Analysis, Development, Design, Implementation, Evaluation
BL	Blended Learning
CAMRI	Communication and Media Research Institute
DV	Dependent Variable
F2f	Face-to-Face
FL	Formal Learning
ICT	Information Communication Technology
ID	Instructional Design
IL	Informal Learning
IV	Independent Variable
M-learning	Mobile Learning
MANOVA	Multivariate Analysis of Variance
MBL	Mobile Blended Learning
ML	Micro-Learning
SME	Subject Matter Expert
SoML	Social Micro-Learning

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Chapter 1: Introduction

1.1 Personal Background

My name is Nanette Willberg, and I am writing this dissertation in the Faculty of Business, Design, and Technology at Macromedia University of Applied Sciences, Germany, in collaboration with the Communication and Media Research Institute (CAMRI) at the University of Westminster in London. Macromedia University of Applied Sciences and the University of Westminster are linked through a PhD programme. I am proud to be part of this programme. My PhD supervisors are Professor Dr Ranner in Munich and Professor Dr Saunders in London.

The title of the present monography is "Social Micro-Learning Interventions for Blended Learning in Higher Education: Mixed Methods Case Study at Macromedia University of Applied Sciences." It is focused on the novel technology-enhanced learning method *social micro-learning (SoML)* and the globally applied learning format *blended learning (BL).* Employing mixed methods, including qualitative and quantitative approaches, the research aims to explore and improve BL in higher education. The current state of BL in higher education was explored within a case study framework in the winter semester of 2021/ 22 leading to the development of hypotheses. The quantitative measure as well as the interventions were developed based on the qualitative data and literature using two different designs. The interventions were iteratively improved within the summer semester of 2022. The results of both student surveys were compared at the end of the research period to test the hypotheses.

In terms of context, I can be classified as a *digital native* (Prensky, 2001). More specifically, I belong to *Generation Y,* the first generation to grow up in a digital environment. This affects my work and life, as well as my relationship with smart devices and social media platforms (Bennett, Maton, & Kervin, 2008; Wesner & Miller, 2008). Furthermore, during my bachelor's degree in *media and communication design* and international master's degree in *design management* at the Macromedia University of Applied Sciences in Munich, I gained many years of experience in working with different devices, media platforms, and technology-enhanced learning methods. In addition, expertise in teaching undergraduate courses was in my background as I am an experienced and practising teacher in subjects such as academic work, practical projects, and design and media theory courses, as well as being a research assistant at Macromedia University of Applied Sciences since September 2018. I am in the *Faculty of Business, Design, and Technology*, which is both theoretically sound and practice-oriented. My expert knowledge and practical experience include teaching in *blended* (BL), *face-to-face* (f2f),

and *eLearning* (EL) courses with tools and platforms such as *Moodle, Kahoot, Microsoft Teams, Blackboard Ultra, Miro,* and *Menti* – to name a few.

As I am currently working as a lecturer and research assistant at Macromedia University of Applied Sciences, and conducting my research project in this organisation, I took on the role of a *practitioner-researcher* (Saunders, Lewis, & Thornhill, 2009). Furthermore, my design background makes me a *designer-practitioner-researcher*. This title considers that all three aspects – designing, practising, and researching – are integrated into a professional context (Vaughan, 2019). In my case, I have brought the ability to work professionally in the field of teaching and learning due to my position as a lecturer in higher education. Further, I have expertise in design, having been not only a lecturer in design and media theory for years but also an active designer in service design and design thinking workshops. Finally, I am a researcher in the field in which I work.

1.2 Context and Rationale

The German Higher Education System is characterised by a diverse array of institutions, primarily categorised into Universities and Universities of Applied Sciences. Universities are more research-oriented and offer a wide range of subjects, including humanities, natural sciences, and various interdisciplinary fields. They are known for their strong emphasis on theoretical knowledge and research. In contrast, Universities of Applied Sciences are more practice-oriented, focusing on applied sciences and often maintaining close ties with industry partners. These institutions provide education that is closely aligned with the demands of the job market (Wissenschaftsrat, 2019). The degree structure in Germany follows the bachelor's, master's, and doctorate system, aligning with the *Bologna Reform* for standardisation and comparability of higher education across Europe. Bachelor's programs typically last 3-4 years, while master's programs are usually 1-2 years in duration. Doctorate programs, which involve a significant research component, vary in length depending on the field and research topic. The academic year in German higher education institutions is divided into two semesters: the winter semester and the summer semester. The winter semester generally runs from October to March, and the summer semester from April to September. However, these dates can vary slightly between institutions (European Commission, 2024).

The Bologna Reform, initiated in 1999, significantly reframed German higher education, emphasising competency-based education and international compatibility (European Commission, 2024). Its main contribution was the introduction of the bachelor-master's degree structure, replacing the traditional Diploma and Magister programs. This reform aimed to create

a more cohesive, compatible, and competitive European Higher Education Area. A key focus was on *competency-based education*, shifting away from solely academic knowledge to developing skills and competencies relevant to the job market. The reform also enhanced international mobility and cooperation by standardising degree programs and credit systems across Europe, thereby making German higher education more accessible and recognisable internationally. This alignment with European standards has had a profound impact on the educational landscape in Germany. The influence on the individual case considered in this thesis is discussed in more detail in Chapter 3.1.2.

In recent years, German higher education has been focusing on three primary areas: digitalisation, internationalisation, and research innovation. This shift reflects global educational trends and the increasing importance of technology in academia (BMBF, 2021a). Digitalisation aims to integrate digital technologies into the learning process, enhancing accessibility and engagement. Internationalisation strategies are designed to attract and accommodate international students and faculty, promoting a global perspective. Lastly, an emphasis on research innovation fosters cutting-edge discoveries and practical applications, solidifying Germany's role as a leader in academic research.

The student population in Germany is increasingly diverse, with a significant representation of international students. This diversity shapes the educational offerings, requiring more inclusive and adaptable teaching methodologies (BMBF, 2021b). Universities are now focusing on creating an environment that caters to a wide range of cultural backgrounds and learning styles, ensuring equal opportunities, and fostering a more globalised academic community. The student demographics in Germany have become increasingly diverse, with a notable influx of international students. This diversity has led to a more inclusive and adaptable educational approach, fostering a globalised academic community (BMBF, 2021b).

There has been a remarkable shift in German higher education that is increasingly leading to a globalised, student-centred approach to teaching. Methods have evolved to emphasise interactive and personalised learning experiences supported by technology. This approach emphasises the role of students as active participants in their learning journey, supported by technology-enhanced educational experiences. Innovative teaching methods, such as BL and flipped classrooms, are increasingly adopted to improve engagement, and learning outcomes, reflecting a modern approach to education that values interactivity and personalised learning experiences (Gaebel & Zhang, 2018).

German universities maintain high standards through strict accreditation procedures and comprehensive internal quality management systems (Akkreditierungsrat, 2020). These mechanisms ensure educational excellence and compliance with national and international academic standards. To finance them, German higher education is primarily funded from public sources, supplemented by private funding. The governance structure of these institutions strikes a balance between autonomy and state oversight and fosters an environment conducive to academic freedom while maintaining accountability and quality (BMBF, 2021b).

As German higher education navigates demographic shifts and funding challenges, it is compelled to adapt to global trends and innovate educational practices. This landscape sets the stage for a global transformation in higher education, where institutions face the pressing need to prepare graduates for a digitised and rapidly changing world. Embracing learning outcome-oriented approaches, the focus shifts to catering to the digitally native Generation Z. The integration of BL strategies and micro-learning techniques in higher education emerges as a response to these challenges, aiming to enhance competencies relevant to the digital era and future skills. This study delves into these dynamics, exploring the adaptation of higher education to these evolving demands and technologies.

1.3 Problem Statement

This thesis comprehensively examines the educational needs and characteristics of current and future higher education students, with a specific focus on the evolving concept of ‘digital natives’. Initially coined by Prensky (2001), the term ‘digital natives’ referred to individuals born post-1980, presumed to have inherent digital proficiency. This concept was further developed by scholars who introduced terminologies like Net Generation, Homo Zappiens, Generation N, Digital Generation, and App Generation, ascribing innate technological skills and unique learning styles to these individuals (Oblinger & Oblinger, 2005; Tapscott, 1997; Veen & Vrakking, 2006; Feiertag & Berge, 2008; Jukes, McCain & Crockett, 2010; Gardner & Davis, 2013). However, subsequent research by Bullen et al. (2008), Ebner, Schiefner, & Nagler (2008), Kennedy et al. (2007), and Kvavik (2005) challenged these assertions, revealing that the technological skills of these so-called ‘digital natives’ often did not surpass basic digital competencies. Margaryan, Littlejohn, and Vojt (2011) also highlighted the limited use of digital technologies for learning among university students.

This led to a re-evaluation of the ‘digital native’ concept, distinguishing between Generation Y (born 1981-1995) and Generation Z (born 1995-2010), each with different technological experiences and values (Chun et al., 2016; Lancaster & Stillman, 2010; Strauss & Howe, 1998).

Generation Z, or Post-Millennials, are often considered true digital natives, having been immersed in digital environments since birth (Seemiller & Grace, 2016; Twenge, 2017). Despite their extensive engagement with multimedia platforms, there is a notable sense of loneliness among this generation (Vultaggio & Richter, 2020), and Twenge et al. (2019) have observed an increase in mental health issues among young adults, partly due to loneliness despite constant digital connectivity.

Despite their familiarity with digital media, Generation Z does not completely align with the original notion of digital natives. They are not inherently adept at multitasking and managing information overload from multimedia platforms (Kirschner & De Bruyckere, 2017). They spend a significant amount of time on multimedia platforms, with smartphones being their primary device (Chicca & Shellenbarger, 2018; Rideout, Foehr, & Roberts, 2010; mpfs, 2018). However, this constant connectivity raises concerns about their media literacy and effective use of these tools. This thesis aims to develop educational strategies that resonate with Generation Z's digital habits while addressing their specific learning and mental health needs. The focus is on leveraging digital proficiency and addressing the challenges and gaps identified in current research. The aim is to equip them with the competencies necessary for academic success and well-being in a digitalised world.

The changing educational landscape, influenced by factors like the Bologna Reform and a diverse student population, has led to more student-centred learning environments (Meacham, 2016). The COVID-19 pandemic accelerated the adoption of blended learning (BL) in higher education, combining ICT-enhanced learning with f2f or live online sessions to foster innovation in education (Ranner, personal communication, January 10, 2021; Schmitt-Fumian, 2020). This approach includes inverted or flipped classroom models, promoting synchronous and asynchronous learning. The focus on competence-oriented higher education is aimed at preparing students for tomorrow's labour market, emphasising employability (Emre, Masur & Ranner, 2020[1]; Schmitt-Fumian, 2020[2]). In an environment of constant change, a renewed university system is necessary to address societal challenges like climate change, migration, and the future of democracy (Ehlers, 2020; Emre, Masur & Ranner, 2020; Schmitt-Fumian, 2020). University educators must be proficient in integrating new ICT to support students' learning (UNESCO, 1998). However, students often lack guidance during independent study, which comprises a significant portion of their study time (Macromedia University, 2018). Thus, effective learning requires guidance on the use of smart devices and social media (Warzocha, 2017).

[1] Source from the university intranet (not publicly accessible).

[2] Source from the university intranet (not publicly accessible).

The thesis also addresses the transformation in information consumption from printed books to digital texts, and the evolution of the web from Web 2.0 to Web 3.0, emphasising user-generated content and the wisdom-of-the-crowd approach for quality assurance (Göschlberger, 2016). The integration of ML and SoML is proposed to enhance learning experiences in higher education (Emerson & Berge, 2018; Shail, 2019; MacLeod, Reynolds, & Lehmann, 2018; Roesler, 2017; Kang, 2016). SoML combines ML with social software strategies to engage learners in higher cognitive level activities (Baumgartner, 2013; Göschlberger, 2016). However, further research is needed to develop didactically designed interventions for SoML and to determine its effectiveness in higher education settings.

1.4 Objectives

The primary objective of this dissertation is to assess the value of integrating social micro-learning (SoML) interventions in blended learning (BL) within higher education, focusing particularly on student learning experiences and outcomes. The research adopts a normative and evaluative design, encompassing a case study that involves exploring the status quo, an exploratory sequential design, instructional design (ID) processes, and a student survey. The intent is to evaluate whether incorporating SoML interventions into higher education teaching practices enhances their value.

The central research question posed is: “How valuable is it for higher education to support blended learning with social micro-learning interventions?”. To address this, the thesis establishes both a theoretical foundation through a comprehensive literature review and an empirical basis. The literature review delineates the target group as Generation Z (Oblinger & Oblinger, 2005), scrutinises their relationship to the concept of digital natives (Prensky, 2001), and delves into the integration of ICT in education, particularly the evolution towards BL in higher education, setting the stage for exploring SoML.

Theoretical underpinnings include examining significant shifts in teaching and learning paradigms, the evolution of key learning theories, and the transformation of institutional roles. This culminates in a focus on Social Learning Theories (Bandura, 1977) and the development of Bloom’s Taxonomy (Bloom, 1956), along with post-2001 learning theories and their associated critiques. The review also covers the implementation of ICT, BL, mobile learning (M-learning), mobile blended learning (MBL), ML, and the use of social media in learning, concluding with a reflection on the relatively unexplored field of SoML.

The empirical research component aims to justify, implement, analyse, and evaluate a mixed-methods approach. It begins with a case study assessing the current state, incorporating

participant observation and developing quantitative measures and interventions within the ID process. These interventions aim to enhance existing BL frameworks at Macromedia University of Applied Sciences with practical SoML instructions, intending to enrich formal learning units and support student learning experiences and outcomes. The student learning experience and outcomes are measured against indicators such as joy, motivation, effort, participation, interaction, competencies, future skills, success, and grades. Hypotheses were formed based on qualitative data from participant observations during the winter semester of 2021/22. An exploratory sequential study design led to a quantitative student survey. The ID process involved developing, implementing, and iteratively improving interventions, evaluated through participant observation. A MANOVA was conducted to compare surveys from both semesters, assessing the effectiveness of the interventions.

Teacher competence in using the necessary technologies was crucial for the study. Technologies used at Macromedia University included Microsoft Teams, Blackboard Ultra, Moodle, Outlook, Miro, Kahoot, and Menti. The study also considered potential methods for SoML, such as video conferencing, posting, commenting, and chatting (Göschlberger, 2016; Ramirez & Faust, 2020). Limitations include the non-replaceability of formal learning units and potential educational policy impacts, which are not the focus of this dissertation. The research concludes with an outlook on how SoML could enrich the curriculum at Macromedia University of Applied Sciences and lays a foundation for further research in this domain.

1.5 Research Questions

Based on the problem statement as well as the objectives, the following research questions arise, which I aim to answer in the present PhD thesis:

1 How *valuable* is it for higher education to support *blended learning* with *social micro-learning* interventions?

Thereby, *value* in the context of learning in higher education is defined as the quality of teaching approaches concerning the research dimensions ‘learning outcomes’ and ‘learning experience’. These are measured by the indicators ‘competencies’, ‘success’, ‘future skills’, and ‘grades’ regarding the direct outcomes, ‘joy’, ‘motivation’, ‘participation’, ‘interaction’, and ‘focus’ concerning the learning experience. In addition, a possible trade-off is questioned.

To answer the main research question named above, the following sub-questions were developed:

2 How can the implementation of *social micro-learning* interventions enhance the *learning outcomes* of students?

2.1 Can it enhance the acquisition of *competencies*?

2.2 Can it lead to a higher *learning success*?

2.3 Can it improve students' acquisition of *future skills*?

2.4 Can it lead to an improvement in the *grades* of the students?

3 How can the implementation of *social micro-learning* interventions enhance the *learning experience* of students?

3.1 Can it improve the *joy* of students?

3.2 Can it lead to an enhancement of *motivation* of students?

3.3 Can it increase *participation*?

3.4 Can it improve student's *effort*?

3.5 Can it increase *interaction*?

3.6 Can it increase *focus*?

4 How likely is a *trade-off*?

In summary, the above questions were to be answered with the help of the planned studies. They refer to bachelor students at Macromedia University of Applied Sciences in Germany. The aim was to close the research gap identified by the literature review and to provide an innovative educational approach. How the mixed-methods research was structured and methodologically conducted is shown in the following section.

1.6 Thesis Design

1.6.1 Structure and Layout

Following the objective, this thesis is essentially divided into two parts: a theoretical part and an empirical part (see Figure 1). The theoretical part encompasses the introduction followed by the literature review. This part is introduced by a short methodological chapter, to elaborate the approach, as well as the most important definitions. The main part of the literature review is divided into three sections:

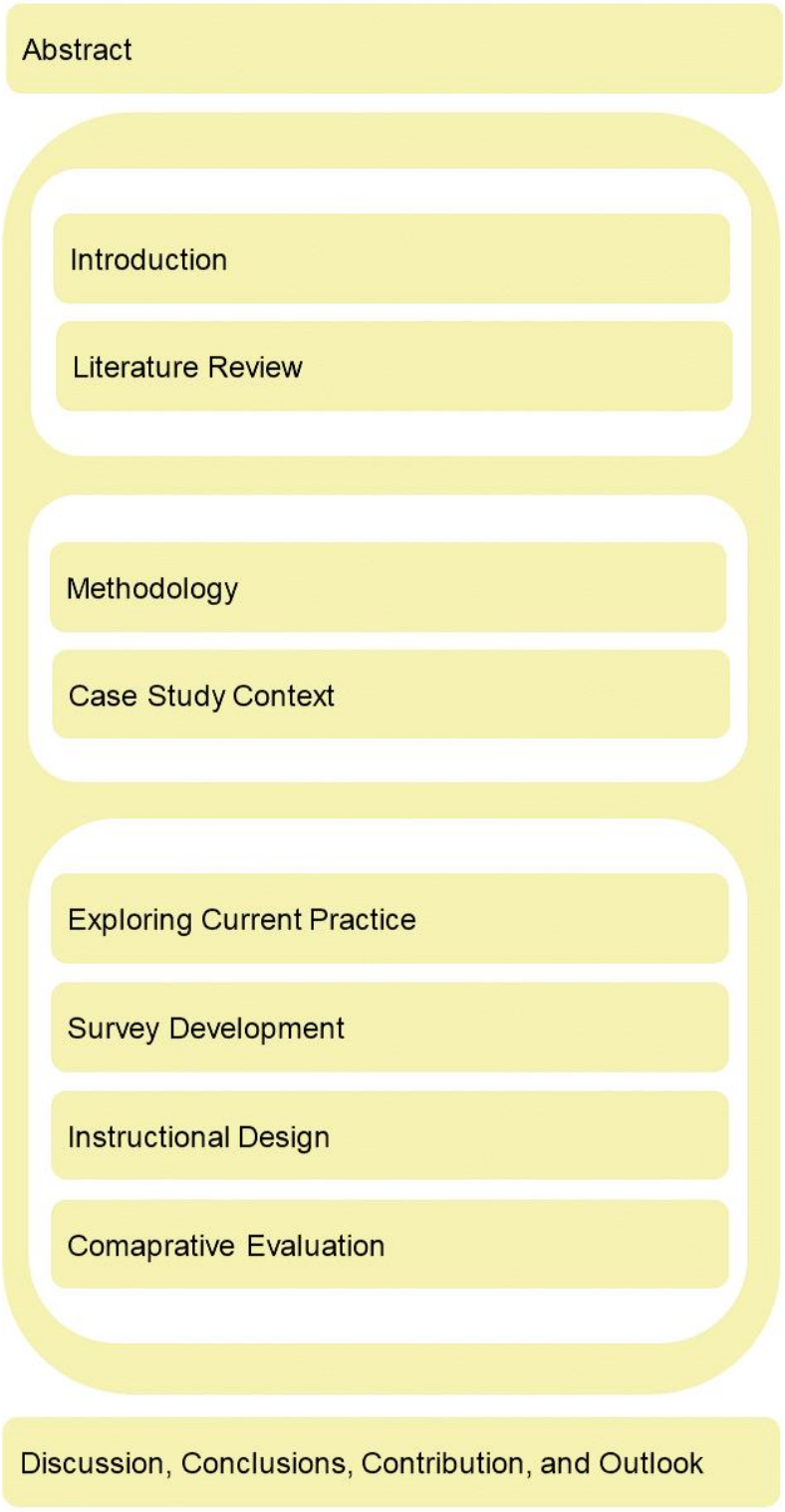
(1) a historical review of the basic educational theories, mainly focusing on the learning theories before 2001,
(2) the paradigm shift in higher education didactics around the turn of the millennium, and the related learning theories, developments, critiques and

(3) the didactic changes in teaching and learning due to digitalisation, changes in the global labour market, and adaptations due to the demands of the younger generation were presented.

The empirical part is introduced by a methodological section that embeds the object of research in the context and framework of the level of innovation in higher education, legislation, and educational regulations in Germany. In the following section, the research design, the data collection and analysis, the research quality considerations and the limitations and conclusions are presented. A clear, direct, and obvious link is made to the chosen research methods by explaining which methods are used and why. This is followed by the section on the context of the chosen case study. The investigation of current practice, the development of the survey, the process of lesson design and the comparative evaluation are presented in turn. They aim to show the status quo of current BL teaching and the development and implementation of SoML interventions and their impact on student learning experiences and outcomes. The final chapter summarises and discusses the findings. This chapter includes the discussion, conclusions and recommendations for further research based on the findings. In addition, the contribution to knowledge and closing the research gap in relation to SoML interventions is assessed as an improvement to existing BL teaching in higher education.

Figure 1

Design of the Doctoral Thesis



Note. This illustration helps the reader to understand the structure of the entire dissertation. It is the author's own representation.

1.6.2 Work and Time Schedule

This doctoral thesis has been carried out in full-time study at the University of Westminster in the Communication and Media Research Institute (CAMRI) department. To plan the implementation a clear timetable was prepared. The general work and schedule were as follows:

First Half of First Year (Sept. 30th, 2019 – April 30th, 2020)

- Large-Scale Literature Research
- Literature Review (8 000 words)
- Project Plan
- Submission of APR 1

Second Half of First Year (Mai 1st, 2020 – Sept. 29th, 2020)

- Symposia and Research Conferences
- Introduction (3 500 words)

First Half of Second Year (Sept. 30th, 2020 – April 30th, 2021)

- Methodology (8 000 words)
- Overview Progress Report
- Submission of APR 2

Second Half of Second Year (May 1st, 2021 – September 29th, 2021)

- Half-time Viva Interview in Westminster
- Symposia and Research Conferences
- Case Study Context (2 000 words)

First Half of Third Year (September 30th, 2021 – April 30th, 2022)

- Case Study Research in the winter semester of 2021/ 22
    - Exploring the Current Practice
        - Analysing Data
        - Generating Hypotheses
    - Developing the Survey
        - Analysing Data
        - Constructing Questionnaire
    - Conducting the First Survey
        - Analysing Data
    - Designing the Instructions
        - Analysing Data
        - Executing ADDIE Process
- Exploring Current Practice (8 000 words)
- Survey Development (10 000 words)
- Overview Progress Report
- Submission of APR 3

Second Half of Third Year (May 1st, 2022 – September 29th, 2022)

- Case Study Research in the summer semester of 2022
  - Implementing the Instructions
    - Analysing Data
    - Iteratively Improving the ID
  - Conducting the Second Survey
    - Analysing Data
    - Comparing Surveys
    - Testing Hypotheses
- Instructional Design (12 000 words)
- Comparative Evaluation (3 000 words)

First Half of Fourth Year (September 30th, 2022 – April 30th, 2023)

- Final Discussions Section (9 000 words)
- Abstract (250 words)
- Finalising Thesis Draft

Second Half of Fourth Year (May 1st, 2023 – September 29th, 2023)

- Editing, Reviewing, and Final Proofreading
- Submission of APR 4
- Preparing Viva presentation
- Viva on MS Teams

First Half of Fifth Year (September 29th, 2023 – April 30th, 2024)

- Implementing Revision Report Changes
- Submission of Revised Thesis
- Doctorate

Chapter 2: Literature Review

2.1 Method

The literature review aimed to provide a critical summary of existing knowledge on higher education for *digital natives* (Prensky, 2001) and the implementation of *information and communication technology* (ICT) in the form of *blended learning* (BL). In doing so, the novel research gap of enhancing BL in higher education through social learning and *micro-learning* (ML) was explored, leading to the niche of *social micro-learning* (SoML). The literature review formed the basis for identifying the research gap and the specific research questions for this thesis. A range of different sources were consulted and evaluated, including academic and professional journal articles, books, and web-based resources. To identify and locate relevant documents and other sources, a three-part literature review was conducted. First, a keyword analysis was conducted following the organisational frameworks of Webster and Watson (2002) and Rowley and Slack (2004). Second, a literature review of basic learning theories was conducted as the keyword analysis literature analysed only included studies from 2003 to 2020. Third, recommended literature from university researchers and a literature review were added. This completed the theoretical foundation of the dissertation.

2.1.1 Keyword Analysis

For the keyword analysis, SCOPUS was used as the main search engine, as it is the "world's largest abstract and citation database of peer-reviewed research literature" (SCOPUS Blog, 2019). The keywords were taken from the original title "Innovating Teaching and Learning for digital natives in Higher Education with ICT by Designing an Instructional Format for SoML: Mixed Methods Research at Macromedia University of Applied Sciences". The keywords *Teaching and Learning, Digital Natives, ICT, Higher Education, Instructional Design,* and *Social Micro-Learning* were transformed into abbreviations and sub-categories (see Table 1). When searched, the terms "(Teaching and Learning) AND (Higher Education) AND (Digital native* OR Net Gener*)" were considered, which led to 33 results. Furthermore, "(Design*) AND (Instructional Design* OR Instructional Format*) AND (Digital native* OR Net Gener*)" had 23 results. "(Social Micro-Learning)" itself had only three results. A further search for connected terms including "(Microlearning OR Mobile Blended Learning OR Informal Learning) AND (Higher Education) AND (Digital native* or Net Gener*)" ended up with three more results, which led to another search of "(Microlearning) AND (Higher Education)" which led to 12 other results. In the end, after a preliminary title and abstract analysis of the 73 results, as well as after deleting exact doubles and papers that were mainly

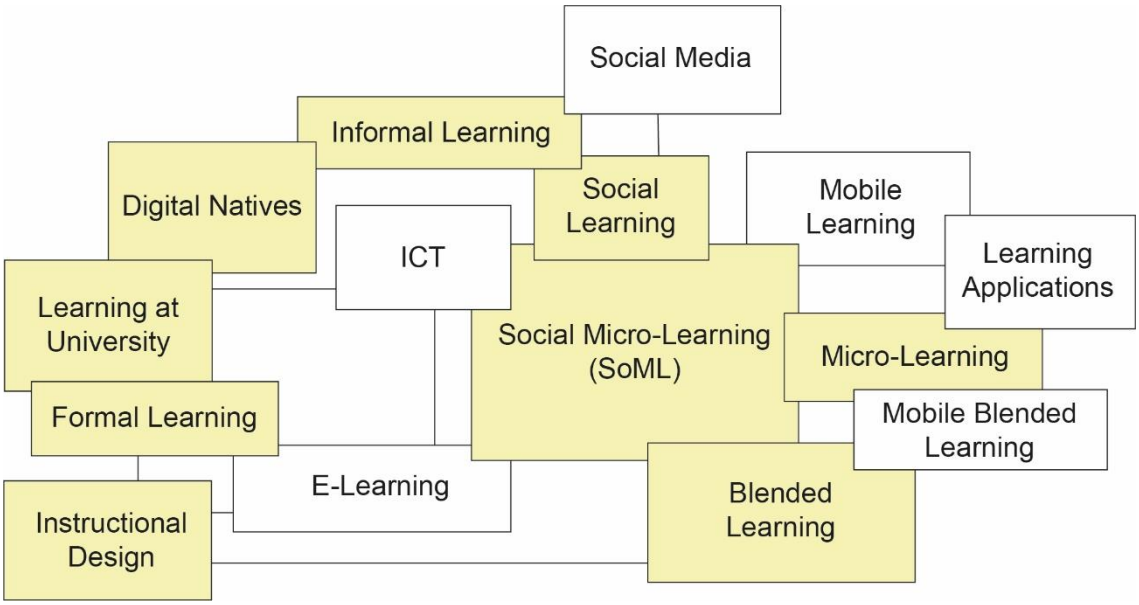
focussed on e-learning or game-based learning, 41 studies were retrieved. Eleven articles were additionally added – recommended by scientific sources within Macromedia University and the University of Westminster or collected from a selected (Göschlberger & Anderst-Kotsis, 2019; Göschlberger, 2016; Baumgartner, 2013) reference analysis – as well as four literature reviews. In the end, 56 scientific sources were reviewed as part of the analysis.

2.1.2 Related Research Areas

The general organisation of the review included a mind map based on Rowley and Slack (2004) (see Figure 2) to define the most important fields of literature surrounding SoML.

Figure 2

Mind Map of Research Areas



Note. This figure is an own representation after Rowley and Slack (2004).

Furthermore, to structure the review, a concept-centric approach was chosen after Webster and Watson (2002). It includes a concept matrix consisting of the literature analysed for this review, which was assigned to different concepts related to the topic of this thesis. The concepts themselves were sorted historically after Cooper (1988), starting with a *central coverage* of learning theories. Building on the theoretical classification, a paradigm shift was portrayed, defining the beginning of a new area of teaching and learning. The review guided the researcher through related areas that contributed to the concept of SoML, describing how it came about and what role it played for universities. By understanding and grasping the existing knowledge, the research area could be located, and gaps could be identified to develop research questions. Therefore, looking deeply into the field and collecting, evaluating, and selecting literature was

the foundation of this literature review. To organise the literature review's argument and structure, connections and themes were found and grouped into several main concepts. In the end, the research questions were presented. This led to the outcomes which laid the foundation of the methodological framework.

The target audience of this thesis is scientists and experts in the field of ICT-enhanced teaching and learning in higher education. Therefore, some basic areas, such as the history of learning theories, were only touched upon and more emphasis was placed on current results and current ID developments in education.

2.2 History of Teaching and Learning

2.2.1 Foundational Theories and Taxonomies

2.2.1.1 Learning Theories Until 2001

This historical overview begins with a comprehensive review of seminal works in the teaching and learning field, delving into foundational educational theories and taxonomies. The objective is to elucidate the primary categories of learning theories and provide a foundation for understanding social learning theory. Educational philosophies and practices have been significantly influenced by various learning theories developed by notable educators and theorists, such as Piaget (1923), Skinner (1953), Lev Vygotsky (1978), and Harris & Graham (1999). These theories are broadly categorised into four main groups: Behaviourism, Cognitivism, Constructivism, and Social Learning (Chowdhury, 2006).

Behaviourism, as articulated by Skinner (1953) and expanded upon by Bransford, Brown, & Cocking (2000), emphasises the relationship between the environment and behaviour. It views learning as a process of forming associations between environmental stimuli and corresponding responses, with a focus on rewards and punishments as motivational tools. However, given the focus of this dissertation on contemporary students' learning, Behaviourism will not be extensively discussed. Cognitivism, examining the relationship between learners and their environment, posits that learning occurs as individuals think and engage actively with their surroundings (Harris & Graham, 1999). Yet, considering the digital native generation's propensity for online collaboration, information sharing, and collective creation (Carletti, 2011; Tapscott, 2009; Feiertag & Berge, 2008; Churches, 2008), the traditional individualistic learning model may be less relevant. Consequently, this dissertation will not concentrate on the cognitive learning model. Constructivism, pioneered by figures such as Piaget (1923), Dewey (1929), Bruner (1960), and Vygotsky (1978), posits that learners construct knowledge and meaning from their experiences. This student-centred approach, advocating learning by doing

with the teacher as a facilitator, aligns with the needs of contemporary learners. Constructivism emphasises the role of learner interaction with existing knowledge, social context, and problem-solving (Tam, 2000).

The dissertation primarily focuses on the constructivist approach in higher education, particularly exploring social learning theories that underpin social constructivism. This includes a detailed examination of the evolution of Bloom's Taxonomy and Baumgartner's Taxonomy of Educational Objectives, providing a nuanced understanding of the constructivist framework in the context of modern educational practices.

2.2.1.2 Social Learning Theories

Bandura's social learning theory (1977) is a significant advancement in the field of education, extending beyond the behavioural focus on conditioning and cognitive focus on psychological influences. It introduces a critical social dimension to learning, emphasising three core concepts: observational learning (OL), the role of internal mental states (instinct reinforcement), and the understanding that learning does not necessarily lead to behaviour change (Cherry, 2019).

Bandura identified three models of OL: live models (actual people demonstrating behaviours), symbolic models (characters in various media forms), and verbal instructional models (descriptions and explanations of behaviour). This understanding broadens the scope of OL, showing that it encompasses not just direct observation but also learning through various forms of media (Bajcar & Bąbel, 2018). Key cognitive processes involved in OL include attention, memory (retention and reproduction), and motivation. Attention is crucial for learning; distractions can negatively impact OL, whereas interest and novelty can enhance it. Memory, as described by Squire (2004) and further explained by Shail (2019), is not a singular faculty but a system with multiple components and neuroanatomical structures. Successful OL involves retaining the information and later reproducing the observed behaviour. Motivation, influenced by factors like reinforcement and punishment, is essential for the learner to imitate the modelled behaviour (Fryling, Johnston, & Hayes, 2011).

Complementing Bandura's theory, Vygotsky's Social Development Theory (1978) focuses on the role of social interaction in cognitive development, proposing that cognitive development is limited at certain ages and requires social interaction for full development. The Situated Learning Theory by Lave and Wenger (1991), which includes Vygotsky's theory as a component, posits that learning should occur in an authentic context and necessitates social interaction and collaboration. This theory suggests that learning is situated within specific

activities, contexts, and cultures, contrasting with the decontextualised nature of most classroom learning (Cognition & Technology Group at Vanderbilt, 1993). Lave and Wenger (1991) introduced the concept of legitimate peripheral participation, where learners gradually move from the periphery of a community to a more central role, engaging actively in the culture and practices of the community. Brown, Collins, and Duguid (1989) further developed this with the concept of cognitive apprenticeship, arguing for learning through active participation and social construction of knowledge, necessitating a new learning epistemology that prioritises active perception (Culatta, 2019).

These theories collectively underpin the dissertation's focus on the constructivist approach to learning in higher education, emphasising the importance of social interaction, collaboration, and situated learning experiences. This approach aligns with the modern educational context, where learning extends beyond traditional classroom boundaries and involves a dynamic interplay of observation, social interaction, and contextualised experiences.

2.2.1.3 Educational Taxonomies

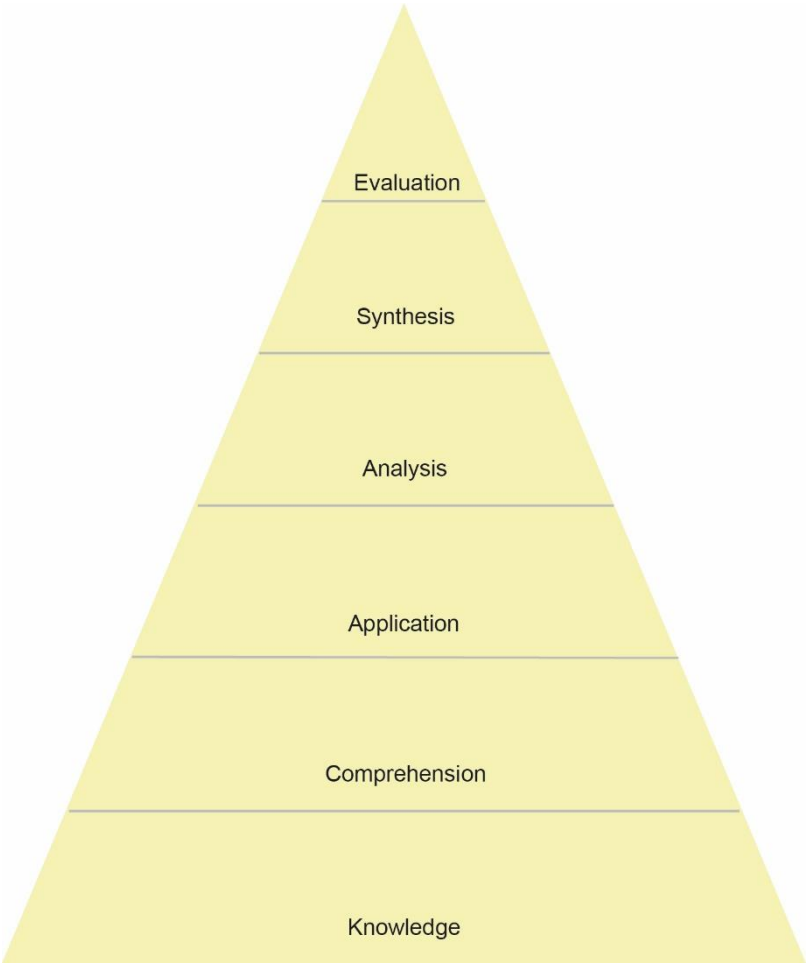
Pedagogical taxonomies play a central role in education, primarily involving the categorisation of learning objectives and levels, as has been outlined by professionals in the field for more than the past half century (i.e., Ramirez & Faust, 2020; Baumgartner, 2013; Armstrong, 2010; Valcke, De Wever, Zhu, & Deed, 2009; Churches, 2008; Forehand, 2005; Krathwohl, 2002; Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Rath, & Wittrock, 2001; Anderson, Sosniak, & Bloom, 1994; Bloom, 1956). These taxonomies are crucial in shaping the framework for educational planning and assessment. As versatile tools, they facilitate the identification and formulation of learning objectives and provide educators with a structured approach to curriculum design and assessment of learning outcomes (Baumgartner, 2013; Armstrong, 2010; Forehand, 2005).

Among these, *Bloom's Taxonomy of Educational Objectives*, introduced in 1956 by Bloom and colleagues, stands out as a landmark in educational theory (see Figure 3). This taxonomy, initially devised for f2f teaching, systematically classifies learning into three psychological domains: Cognitive, Affective, and Psychomotor. The Cognitive Domain emphasises knowledge processing, ranging from basic fact recall to advanced analytical skills, across six levels. The Affective Domain, concerned with emotions and attitudes, encompasses five levels. The Psychomotor Domain focuses on the development of manual or physical skills, spanning six levels. The enduring relevance of Bloom's taxonomy, even amidst the advent of alternative models, underscores its foundational role in educational theory and practice (Bloom, 1956).

Forehand (2005) highlights its status as a standard in education, attesting to its broad applicability and significance.

Figure 3

Bloom's Taxonomy



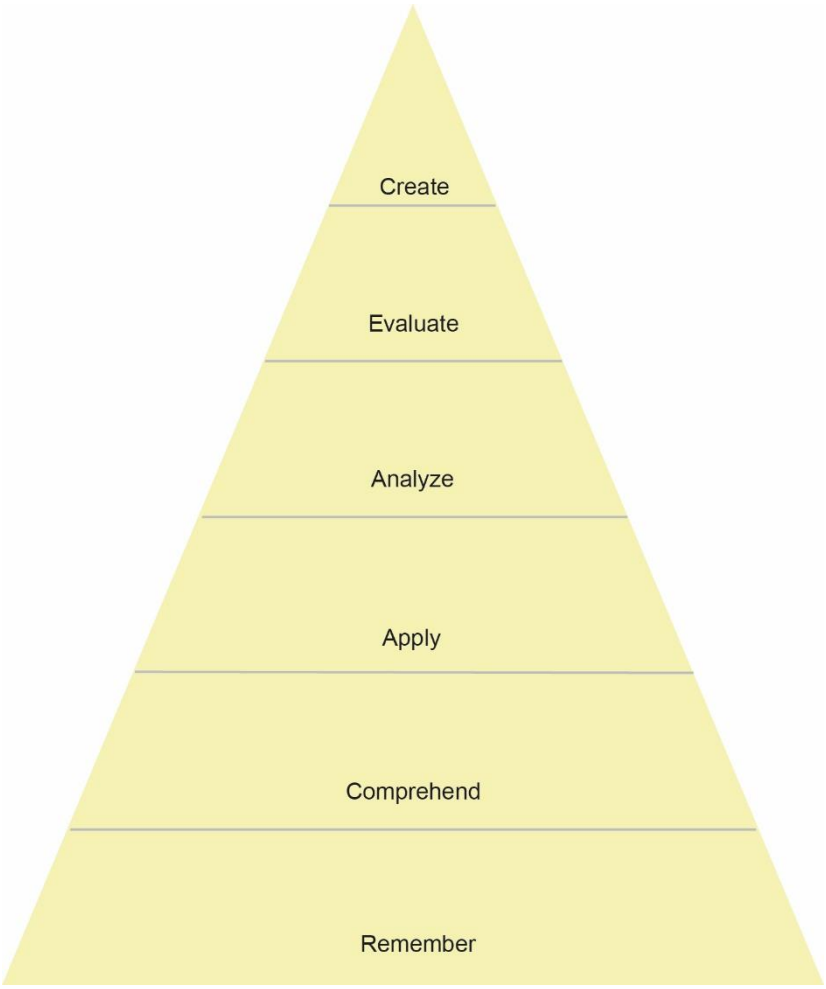
Note. This figure is an own representation based on Bloom (1956).

The evolving educational landscape and shifting labour market demands necessitated a substantial refinement of Bloom's taxonomy, notably undertaken by Anderson et al. in 2001. This revision (see Figure 4) was essential for maintaining the taxonomy's relevance in an increasingly digital era. The revised structure of the cognitive domains in the updated taxonomy maintains the origina''s progression from simple to complex cognitive tasks but restructures these to align with contemporary educational needs. A significant enhancement in the revised taxonomy is the incorporation of action verbs to articulate cognitive processes, employing verbs like 'remember, understand, apply, analyse, evaluate, and create', as outlined by Krathwohl in 2002. This modification not only enhanced clarity but also introduced a more dynamic, action-oriented framework for educators and learners. Both the original and revised versions of

Bloom's Taxonomy serve as comprehensive tools for educators and students, aiding in the classification and organisation of learning objectives and facilitating structured approaches to educational planning and assessment, as highlighted by Armstrong in 2010.

Figure 4

Bloom's Revised Taxonomy



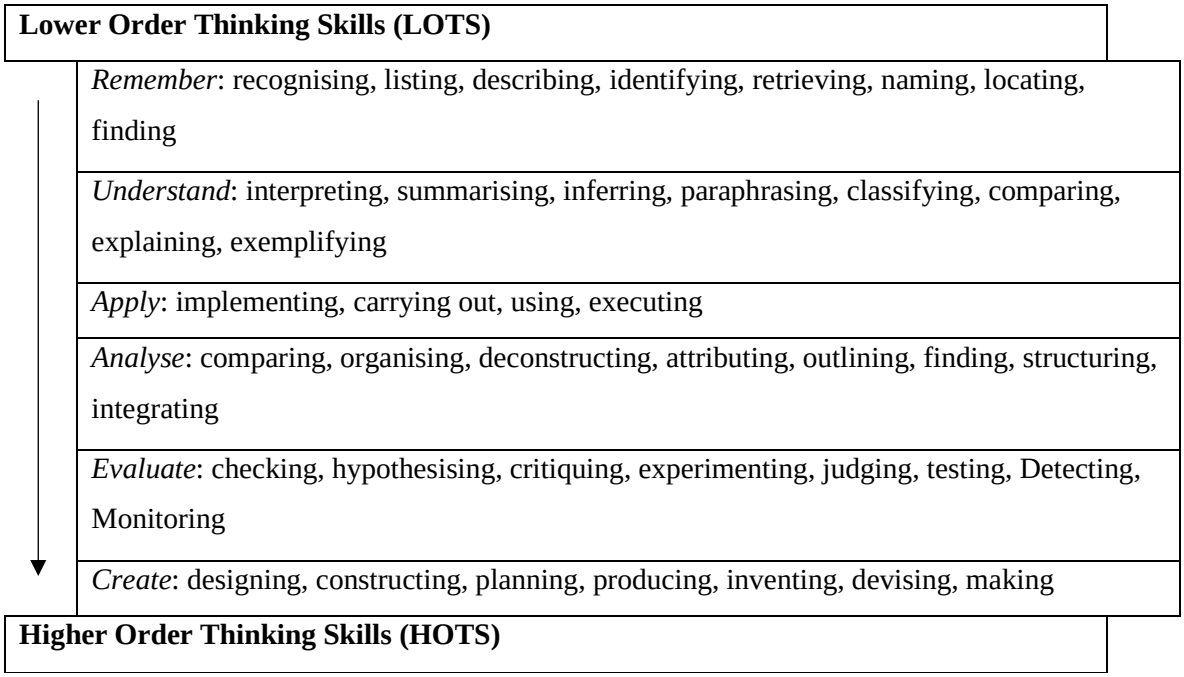
Note. This figure is an own representation based on Anderson et al. (2001) and Krathwohl (2002).

This two-dimensional framework leads to a taxonomy table, an important tool in education that provides educators with a clear, concise visual representation of course content and teaching units. It facilitates the categorisation of objectives, activities and assessments and helps to check and balance the curriculum. Educators can use this table to systematically analyse the distribution and alignment of learning objectives and identify potential curriculum deficiencies or areas of excessive focus. The structure of the table illustrated in Figure 5, which ranges from Lower Order Thinking Skills (LOTS) to Higher Order Thinking Skills (HOTS), helps to assess the cognitive demands placed on students. The key verbs associated with each taxonomy

category help educators design curriculum and assessment strategies, as Krathwohl noted in 2002.

Figure 5

Taxonomic Elements of Bloom's Revised Taxonomy



Note. This figure is an own representation based on Krathwohl (2002).

The rapid integration of digital technologies into education led to a major adaptation of Bloom's revised taxonomy in 2008, driven by Churches. This revision, called Bloom's Digital Taxonomy (see Table 1), was a response to the limitations of the existing taxonomy in the context of the digital world. Churches criticised the revised taxonomy's focus on traditional f2f teaching and learning and emphasised that it did not do justice to the challenges and opportunities presented by ICT in education. His revision, while based on Anderson et al's 2001 framework, placed a greater emphasis on digital technologies and digital cognitive goals.

Churches' version of Bloom's taxonomy from 2008 explicitly integrated digital technologies and cognitive objectives and incorporated elements of collaboration to enhance learning in digital environments. He argued that while collaboration is not a prerequisite for learning, it greatly enhances the effectiveness of learning. This adaptation was more than just an addition to the existing framework; it was a reimagining that recognised the profound impact of digital technologies on student learning experiences and educational practice. Churches argued that while the 2001 revision by Anderson et al. captured the essence of traditional classroom activities and objectives, it did not fully address the new goals, processes and actions required by the integration of ICT into the classroom (Churches, 2008).

Table 1

Mind map of Bloom's Digital Taxonomy

Creating	Designing, constructing, planning, producing, inventing, devising, making, programming, filming, animating, blogging, publishing, video-casting, podcasting, directing, broadcasting	**Collaboration**
Evaluating	Checking, hypothesising, critiquing, experimenting, judging, testing, detecting, monitoring, blog commenting, reviewing, posting, moderating, collaborating, networking, testing, reflecting, validating	Collaborating Moderating Negotiating Debating Commenting Online meeting Video conferencing Reviewing Questioning Posting Networking Contributing Chatting Emailing Twittering Texting Instant messaging
Analysing	Comparing, organising, deconstructing, attributing, outlining, finding, structuring, integrating, linking, reverse-engineering, validating, cracking, mind-mapping	
Applying	Implementing, carrying out, using, executing, showing, exhibiting, loading, playing, operating, hacking, uploading, sharing, editing	
Understanding	Interpreting, summarising, inferring, paraphrasing, classifying, comparing, explaining, exemplifying, advanced searching, Boolean searching, twittering, categorising, tagging, commenting, annotating, subscribing	
Remembering	Recognising, listing, describing, identifying, retrieving, naming, locating, finding, bullet pointing, social networking, highlighting, bookmarking, favouring, searching, googling	

Note. This table is based on Churches (2008).

In 2013, Baumgartner presented a progressive taxonomy of pedagogical interactions, which represents a development in the context of ML and contemporary educational theories. This taxonomy, an extension of Baumgartner's work from 2004, adapts Bloom's taxonomy to the field of ML, as noted by Göschlberger and Anderst-Kotsis in 2019. It is characterised by the

fact that it divides the learning process into three stages, moving from teacher-centred to learner-centred approaches. His taxonomy thereby reflects the dynamic development of higher education didactics and takes account of the increasing complexity of knowledge and the need for authentic learning environments. This taxonomy complements and aligns with Bloom's evolving taxonomy. It fits into the broader educational shift towards learner-centred learning. This orientation is crucial in equipping students with skills and competences for an increasingly complex world (Baumgartner, 2013).

- Learning I: Absorbing Knowledge is based on the behaviourist approach, where learning is seen as the transfer of knowledge from the teacher to the student, as emphasised by Skinner in 1953 and Baumgartner in 2013. In the advanced phase, Learning I+, learners repeat and refine their knowledge, which is consistent with the concept of the competence spiral.
- Learning II: Knowledge Acquisition views learning as an active process in which learners plan, review and reflect. This phase goes beyond outcome-based learning I and encourages learners to apply abstract knowledge in a controlled environment. This is consistent with cognitivism, which focuses on building compatible internal mental models, a concept supported by Harris and Graham (1999) and Baumgartner (2013).
- Learning III: Constructing Knowledge emphasises independent problem solving and the transition to student-generated problems, which is consistent with the principles of constructivism. This stage encourages collaborative and realistic problem solving as originally proposed by Piaget in 1923.

Lastly, in 2020, Ramirez and Faust introduced a novel model of educational taxonomy that combines Bloom's digital taxonomy with the contemporary educational theories of constructivism and the principles of ML. This model, a third revision of Bloom's taxonomy, is specifically tailored to the needs of digital learners and the complexity of digital learning environments. Its uniqueness lies in the integration of ML and constructivist approaches with the principles of Bloom's Digital Taxonomy, which aims to create a taxonomy that is not only relevant for the digital age but can also be customised to the individual needs of learners. This reflects the dynamic nature of learning in digital contexts and the importance of supporting personalised learning pathways.

The *New Bloom's Digital Taxonomy Model* (see Table 2) places a strong emphasis on collaboration and understanding as essential components of learning in digital environments and adds these as new dimensions to emphasise the importance of interactive and reflective

learning processes. The model emphasises that effective digital learning involves more than just acquiring information, but also understanding how to navigate digital tools and resources efficiently and collaborating in the learning process. A critical aspect of this taxonomy is guiding learners in selecting appropriate tools and information, which is key to effective learning to reduce time spent searching and increase engagement with content. Ramirez and Faust's model emphasises the need to equip learners with the skills and strategies they need to navigate the vast array of digital resources effectively.

Table 2

New Bloom's Digital Taxonomy Model

<table>
<tr><td>Creating</td><td>Designing, constructing, planning, producing, inventing, devising, making, programming, filming, animating, blogging, publishing, video-casting, podcasting, directing, broadcasting</td><td colspan="2">Collaboration</td></tr>
<tr><td>Evaluating</td><td>Checking, hypothesising, critiquing, experimenting, judging, testing, detecting, monitoring, blog commenting, reviewing, posting, moderating, collaborating, networking, testing, reflecting, validating</td><td rowspan="5">Collaborating
Moderating
Negotiating
Debating
Commenting
Online meeting
Video conferencing
Reviewing
Questioning
Posting
Networking
Contributing
Chatting
Emailing
Twittering
Texting</td><td rowspan="5">Personalising
Mentoring
Following
Suggesting
Reacting
Coaching
Guiding
Rating
Adapting
Hash tagging
Updating
Adding
Rehearsing
Revising</td></tr>
<tr><td>Analysing</td><td>Comparing, organising, deconstructing, attributing, outlining, finding, structuring, integrating, linking, reverse-engineering, validating, cracking, mind-mapping</td></tr>
<tr><td>Applying</td><td>Implementing, carrying out, using, executing, showing, exhibiting, loading, playing, operating, hacking, uploading, sharing, editing</td></tr>
<tr><td>Understanding</td><td>Interpreting, summarising, inferring, paraphrasing, classifying, comparing,</td></tr>
</table>

	explaining, exemplifying, advanced searching, Boolean searching, twittering, categorising, tagging, commenting, annotating, subscribing	Instant messaging	
Remembering	Recognising, listing, describing, identifying, retrieving, naming, locating, finding, bullet pointing, social networking, highlighting, bookmarking, favouring, searching, googling		

Note. This figure is an own representation based on Ramirez and Faust (2020). It is originally based on (Churches, 2008).

Overall, the development of Baumgartner's taxonomy alongside the evolution of Bloom's taxonomy indicates a significant change in the principles of higher education didactics, reflecting a shift towards learner-centred, experiential, and problem-based approaches. These changes emphasise the need to adapt the educational framework to the demands of the digital age and changing labour markets to ensure that students are prepared for future challenges and opportunities.

2.2.2 Paradigm Shift

2.2.2.1 Learning Theories After 2001

Orthodox learning theories, primarily developed before the digital era, continue to underpin contemporary education. However, literature from the past two decades, including works by Kelly, McCain, and Jukes (2009), Tapscott (2009), Churches (2008), and Prensky (2001), underscores the need for curricular models in educational institutions to be more attuned to the education of digital natives. Around 2010, this issue gained significant attention, with experts like Baumgartner (2013), Hwang & Bowers (2012), Ferris (2011), Le Rossignol (2009), Sahin (2009), Tapscott (2009), Burkle (2009), and Feiertag & Berge (2008) advocating for teaching methods to be adapted to the unique needs and characteristics of digital natives to ensure meaningful student learning.

Kelly, McCain, and Jukes (2009) warned of a potential mismatch between current teaching practices and the expectations of digital natives. They criticised the prevalent 'that's the way we've always done it' (TTWWADI) approach in universities, which has led to stagnant teaching methods (Kelly, McCain, & Jukes, 2009, p. 34). To counter this, they argued for a

reevaluation and adaptation of existing learning theories. Despite this call for change, the knowledge and implementation of how to effectively integrate ICT in higher education to cater to digital natives remained inadequate as of 2014. This gap has resulted in apprehension, skepticism, and uncertainty regarding the approach towards digital natives and the evolving role of technology in supporting teaching and learning in higher education, as highlighted by Kivunja in 2014.

2.2.2.2 Criticism of ICT in Teaching and Learning

The uncertainty surrounding the integration of digital technologies into education has sparked both innovation and anxiety, leading to debate and research on the topic. Looking at the last two decades, Kennedy and his team first challenged the prevailing notion of students as eager users of new technologies in 2007. They found that while students were frequent users of established technologies such as online searches, email and mobile communication, their use of newer technologies such as blogs and wikis was limited, suggesting less engagement with Web 2.0 technologies for collaboration and self-publication. Kennedy et al (2007) urged further research before making claims about the need for drastic changes in universities to cater for this generation of students. In 2008, Kennedy et al. extended this research and questioned the term 'digital divide' and its impact on teaching and learning. They found slight differences in technology use in relation to mobile phones and games but no significant differences in role, gender, or age in the use of Web 2.0 technologies. Their findings suggest that the digital divide between students and teachers is not as wide as some commentators claim.

Furthermore, Kumar found in 2009 that students had a limited understanding of Web 2.0 and its applications in education, although they recognised its benefits for certain subject areas. Technologies such as online discussions, blogs, podcasts, and document sharing were seen as useful, but prior use of these technologies significantly influenced students' perceptions of their usefulness in higher education. Besides, Corrin, Lockyer, and Bennett (2010) examined technology use among first-year students and found a diverse use of technology that was generally lower in academia than in everyday life. Like Kennedy et al. (2008), they suggested that the integration of technology into students' lives should be explored in depth in order to support them effectively in teaching and learning.

Rourke and Coleman (2010) explored the integration of internet and mobile learning devices into blended and face-to-face teaching. They found resistance among higher education students to integrating technologies like social networking systems into face-to-face teaching, citing issues like access to resources and distractions. Morgan (2011) noted that the rapid introduction

of technologies in education did not correspond with broad uptake in schools and universities. He emphasised the need for a better understanding of the skills and dispositions students and teachers bring to the classroom and the effective integration of Web 2.0 tools. Reed (2013) investigated students' attitudes towards social media in education, focusing on Twitter. He argued against categorising students as digital natives based solely on age and emphasised the positive rating of social media tools for classroom use by engaged students. Ko, Thang, and Ou (2014) found that students preferred established technologies over new ones for both learning and leisure and were generally satisfied with their instructors' teaching methods.

In summary, these critical academic perspectives highlight the need for deeper investigation into the implementation of ICT in higher education. While acknowledging the private use of smart devices and social media by digital natives, they emphasise the need for guidance in educational contexts. The research collectively endorses the focus on established technologies rather than new and emerging ones for both learning and leisure, and generally supports face-to-face teaching. Overall, these critics recognise the necessity for changes in universities, curricula, and teaching practices to effectively offer digitally enhanced teaching and learning for digital natives. This body of work underscores the importance of adapting educational strategies to the actual usage patterns and preferences of students in the digital age.

2.2.2.3 Changing Roles of Higher Education

The integration of ICT in higher education, tracing back over two decades, represents a pivotal shift in educational methodology. Initially, studies in the UK in 2002 showed the effectiveness of using websites and asynchronous discussion boards for face-to-face class discussions, methods well-received by both students and tutors. Saunders (2002) found that student engagement with these ICT tools was primarily driven by their necessity for assessed coursework. Further research by Saunders & Klemming (2003) revealed that while students generally accepted ICT-enhanced teaching, they found it more challenging than traditional modules, although it led to improved performance.

Subsequent investigation by Saunders (2004) into the online learning strategy at the University of Westminster highlighted the need for centralised leadership and local support to avoid resource duplication and facilitate effective ICT usage among staff. However, confusion regarding the reliability of networked and local ICT tools posed a barrier to broader adoption. Virkus (2008) underscored the importance of adapting teaching to the learning preferences of both digital natives and digital immigrants, advocating for the pedagogical integration of Web 2.0 technologies in education. This approach recognises the challenge educators face in

effectively incorporating ICT and Web 2.0 technologies into their teaching methodologies. Le Rossignol (2009) described a shift in educational theory from traditional transmission models to learner-centred and performative approaches, moving from behaviourism and cognitivism towards constructivist learning theories. This shift has been marked by an increased emphasis on experiential learning and informal learning (IL), aligning higher education more closely with skills-based workplace requirements.

Kolo and Breiter (2009) argued that ICT-based innovations are essential for preparing students for a workforce increasingly reliant on technology. However, they noted the varied adoption of ICT across countries, proposing an educational innovation system model to overcome these challenges. Graject (2014) emphasised the need for aligning technology use with institutional culture and identity, while Gogela and Ntwasa (2015) stressed that using technology in teaching and learning is a fundamental principle in higher education, essential for enhancing learning outcomes. In this regard, Mehmood et al. (2017) highlighted the urgent need for a transformative approach in teaching and learning to drive global economic growth, indicating a gap between theoretical recommendations and actual implementation in institutions. This technological transformation has also impacted the roles of educators and students. Alarcia and Del Arco Bravo (2013) debunked the belief that students are inherently better ICT users than their teachers, a view supported by earlier studies by Saunders (2004) and Kennedy et al. (2008). Lee and James (2018) stressed the importance of teachers communicating in the language and style of their students to ensure meaningful learning, emphasising a reciprocal knowledge exchange between digital natives and digital immigrants. Bladergroen and Chigona (2019) found that while teachers, including digital natives, were willing to use ICT for teaching, they often lacked the skills for effective classroom ICT management, highlighting the need for ongoing support.

The evolving roles of educators and technology in the classroom have been a focal point of recent educational research. Alarcia and Del Arco Bravo (2013) challenged the widespread belief of a significant digital divide between students and teachers in terms of ICT competency. Their findings align with those of Saunders (2004) and Kennedy et al. (2008), indicating that both teachers and students possess a good level of ICT use, thus dispelling the notion that being a digital native is a prerequisite for mastering ICT tools. Lee and James (2018) emphasised the necessity for educators to engage actively with technology, advocating for a teaching approach that resonates with the language and style of digital natives to make learning meaningful. This

perspective supports the idea of a knowledge exchange between digital natives and digital immigrants, enhancing the integration of technology in classrooms.

Bladergroen and Chigona (2019) further investigated the challenges faced by teachers, including those who are digital natives, in managing ICT in the classroom. They found that while there is a willingness to use ICT for teaching, a lack of skills in effectively integrating these tools remains a barrier, underscoring the need for continued management support. Pinna, Mena, and Funes (2019) explored interactive learning tools such as Kahoot, highlighting their potential to stimulate and motivate learning through engagement and competition. They also endorsed methodologies like the flipped classroom, which involve and motivate students through innovative teaching strategies.

Shifting to the concept of didactics, Okoń (2003) defined it as the learning process that encompasses educators, learners, educational content, methods, and the environment of knowledge dissemination. This definition has evolved from a historical teacher-centric approach to a more learner-centric focus, as described by Arnold (2007). Modern educational models, such as the flipped classroom outlined by Schmitt-Fumian (2020), invert traditional learning sequences, placing greater emphasis on self-study facilitated by digital media, followed by in-depth classroom discussions. In the context of future skills, Ehlers (2020) highlighted the need for equipping students with competencies necessary for navigating a digitised world. This approach is supported by the findings of Stifterverband & McKinsey (2018), emphasising the growing importance of these skills for work and social participation. Ehlers (2022) conducted a meta-analysis identifying 17 future skills profiles across various domains, stressing the need for skills like digital literacy and intercultural communication. These skills, aligned with lifelong learning principles, are crucial in adapting to changing demands and learning environments, particularly highlighted during the COVID-19 crisis.

In conclusion, the ongoing development and potential of ICT implementation in higher education are significant. The necessity to adapt teaching and learning methods to the evolving needs of students and educators is paramount. This adaptation involves not just embracing new technologies and teaching strategies, such as the flipped classroom, but also facilitating the development of future skills, bridging the gap between theoretical recommendations and practical implementation in educational institutions.

2.2.3 Innovations in Higher Education

2.2.3.1 Acquisition of Blended Learning

In the context of blended learning (BL) within a didactic environment, the focus is on enhancing students' competencies, a term that, like didactics, lacks a universally agreed-upon definition. Competence, derived from the Latin 'competentia', implies the capacity to make authoritative judgments in various subjects based on relevant knowledge (Furmanek, 1997). Czerpaniak-Walczak (1999) defined competence as attributes evident in the skill level of socially acceptable behaviour, its implications, and the assumption of responsibility.

Blended learning itself has evolved in definition and application. Driscoll (2002), followed by Oliver and Trigwell (2005), offered three interpretations of BL: a combination of media and tools in e-learning, a mix of various pedagogical approaches, and an integrated combination of traditional and web-based learning. Clark (2003) cautioned against oversimplifying BL as just a fusion of face-to-face and online learning, while Garrison and Vaughan (2008) viewed BL as a thoughtful integration of these modalities, aimed at optimising student engagement. Bliuc et al. (2007) described BL as a systematic combination of face-to-face interactions and technologically mediated interactions, and Alammary, Sheard, and Carbone (2014) defined BL courses as those integrating different instructional methods. Emre, Masur, and Ranner (2020) expanded on this, describing BL as the combination of non-virtual/analogue and virtual/digital learning in a didactically meaningful mix.

In this framework, traditional f2f teaching formats like lectures and seminars are complemented by synchronous and asynchronous activities, allowing students to control the timing, location, and pace of their learning (Emre, Masur, & Ranner, 2020). Before the COVID-19 pandemic, BL was already gaining popularity as an effective approach to accommodate a diverse student population and enrich the learning environment (Alammary, Sheard, & Carbone, 2014). A meta-analysis by Means et al. (2009) concluded that BL is more effective than purely online or face-to-face learning. Westbrook (2008) emphasised the importance of defining BL, as it influences the design of BL courses. Simplistic views of BL have led some educators to merely add online activities to traditional courses, whereas more nuanced definitions imply a need for careful planning and integration (Garrison & Kanuka, 2004; Osguthorpe & Graham, 2003). Alammary, Sheard, and Carbone (2014) simplified BL into two key concepts: a pedagogically oriented process and a product comprising a mix of face-to-face and online components.

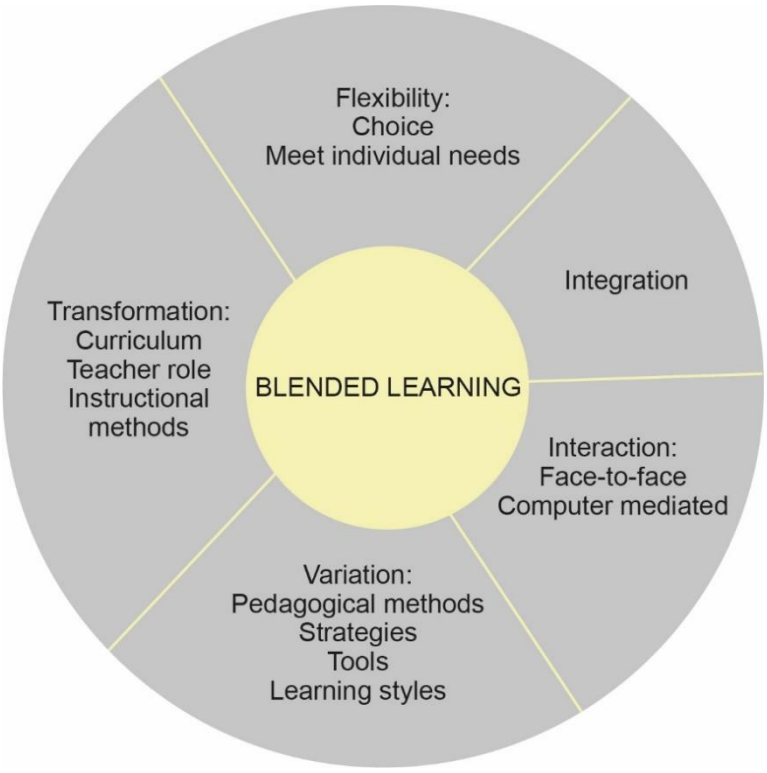
Vaughan (2007) identified the benefits of BL from different perspectives: students valued the flexibility and enhanced learning experience, while case studies showed positive effects on

learning outcomes (Rovai & Jordan, 2004; Graves & Twigg, 2006). For instance, the 'just-in-time' teaching method, where learning activities are spread out over the week, helps deliver material when students are most receptive (Novak, Patterson, & Gavrin, 1999). Alammary and his team (2014) identified three BL design approaches: low-impact blend (adding activities), medium-impact blend (substituting activities), and high-impact blend (building from scratch). Cress (2017) noted that BL is perceived as beneficial when it impacts the learning process, like forming online communities or engaging intensively with course material. At the management level, BL is expected to position institutions as innovative and address new target groups (Cress, 2017).

From a theoretical perspective, Atef and Medhat (2015) emphasised that regardless of the approach, the main pedagogical ideas of BL should integrate into BL environments (see Figure 7). Flexibility and integration are key aspects of this approach (Atef & Medhat, 2015). BL's benefits include continuity during university closures, transforming students into active learners, mitigating the effects of poorly designed online programs, and building relationships vital for the reflection process (Atef & Medhat, 2015).

Figure 6

Key Pedagogical Ideas Associated with the BL Definitions



Note. This figure is an own representation based on Atef and Medhat (2015).

Walker and Baets (2008) highlighted the significance of BL in higher education teaching strategies, developing an overview of instructional approaches for online learning (see Table 3). They suggested that instructional information processing, where knowledge is presented for accurate acquisition and reproduction, is compatible with online teaching methods. Social constructivist philosophy, which supports the discourse among learners and learning constructed in a social context, can guide the design of virtual spaces (Walker & Baets, 2008; Winn, 1993). The goal of instructional change in BL should be to create interventions where students use digital tools to negotiate meaning, share ideas, and solve problems, supported by various tools like wikis, blogs, and discussion forums (Aram & Noble, 1999). Additionally, Onguko (2014) examined the design, development, and implementation of BL interventions, finding that teachers exposed to new BL practices continued to use collaborative and action-based learning strategies. They also developed new content for self-study, complementing what they had previously learned. This approach highlighted the reciprocal support between digital native students and digital immigrant lecturers in implementing successful BL strategies (Onguko, 2014).

Table 3

Instructional Approaches and Their Consequences for E-learning

	Instructional Information Processing	**Instructional Behaviourism**	**Personal Constructivism**	**Social Constructivism**
Philosophy	Knowledge as reproduced cognition	Knowledge as changed behaviour	Knowledge as personally constructed meaning	Knowledge as socially constructed meaning
How to learn?	Learning is information processing	Learning is a response to stimuli	Learning is an independent experience and reflection	Learning is experiencing and reflecting on a social context
Electric Support	Virtual learning environments Technologies are used as a tool to support classroom activities	Computer-aided instruction environments	A range of manageable content-rich tools	A set of manageable, content-rich tools and instruments for knowledge sharing and collaboration

				E.g., Wikis, blogs, forums

Note: The content of the table is based on Walker and Baets (2008).

In the realms of formal and informal learning, BL supports both paradigms. Formal learning (FL), characterised by structured environments, organised curricula, and systematic assessment (Resnick, 1987; Eshach, 2007; OECD, 2018), contrasts with IL, which occurs outside formal institutions and is often self-directed, lacking formal assessment (Callanan, Cervantes, & Loomis, 2011; Sefton-Green, 2004; Eshach, 2007; Laurillard, 2009). IL can also be incidental and spontaneous, emerging from leisure activities (Kerka, 2000; Marsick & Watkins, 2001; Sefton-Green, 2004). Innovations in higher education, especially in language learning, have been significantly influenced by the rising prevalence of IL and the integration of mobile technology. Chen and Bryer (2012) observed a notable decline in classroom language learning from primary to secondary education, decreasing from 19% to just 5% by the final years of high school. This trend underscores the growing significance of IL as students progress into higher education, highlighting a shift in the importance of learning location.

Mobile learning (m-learning), facilitated through various devices like smartphones and tablets, has gained relevance in education (Sung, Chang, & Liu, 2016). Sharples et al. (2009, p. 225) describe m-learning as knowledge acquisition through exploration and conversation across multiple contexts, involving interaction with people and technologies, transcending spatial, temporal, and conceptual boundaries (Kukulska-Hulme et al., 2009). The adoption of mobile technology in education has refocused pedagogical interactions around these technologies, making one-to-one computing a potent tool for learning in both traditional and informal settings (Sung, Chang, & Liu, 2016, p. 252).

Mobile Blended Learning (MBL) integrates mobile technologies into the university system, creating an environment conducive to mobile collaborative learning (Khaddage, Lanham, & Zhou, 2009). It enables a shift from formal to informal learning contexts (Lai, Khaddage, & Knezek, 2013), merging formal and informal learning through methods like micro-blogging (Gao, Luo, & Zhang, 2012) and fostering a flexible MBL framework through IL activities initiated by mobile devices (Clough et al., 2008). MBL supports situational and situated learning, where situated learning is a social process within a specific activity, context, and culture (Lave & Wenger, 1991; Brown, Collins, and Duguid, 1989), and situational learning focuses on practice-oriented learning (Lave & Wenger, 1991). MBL incorporates learner mobility into learning opportunities, supporting activities in both social and hands-on contexts (Glahn & Gruber, 2018).

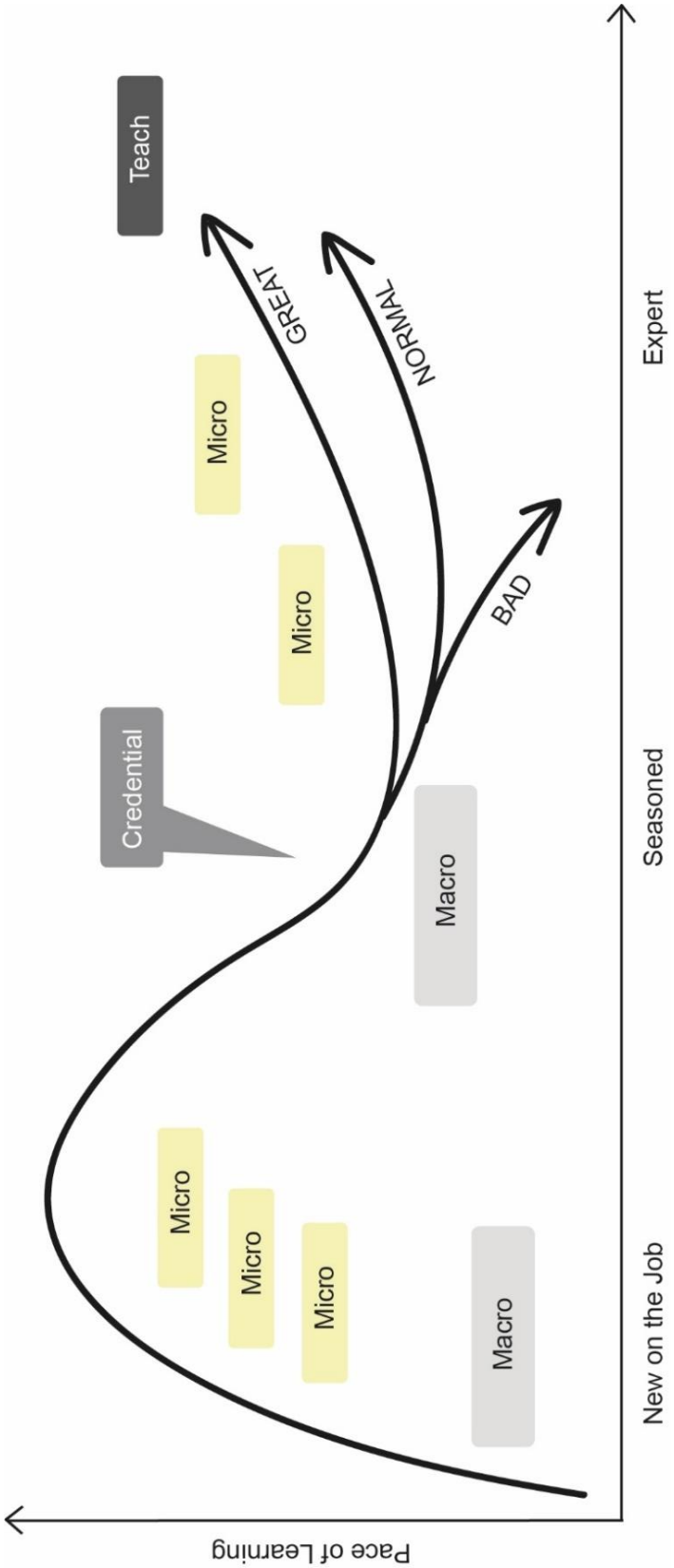
The integration of informal learning into the formal curriculum, as Banks et al. (2007) suggest, could significantly enhance current educational approaches. This integration acknowledges the value of diverse learning experiences and the potential of IL to supplement formal education. By combining structured and unstructured learning opportunities, this holistic approach enriches the overall educational experience, offering a comprehensive perspective that encompasses both structured and unstructured learning opportunities. Consequently, MBL stands out as a versatile approach in the evolving landscape of higher education, adaptable to various teaching and learning activities and reflecting the significant shift towards digital technology in educational settings. This shift not only highlights the importance of integrating mobile and web-based technologies into learning processes but also emphasises the need to reconceptualise educational methodologies to accommodate the dynamic interplay between formal and informal learning environments.

2.2.3.2 The Role of Micro-Learning

In higher education, micro-learning (ML) has emerged as a pivotal educational approach, evolving from its initial conception by Glahn, Hug, and Gassler (2005) as brief, self-contained learning activities. This approach has developed into a multi-platform tool that caters to a broad spectrum of learners (Shail, 2019). Göschlberger and Anderst-Kotsis (2019, p. 2) define ML as digital learning resources that are interactive, self-explanatory, and can be completed in a brief timeframe, offering immediate feedback, thereby catering to the modern learner’s need for quick and efficient learning.

Figure 7

Micro-Learning Units Enhancing Macro-Learning Units

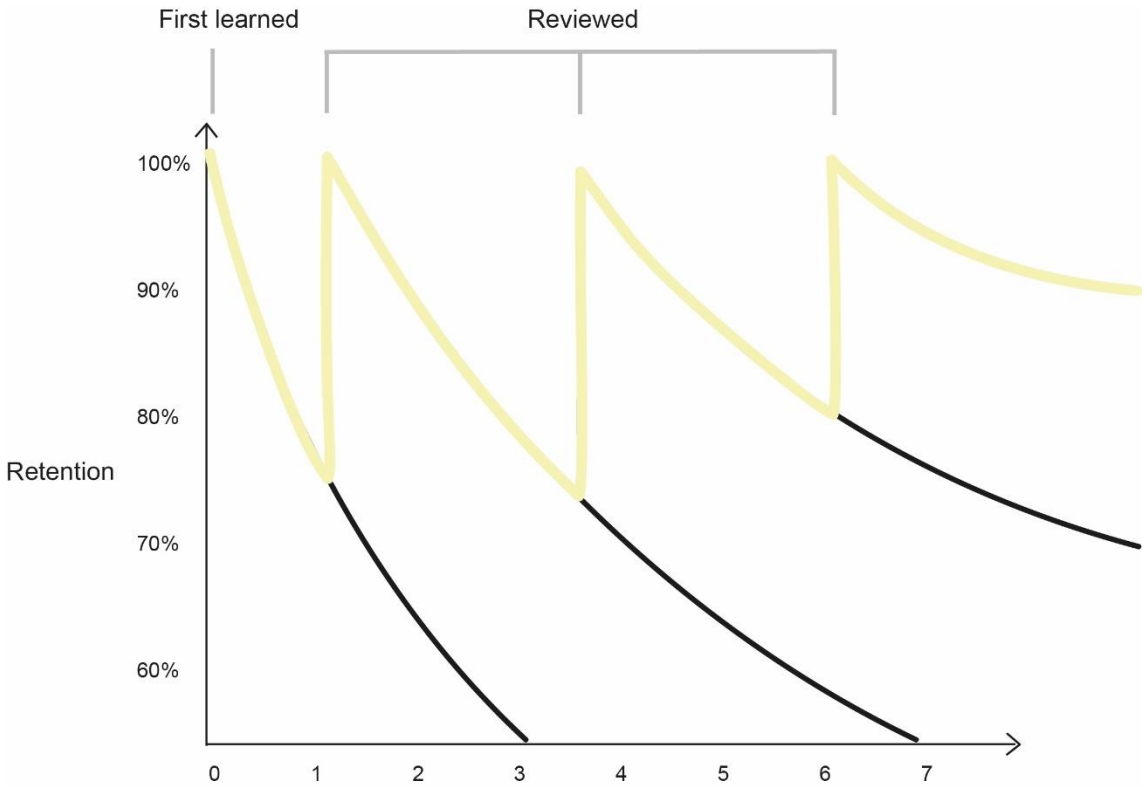


Note. This figure is an own representation of Bersin (2020).

The significance of ML is further accentuated by its relationship with the forgetting curve, a psychological concept introduced by Ebbinghaus in 1885. This curve highlights how memory retention declines over time and emphasises the importance of repetition and continuous questioning in learning. ML's method of regular repetition is analogous to acquiring job skills through consistent practice and inquiry, thereby enhancing retention and understanding (Bersin, 2017, p. 30). Contrasting with macro-learning, which is designed for in-depth learning of new domains, ML is focused on providing concise, online resources for rapid and targeted learning experiences (Kovachev, Cao, Klamma, & Larje, 2011; Hug, 2005; Glahn, 2013).

Figure 8

Ebbinghaus' Forgetting Curve



Note. This figure is an own representation of Bersin (2017).

ML is predominantly utilised in IL contexts, offering a flexible, bite-sised approach to education, as opposed to the more structured and comprehensive nature of macro-learning found in FL environments (Bersin, 2017; Kamilali & Sofianopoulou, 2013). This adaptability of ML makes it an ideal tool for modern educational settings, where the needs and preferences of learners are diverse and dynamic. In the context of higher education, ML's role in augmenting macro-learning has been increasingly acknowledged. Baumgartner (2013) investigated the action structures at the micro-level, underscoring ML's utility in supporting

and enhancing macro-learning. This approach integrates knowing-on-action for novices with knowing-in-action through practice, along with reflection-in-action and reflection-on-action as key components of continuous learning, guided by communicative theories like those of Habermas (1995; 2006).

Research by Kang (2016) and others has demonstrated the effectiveness of ML in aiding long-term knowledge retention. By employing strategies like the repetition of lessons in smaller steps and leveraging the primacy and recency effects, ML facilitates the transfer of information from short-term to long-term memory (MacLeod, Reynolds, & Lehmann, 2018; Roesler, 2017; Shail, 2019; Meacham, 2016). Furthermore, ML enhances student engagement and fosters a passion for learning through diverse formats, such as micro-lectures and micro-teaching with interaction (Liu, 2018; Jiang & Su, 2017; Göschlberger & Bruck, 2017; Sofianopoulou & Kamilali, 2012; Penrose, 2008).

Lastly, Reinmann (2010) argued that while ML should not supplant comprehensive educational methods, it can effectively complement them. By adapting components of broader training for ML units, a holistic and enriched learning experience is achieved. ML's flexibility in terms of content delivery and format, combined with its focus on problem-oriented and targeted learning, makes it an essential tool in the modern educational paradigm, effectively bridging gaps and enhancing the overall learning process in higher education.

2.2.3.3 The Potential of Social-Microlearning

In the evolving landscape of higher education, a novel subtype of micro-learning (ML) known as social micro-learning (SoML) has gained prominence. This approach represents a blend of the concise, focused aspects of ML with the principles of social learning, placing emphasis on knowledge sharing and integrating social dimensions into the learning process.

Social learning, as introduced by Bandura in 1977, posits that learning occurs through observation, imitation, and modelling, influenced by factors such as attention, motivation, and emotions. This theory acknowledges the interplay of environmental and cognitive elements in the learning process (Cherry, 2019). In the digital era, higher education faces the challenge of blending traditional and contemporary didactic approaches to meet the changing needs of students. This includes fostering student-centred learning, collaboration, individualised learning experiences, and flexible learning times across different devices (Chicca & Shellenbarger, 2018; Kirschner & De Bruyckere, 2017; Meacham, 2016; Kresch & Evans, 2015; Churches, 2008; Vaughan, 2007).

Baumgartner (2013) and Riel and Sparks (2009) highlighted the importance of building and maintaining relationships for successful reflective learning, achievable more effectively in a classroom setting. Students benefit from interaction with peers and teachers, enhancing their learning beyond the material through knowledge sharing. Observational learning (OL), a key aspect of social learning, posits that learning can occur by observing others, a concept that can be integrated with discovery (informal learning) and didactics (formal learning) (Bandura, 1977; Cherry, 2019; Hart, 2022). OL is central to social learning and involves attention, memory, and motivation. Successful learning requires observing behaviours and internalising them, which can happen both formally and informally (Cherry, 2019). Vygotsky's (1978) theory of social development and Lave and Wenger's (1991) theory of situated learning further support the idea that learning is a function of activity, context, and culture, often occurring in social settings.

Digital innovations have revolutionised social learning, with social media emerging as a vital tool for informal social learning. Grevtseva, Willems, and Adachi (2017) and Emerson and Berge (2018) view social media as integral to modern teaching and learning in higher education. Hamid et al. (2010) suggested that social media activities like content generating, sharing, interacting, and collaboratively socialising can support educational delivery. Cubukcuoğ and Elci (2012) found that social networks can serve as supportive virtual learning environments, enhancing engagement and collaboration among students and teachers.

Pioneered by Göschlberger (2016), SoML was initially proposed as a platform to motivate students to create and share learning activities, utilising interaction patterns found in successful social web solutions. This innovative approach aligns with Vygotsky's (1962) theory on the importance of collaborative learning and its pivotal role in equipping students with future skills, as emphasised by Ehlers (2020). By focusing on fostering knowledge sharing rather than mere transfer, SoML marks a significant shift in educational methodologies, reflecting the growing trend towards more interactive and socially-engaged learning experiences in higher education. SoML aligns with Vygotsky's (1962) emphasis on collaborative learning and is anchored in social constructivism. It aims to facilitate knowledge sharing through communities of practice (CoPs), offering a learner model that provides guidance for novices and autonomy for expert learners (Göschlberger, 2022). This approach contrasts with the more individualistic and content-focused perspective of traditional ML, as outlined by Anderson and Dron (2010), and emphasises the role of collaboration, increasingly recognised as a crucial 21st-century skill (Valcke et al., 2009; Churches, 2008).

In the context of higher education, SoML is yet to be fully explored. However, it holds the potential to enhance BL by incorporating elements of social learning into ML activities. Göschlberger's (2017) research indicates that SoML can elevate learners' engagement with higher cognitive levels – such as analysing, evaluating, and creating – through strategies borrowed from social software. This process leads learners through an upward spiral of competence development, aligning with Baumgartner's (2013) competence spiral. Pandey (2016) suggests that combining social learning with ML can provide learners with a more personal, accessible, and focused learning experience. The integration of SoML into BL in higher education could result in learning content that is easily accessible, bite-sized, and less time-consuming, fitting well with the modern learners' preferences and habits. This integration also offers multi-device compatibility and flexibility to incorporate various features, enhancing the overall learning experience.

Despite its potential, SoML still lacks a well-established scientific foundation. However, its prospects for enhancing formal learning in higher education are promising, provided it is utilised in a didactically meaningful manner. SoML assumes that centralised curation of learning content is not feasible due to the rapid development of knowledge. Instead, it leverages CoPs to share, discuss, and develop knowledge through micro-content units, transforming these into a dynamic repository of evolving knowledge (Göschlberger, 2016; Wrenger, 1998). Paavola and Hakkarainen (2005) further support this approach by suggesting a third metaphor for learning, beyond the traditional acquisition and participation metaphors, focusing on knowledge creation. This view aligns with Anderson and Dron's (2010) categorisation of learning processes following social constructivist or connectivist pedagogies, which emphasise the creation and maintenance of networks connecting people to others and resources (Siemens, 2005; Bell, 2011). Göschlberger (2017) underscores the importance of designing ML systems that can support a learner's progression through different cognitive levels of educational objectives, making them more engaging and insightful. Hanshaw and Hanson's (2019) research in the workplace context, although not directly transferable to formal higher education, provides insights into the potential benefits and challenges of implementing SoML.

In conclusion, SoML represents a promising, albeit nascent, field within higher education. Its focus on social interaction, collaboration, and the practical application of knowledge through CoPs positions it as a valuable addition to BL strategies. As the body of research in this area grows, SoML is poised to become a significant contributor to the evolution of pedagogical

approaches in higher education, aligning with contemporary learning needs and the digital era's challenges and opportunities.

2.3 Conclusions

The extensive review of literature concentrates on higher education in the context of contemporary students, particularly Generation Z's affinity with digital environments. This segment scrutinises the implementation and evolution of information and communication technology (ICT) in educational settings, the progression towards BL in higher education, and the specialised area of SoML. Additionally, it encompasses a thorough examination of significant learning theories and the historical development of teaching methodologies, tracing their evolution from past paradigms to contemporary practices.

Central to the literature review are pivotal learning theories, including Behaviourism, Cognitivism, Constructivism, and Social Learning (Chowdhury, 2006). The research primarily focuses on the constructivist approach to teaching and learning, highlighting the role of learners in constructing knowledge through experiences, with educators serving as facilitators. This is complemented by a detailed exploration of social learning theories, particularly Bandura's (1977) social learning theory, Vygotsky's (1978) social development theory, and the situated learning theory by Lave and Wenger (1991), which collectively underscore the importance of social interaction and contextual learning in cognitive development. The dissertation also discusses Bloom's Taxonomy (1956) and its significant role in structuring educational objectives in German higher education, particularly within the cognitive domain. The taxonomy has undergone revisions to accommodate technological advancements and digital learning challenges, most notably in Anderson et al.'s (2001) and Krathwohl's (2002) revised versions, and further in Churches' (2008) proposal of Bloom's Digital Taxonomy. An important aspect of the theoretical review is the paradigm shift in education around the year 2000, focusing on the necessity to adapt traditional learning theories for the digital native generation. This shift, highlighted by various scholars (e.g., Baumgartner, 2013; Le Rossignol, 2009; Kelly, McCain, & Jukes, 2009; Tapscott, 2009; Churches, 2008; Feiertag & Berge, 2008; Prensky, 2001), reflects the ongoing debate and uncertainty about the effective integration of ICT in higher education.

Innovations in teaching and learning are further explored through the concept of ML, as delineated by Bersin (2017), which involves engaging in short, self-contained learning activities. This approach is contrasted with macro-learning, emphasising its role in facilitating continuous learning and addressing the challenges of memory retention. The dissertation also

highlights the significance of social learning in higher education, drawing from the theories of Vygotsky (1978) and Lave and Wenger (1991), which complement Bandura's social learning framework. A key innovation discussed is the concept of SoML, which merges the principles of ML with the social dimensions of learning within communities of practice (CoPs). SoML is characterised by its adaptability, efficiency, and flexibility, making it conducive to learning in dynamic environments. However, the dissertation acknowledges a gap in the literature regarding the empirical substantiation of SoML's effectiveness in higher education, suggesting a need for further research using both qualitative and quantitative methodologies to explore this emerging field.

Chapter 3: Methodology

3.1 Research Context and Frameworks

In this thesis, the methods are framed within the context of Information and Communication Technology (ICT) use in universities, focusing on the interdependencies between students, lecturers, and the university's didactically implemented technologies. This approach links the findings of this thesis to the broader dynamics of educational innovations, making them applicable to various university settings.

3.1.1 Educational Innovation Levels

The research undertaken in this thesis considers innovation within the educational domain at both the individual and institutional levels, as framed by Kolo and Breiter (2009). This approach is essential to comprehensively understand the dynamics and impact of innovation in an educational setting like Macromedia University.

At the individual level, the focus is on the practices, beliefs, and processes of media appropriation among critical stakeholders in the educational process:

- Teachers: This includes exploring how educators integrate new technologies into their teaching, their attitudes towards innovative pedagogical approaches, and their engagement with digital media in the educational context.
- Students: The research examines how students adapt to and engage with these innovative teaching methods and technologies, and how these changes affect their learning experiences and academic outcomes.
- Parents: While not a central focus of this thesis, the role of parents is acknowledged as influential in shaping students' attitudes and responses to educational innovations.

At the institutional level, the research delves into:

- University Culture: This aspect considers the overarching ethos and attitude of Macromedia University towards innovation, including its openness to new teaching methods and technological integration.
- Development Processes: The focus here is on the processes and strategies employed by the university to develop and implement innovative educational practices, including the role of technology in these processes.
- Technology Integration: The research assesses how effectively technology is incorporated into the university's teaching practices and curriculum design, evaluating both the resources available and the outcomes of such integrations.

This thesis deliberately excludes examining the macro level of innovation, which typically encompasses broader regional and educational policy elements. This exclusion is strategic, allowing the research to concentrate on the more direct and immediate aspects of innovation at the individual and institutional levels.

In summary, by examining both the individual and institutional levels of innovation in education, this thesis aims to provide a nuanced understanding of the multifaceted nature of educational innovation. This approach is crucial for comprehending how innovative practices are adopted and implemented within a university setting and identifying the factors that facilitate or hinder these processes.

3.1.2 Impact of the Bologna Reform

The academic degree of a bachelor is still comparatively young. The changeover to the bachelor-master system began in Germany in 1999 with the signing of the Bologna Reform. Since then, the higher education system has changed fundamentally (Baumann & Benzing, 2013). The changeover to the bachelor-master system has fundamentally changed the German higher education landscape. One of the most significant upheavals was abolishing the old diploma exam and magister degree programmes, which some universities still resist today. During the process, the requirements for the degree programmes increased, which had an impact on the workload of the students. For this reason, the introduction of the bachelor's degree was criticised (Online Akademie, 2020).

After implementing the German education system, the Bologna Reform was criticised and led to student protests (Winter, 2015). The downsides of the reform included a highly structured bachelor's programme that limited independent thinking and pressure to perform, difficulty

reconciling a part-time job or raising children with the programme, reduced professional qualifications, and difficulties combining regular study time and a stay abroad. However, there were also benefits, such as streamlining subject matter and increased practical relevance, a more leisurely start for first-year students, earlier entry into professional life, and more flexible career planning (Online Akademie, 2020; Winter, 2015). Despite the heavy criticism, the reform remained and led to changes such as modularised and structured study programmes with a credit point system, standardised periods of study, and accreditation of degree programmes by agencies. The teaching of scientific fundamentals, methodological competencies, and professional qualifications are ensured in the bachelor's degree programmes, and the master's degree programmes focus on application or research. A core element in the qualification's framework is the formulation of learning outcomes or *competencies* (Online Akademie, 2020; Funter, 2012).

The new focus on acquired competencies reflects the general shift from input to output orientation within the Bologna Process. It is no longer about the course content 'input' description, but about what students can do after completing a module or a study programme 'output' (Kopf, Leibold, & Seidl, 2010). The formulation of competencies is essential both as a (1) qualification goal of the study programme at the level of a study programme and as a (2) qualification goal of the module when preparing module manuals at the module level (Baumann & Benzing, 2013). The central component of these competencies is subject competence, which comprises subject-specific knowledge and methods. In addition, the acquisition and development of general methodological, social, and personal competence should be part of higher education. The individual competencies are each composed of both a cognitive and a functional dimension, i.e., not only specific theoretical knowledge but also its practical implementation is the goal of education. These different competencies are distributed very differently depending on a degree programme's course and examination form (Baumann & Benzing, 2013; Kopf, Leibold, & Seidl, 2010).

There is no single definition of the term 'competence'. According to Weinert (2001), competencies include knowledge, skills, and motivational and social aspects. Competencies are acquired in educational processes, enabling people to cope with various academic, occupational, and social problems. For the proof of competencies, the observable actions of a person are in the foreground. There are four types of competence areas: (1) professional competence, (2) methodological competence, (3) social competence, and (4) self-competence (Weinert, 2001). The term professional competence includes professional knowledge and

methods and their application (cognitive and functional dimension of competence), which are necessary to cope with specific tasks. In contrast, methodological competence encompasses knowledge and skills that can be used independently of the subject and enable complex tasks and problems to be mastered independently and flexibly. Social competence refers to knowledge, skills, and abilities related to communication, cooperation, and conflict in intra- and intercultural contexts. They enable people to act appropriately in relationships and realise individual and shared goals. Self-competence is the ability and willingness to develop one's talents, motivation, and willingness to perform and the development of specific attitudes and an individual personality (Baumann & Benzing, 2013).

The different levels of competence can be distinguished and assigned based on the taxonomies of Bloom (1956), Anderson et al. (2001), and Krathwohl (2002). In doing so, they are assigned to learning objectives that can best be described with the help of learning objective taxonomies. This is a reference system for classifying statements about what students should be able to do at the end of a learning process and to what depth and breadth. The higher the level, the higher the demands on the learners and the more abstract the content requirements. The hierarchical representation makes it clear that each level is determined by the learner's ability to work at the levels below. The value of this taxonomy for formulating learning outcomes lies in the possibility of linking learning objectives to a level and thus making a very precise statement about what a learner knows, understands, and can do at the end of a learning unit.

3.1.3 Theoretical and Conceptual Framework

In the conceptual framework of this dissertation, Garrison, and Vaughan's (2008) interpretation of BL serves as a foundational definition. This perspective views BL as a thoughtful amalgamation of f2f and online modalities, focusing on optimising student engagement by integrating traditional classroom methods with digital learning environments. The approach is strategic, moving beyond a simplistic fusion of in-person and online instruction, and necessitates careful planning to create a cohesive learning experience.

Furthermore, the framework encompasses the advantages of learning from home, supported by ML and self-assessment. This aspect highlights the flexibility offered to students, allowing them to tailor their learning experience to their individual preferences and schedules, a point underscored by Atef and Medath (2015) and Vaughan (2007). ML plays a crucial role in enabling self-assessment and pacing, crucial for future skill development (Ehlers, 2022; Shail, 2019). Additionally, learning techniques like paused repetition help prevent mental fatigue and enhance long-term cognitive retention (Shail, 2019; MacLeon, Reynolds, & Lehmann, 2018;

Bersin, 2017; Meacham, 2016). Social learning activities, both within and outside the classroom, are emphasised to promote interaction and reflective learning (Baumgartner, 2013; Riel & Sparks, 2009). The design of micro-units effectively captures student attention, ensuring time-efficient and cost-effective learning (Göschlberger & Bruck, 2017). The promotion of self-learning and management through micro-teaching strategies nurtures essential future competencies and fosters lifelong learning (Liu, 2018; Ehlers, 2022), thereby supporting self-management, self-control, and motivation (Sofianopoulou & Kamilali, 2012; Garrison, 1997).

This theoretical underpinning serves as a comprehensive understanding of BL's broader implications and benefits in contemporary educational contexts. It advocates for a balanced integration of traditional and modern learning techniques to optimise the educational experience.

3.1.4 University's Educational Framework

To be a pioneer in the market, associated didactic challenges need to be tackled, such as a lack of professionals and space constraints of the universities due to the rising number of students, time constraints of students as the individual living conditions are becoming more diverse, as well as time difference of international students. Students need to learn to find their way through the ubiquitous, constantly available information on multimedia platforms. This happens in the sense of flexible, connectable learning paths. These are implemented in the form of *BL* building upon the university *didactics*.

At Macromedia University in Germany, the educational approach and pedagogical strategies are anchored in an innovative internal concept known as *mPower*. This framework is pivotal in understanding the university's unique approach to teaching and learning. It integrates contemporary educational theories and practices to create a dynamic, responsive, and student-centred learning environment. Principles of the mPower Concept include:

- Competence-Based Learning: Central to mPower is the focus on developing competencies rather than mere knowledge acquisition. This approach aligns with the Bologna Reform's emphasis on outcome-based education, where the goal is to equip students with skills and abilities directly relevant to the demands of the professional world. Competence-based learning in mPower is about ensuring that students not only understand theoretical concepts but also can apply them in real-world contexts.
- Constructivist Learning Theories: The mPower model is grounded in constructivist theories of learning (Vygotsky, 1962; Bruner, 1960; Dewey, 1929; Piaget, 1923) which posit that learners construct knowledge through experiences and reflections. It enables

flexible study programmes in the BL format, which are manifested in different weightings between the poles of physical presence (synchronous) and structured self-learning activities (asynchronous) according to their specific forms of implementation. This perspective encourages the most critical success factor for *mPower*-guided learning and teaching, the consistent intensification of active and interactive learning, where students engage with the material, participate in discussions, and collaborate with peers, leading to a deeper understanding of the subject matter.

- BL Approach: mPower incorporates BL, which combines traditional f2f classroom methods with modern digital techniques. This hybrid approach allows for a flexible and adaptive learning experience, catering to the varied preferences and requirements of the student body. BL under mPower not only enhances accessibility and convenience but also fosters a more engaging and interactive educational environment (Cress, 2017; Atef & Medhat, 2015; Alammary, Sheard, & Carbone, 2014; Walker & Baets, 2008).
- Flipped Classroom Methodology: A key feature of mPower is implementing the flipped classroom model. This approach reverses the traditional learning sequence – students are first introduced to new content outside of class, typically through digital means, and then apply this knowledge in class through problem-solving activities, discussions, and collaborative projects. The flipped classroom model emphasises the application and analysis of knowledge, fostering critical thinking and practical skills (Pinna, Mena, & Funes, 2019; Gaebel & Zhang, 2018; Johnson & Renner, 2012).

The role of mPower is to ensure the innovative and adaptive capacity of society and the economy by qualifying students. The concept builds on the assumption that knowledge and skills alone are insufficient to meet new contexts' challenges. Developing special competence profiles and a new willingness to act requires further motivational and social resources. The Macromedia University of Applied Sciences aims to orient educational processes in a potential-oriented and sustainable way, to design them individually and flexibly to prepare learners in the best possible way for the challenges of the future and at the same time to strengthen their employability and positive study experience. The university does that through the didactic mPower concept (see above). This concept is in line with the purpose, vision, and values of Macromedia University and serves as a guiding principle for all members of the university (Masur, Emre, & Ranner, 2022[3]).

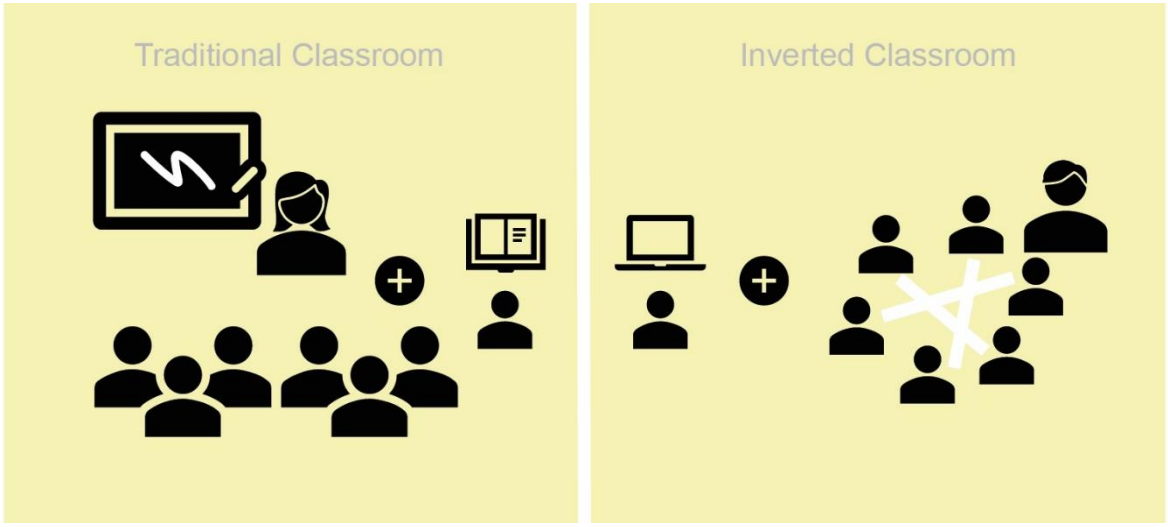
Thereby, mPower is not just a theoretical concept but is actively integrated into the university's curriculum and teaching methodologies. Faculty members are trained and encouraged to design

their courses around these principles, ensuring that classroom activities, assignments, and assessments align with the competency-based and constructivist approach. Technology and digital tools are a significant aspect of mPower, enabling the seamless integration of online and offline learning experiences. This includes using learning management systems, online resources, and interactive digital platforms to complement traditional teaching methods. Assessment strategies under mPower are also aligned with its principles. Instead of traditional exams focusing solely on rote memorisation, assessments are designed to evaluate students' understanding, problem-solving abilities, and the application of knowledge in practical settings.

The mPower concept is particularly relevant to this study as it exemplifies a modern and progressive approach to higher education, focusing on developing practical skills and competencies. BL teaching occurs in the *inverted* or *flipped classroom* (see Figure 10). Here, the conventional principle of learning phases and locations is reversed: the acquisition of specialised knowledge, which is growing ever faster in digitalisation and globalisation, takes place in self-study at home or on the road via digital media that is quality-assured by the university. The subsequent consolidation of what has been learned and the intensive examination of related issues occurs in the physical classroom during contact time (Emre, Masur, & Ranner, 2022). Its emphasis on BL and the flipped classroom model makes it an ideal framework for investigating the effectiveness of innovative teaching strategies, especially in the context of this research, which focuses on BL and its impact on student learning outcomes.

Figure 9

The Flipped Classroom Approach as Success Factor for Blended Learning



Note. This figure is an adaptation of Macromedia University's didactic concept *mPower* based on Emre, Masur, and Ranner (2022).

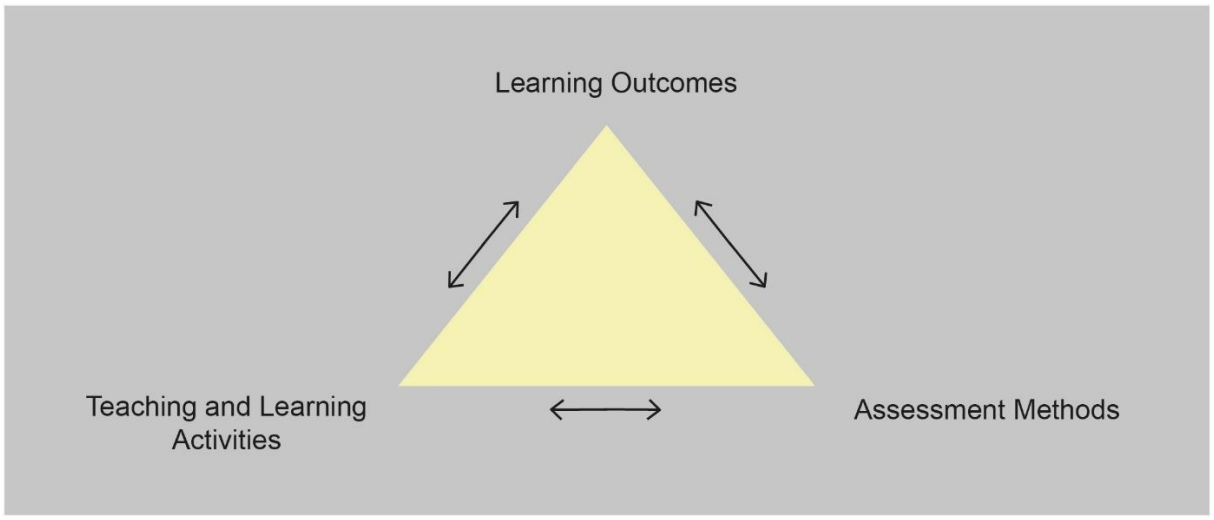
[3] Source from the university intranet (not publicly accessible).

All courses are designed based on *competencies* and *learning objectives* based on the Bologna reform (Macromedia University of Applied Sciences, 2018). Pursuing a competence-based approach means that the didactic focus is on students' employability, not memorised knowledge (Emre, Masur, & Ranner, 2020; Held, 2019). The principle of *lifelong learning* plays an important role here, as it relies heavily on individuals' self and information literacy (Kamilali & Sofianopoulou, 2013). The university is constantly testing, questioning, and developing innovative tools for the future digital world of work – combining the didactic concepts of lifelong learning, competence orientation, and flipped classroom with forms of digitised teaching and learning that incorporate the diversity of students into teaching (Emre, Masur, & Ranner, 2020).

Besides these core concepts, the university didactics are based on *constructive alignment*. As defined by Wunderlich and Szczyrba in 2018, "constructive alignment means consistently aligning the goal of a course, the pathways to that goal, and the assessment. What is described in the goal is tested" (p. 81). The concept can be used as a basis to bring the objectives of a course, the form of examination, and the teaching-learning activities into a coherent structure (see Figure 11). The core of the concept of constructive alignment is that the intended learning outcomes are clearly defined and made clear to students and that the assessment and learning activities are stringently aligned with the intended learning outcomes (Schaper & Hilkenmeier, 2013; Biggs & Tang, 2011).

Figure 10

The Concept of Constructive Alignment



Note. This figure is an own representation based on Biggs and Tang (2011).

Overall, the didactic concept, from lesson planning to constructive alignment, is geared toward teaching competencies. The overarching goal is to teach the students sector-specific competencies, the so-called *future skills*. Future competencies are defined as competencies of a specific nature (Ehlers, 2020; 2022). For example, when developing a solution to a new problem, the ability to change perspectives, flexibility, openness, as well as interdisciplinarity is essential. These competencies are summarised, for example, in a future skill profile called design thinking competence (Ehlers, 2022). For example, when it comes to finding one's way in increasingly networked, often confusing, and complex organisational roles and discussion contexts when working in a different field or when acting privately in very differentiated, patchwork and elective family constellations, skills such as dealing with ambiguity, acting in uncertain situations, and dealing with heterogeneity are essential. The study summarises these skills as future skills under the label ambiguity competence. There are currently a total of 17 future skills profiles (Ehlers, 2022).

Until March 2020, Macromedia's courses were only offered as f2f sessions. However, the switch to BL was in the planning phase. Due to the external impact of COVID-19 in March 2020, the BL scenarios under development were immediately applied nationwide. Macromedia University of Applied Sciences could switch to virtual teaching within a week by using its BL foundation. The scenarios were already applied but further developed.

Blended or hybrid learning combines the best of both worlds: f2f and online learning. Successful implementation of BL in course design required a fundamental shift in thinking to optimise student engagement and to restructure and replace traditional classroom contact hours (Garrison & Vaughan, 2008). A platform was also needed to deliver online courses, share information with students and store course materials. For this purpose, *Microsoft Teams* (MS Teams) was used initially and later *Blackboard* (BB). These platforms have social functions and mobile application possibilities, i.e., mobile blended learning (MBL) activities, which are used as one of the most critical communication and educational tools (Emre, Masur, & Ranner, 2020). Generally, the platforms combine functions such as group chats, online meetings, notes, and attachments. They were first introduced at Macromedia University during quarantine in March 2020. Since their introduction, they have become an integral part of sustainable BL implementation at the university (Emre, Masur, & Ranner, 2020). Other platforms, such as Moodle or OneDrive, are used to store larger amounts of data. Moodle is further used as the foundation for classes and an upload tool for term papers. MS Teams, on the other hand, is used for all types of classes except the ones which must be performed f2f, such as acting workshops

or location scouting seminars in the Film- and Television study programme. The classes were performed fully online during the quarantine in 2020 and the lockdown in 2021.

The existing BL scenarios at the university are:

- *Cross-campus scenarios* (entirely online) for low-interaction teaching formats or bringing together micro-cohorts, such as
    - Lecture – Scenario A,
    - Lecture & Exercise – Scenario B,
    - Seminar & Workshop – Scenario C, as well as
- *Campus-related scenarios* (blended/ presence) for low and high-interaction teaching formats in rotation, such as
    - Seminar & Workshop – Scenario D, and
- *Campus-related scenarios* (entirely on-site) for high-interaction teaching formats for small groups, such as
    - *Lecture, Exercise, Seminar, Workshop* – Scenario E.

Scenarios A, B, and E are accompanied by non-academic *technical support* (NAS[4]).

The various scenarios for teaching and learning each have their unique approach and methodology. Scenario A, for example, is divided into A1, which involves self-learning using digital resources and occasional virtual tutorials. In contrast, A2 involves full-length virtual lectures with interactive elements to keep students engaged. Scenario E is an on-site lecture with the option for more minor group work or individual content development. Exercises are carried out either in a virtual presence (Scenario B) or in person (Scenario E), focusing on applying knowledge rather than transferring knowledge. Special support is provided during the self-learning phase, with a clear structure, content assistance, and self-monitoring options. Seminars and workshops are also offered in various formats depending on the learning objectives, program size, and campus facilities (Emre, Masur, & Ranner, 2020).

3.2 Research Design

3.2.1. Philosophical Approach

This thesis adopts Pragmatism as the primary philosophical approach. This philosophy acknowledges the value of objective and subjective perspectives, making it particularly suitable for educational technology research, where understanding the measurable outcomes and the lived experiences of individuals is crucial (Saunders et al., 2009).

As a philosophical underpinning, pragmatism guides the choice of research methods, enabling a flexible approach that can adapt to the complexities of real-world educational settings. It

4 Non-academic support (NAS) is an additional event that supports the regular courses. The support supports the training of predominantly technical or craft skills. Thereby, a coupling of practice-oriented technical competence with practice-oriented methodological competence takes place. Work steps and technical decisions can thus be constantly reviewed in the sense of an iterative process and thereby train the students in their ability to reflect. Furthermore, the NAS enables access to corresponding laboratories/studios/etc. during the self-study period.

allows for integrating various methodological approaches, ensuring that the research remains relevant and grounded in the practicalities of educational technology implementation. The pragmatic approach also supports blending qualitative and quantitative methods, facilitating a comprehensive understanding of the research questions. This is crucial in a field like educational technology, where the impact of interventions often needs to be understood from both statistical and human-centred perspectives.

3.2.2 Sampling Methodology

In this doctoral thesis, the sampling strategy was an essential component of the research design, focusing specifically on the student body of Macromedia University in Germany. Given the qualitative orientation of this study, the sample size and selection criteria were not rigidly predefined but aligned with the study's relevance and scope. As per the guidelines by renowned scientists (Baur & Blasius, 2019; Onwuegbuzie & Leech, 2007; Baur, & Blasius, 2019; Brosius, Haas, & Koschel, 2016; Cohen, Manion & Morrison, 2011; Johnson & Clark, 2006; Neuman, 2005), the sample selection hinged on the participants' experiences' relevance to the research topic and their potential to provide rich, insightful data. The initial plan was to focus on a single campus, but the scope expanded to include all seven campuses nationwide, thus broadening the sample size. The emphasis was on a specific group of exercise sessions per semester.

The study initially intended to use two parallel courses, with one serving as a control group. However, this approach was revised due to ethical considerations related to equal opportunities for students. Consequently, a non-probability sampling method, particularly purposive sampling, was employed. This approach allowed for selecting a sample based on the subjective judgement of the researcher, within a theoretical framework to minimise bias (Baur & Blasius, 2019; Brosius, Haas, & Koschel, 2016; Cohen, Manion, & Morrison, 2011; Saunders et. al, 2009; Neuman, 2005; Sekaran, 2003; Gill & Johnson, 2002).

The choice of non-probability sampling was driven by several factors, including the impracticality of collecting data from the entire population, the need for a representative sample, the lack of a comprehensive sampling frame, and the specific nature of the research questions and objectives. The decision-making process for sampling, guided by Baur and Blasius (2019), Brosius, Haas, and Koschel (2016), and Saunders et al. (2009), involved addressing questions about the feasibility of collecting data from the entire population, the necessity of statistical inferences, the availability of a suitable sampling frame, and the need for a representative sample.

Purposive sampling was particularly suited to this research because it focuses on a small, information-rich sample that could provide valuable insights into the research questions. This method is often employed in case studies or when selecting highly informative cases, as Neuman (2005) noted. In this context, the study utilised typical case sampling, with the chosen participants representing a typical cross-section of undergraduate students at the university (Baur & Blasius, 2019). This method ensured that the sample effectively contributed to understanding the research topic while aligning with the methodological and theoretical underpinnings of the study.

3.2.3 Ethical Considerations

Ethical considerations play a critical role in this study, ensuring the integrity and respectfulness of the research process. Formal approval was obtained from the Research Ethics Committee, and ethical standards, such as confidentiality and informed consent, are strictly adhered to throughout.

The emphasis on ethical aspects in research has grown significantly, necessitating careful consideration of data access and potential ethical concerns across the entire research project (Baur & Blasius, 2019; Brosius, Haas, & Koschel, 2016; Cohen, Manion, & Morrison, 2011; Saunders et al., 2009). This study, conducted under the auspices of the University of Westminster, required approval from their Research Ethics Committee, emphasising the importance of addressing all ethical requirements comprehensively.

Ethical issues in research encompass all stages, from planning to reporting. Ethical conduct involves respecting the rights of subjects affected by the research and ensuring the methodology is morally acceptable and methodologically sound (Cooper & Schindler, 2008; Sekaran, 2003; Gill & Johnson, 2002; Zikmund, 2000). Key ethical concerns include privacy, voluntary participation, consent, confidentiality, and avoiding harm to participants (Baur & Blasius, 2019; Brosius, Haas, & Koschel, 2016; Cohen, Manion, & Morrison, 2011).

Anticipating and addressing ethical issues in the planning phase is crucial. This involves ensuring ‘no harm’ principles and adjusting methods as needed. Ethical planning includes obtaining data access, considering feasibility, and managing sensitive organisational contexts (Cooper & Schindler, 2008; Marshall & Rossman, 2006; Baur & Blasius, 2019; Brosius, Haas, & Koschel, 2016; Cohen, Manion, & Morrison, 2011). Ethical management in data collection is imperative, addressing general and specific concerns across different techniques. Ensuring participant privacy, voluntary participation, and the right to withdraw, as well as managing data confidentiality, are key aspects (Zikmund, 2000). Ethical guidelines in student surveys are

critical, with fewer ethical problems typically associated with structured questionnaires (Sekaran, 2003; Gill & Johnson, 2002; Zikmund, 2000; Dale et al., 1988). However, privacy, deception, confidentiality, and objectivity remain important considerations.

In summary, ethical management in this research encompasses careful planning, responsible data collection, and adherence to guidelines in survey execution. Maintaining these ethical standards ensures the protection of participants' rights and enhances the credibility and integrity of the research findings. Emerging concerns about the scale and scope as well as the sensitivity and confidentiality of the data were openly addressed and dispelled. Moreover, the anonymity of the individual participants is guaranteed. This, as well as data protection and the voluntary nature of participation, are specified verbally and in writing (see Appendix A).

3.3 Data Collection and Analysis

In this doctoral thesis, a mixed methods approach is employed, integrating both deductive and inductive strategies to explore the complex problem of didactic SoML interventions in existing BL scenarios in higher education. Deductive reasoning involves developing a theory and hypothesis, then designing a research strategy to test the hypothesis and collecting quantitative data to explain causal relationships between variables. Conversely, induction involves collecting data and formulating a theory based on analysis (Saunders et al., 2009; Collis & Hussey, 2003). The novel and under-researched nature of SoML necessitates using both approaches, where data is initially gathered through empirical means to develop hypotheses, which are then tested deductively. This combination of deductive and inductive strategies, both qualitative and quantitative, is particularly appropriate for the research questions addressed in this thesis.

The research strategies utilised encompass exploratory, descriptive, and explanatory research within a mixed methods single case study framework. This includes an exploration of current practice with participant observation and surveys. Surveys are used for exploratory and descriptive research, allowing for substantial data from a large population (Saunders et al., 2009). The case study strategy provides in-depth insights into contemporary phenomena within their real-life context (Robson, 2002). Exploring the status quo facilitates learning and change, closely linking the research process, outcomes, and application (Bortz & Döring, 2006).

Given the focus on improving students' learning experiences and outcomes, a qualitative approach is initially employed to identify the status quo, followed by a quantitative approach for making valid inferences. The survey strategy is particularly suitable for identifying potential

reasons for relationships between variables and constructing models of these relationships (Saunders et al., 2009).

In this thesis, data collection is a core part of the mixed methods approach, integrating qualitative and quantitative elements. This process is structured around three primary objectives: developing a quantitative measure based on qualitative data, refining, and creating new hypotheses, and devising interventions grounded in the theoretical framework established. Data are gathered from two distinct sources: participant observation and student surveys. These data are then analysed and compared within an exploratory sequential design framework. Concurrently, interventions are crafted following the ADDIE (Analysis, Design, Development, Implementation, Evaluation) instructional design process. These interventions are subject to iterative adjustments throughout the implementation phase to refine their effectiveness and alignment with emerging insights.

The research adopts a mixed methods single case study approach, a methodology often selected for its suitability in examining critical, extreme, or unique cases (Hanshaw & Hanson, 2019; Creswell & Plano Clark, 2018). It is defined by Creswell and Plano Clark (2018) as a type of study where quantitative and qualitative data collection, results, and integration are used to provide in-depth evidence for a case or develop cases for comparative analysis. This approach is chosen for its ability to provide a more complete picture of the research problem, as neither quantitative nor qualitative methods alone are sufficient to capture all details related to complex educational interventions (Green, Caracelli, & Graham, 1989; Johnson & Turner, 2003; Tashakkori & Teddlie, 1998). It is particularly relevant given the study's setting at Macromedia University, a distinct entity within a broader national educational context. Conducting the study within this specific university enables access to internal processes and courses, making it feasible to undertake this research. Additionally, Macromedia University's alignment with the Bologna Reform provides a pertinent backdrop, allowing the study's findings, derived from both qualitative and quantitative research, to offer generalisable insights.

The single case study research unfolds in two distinct phases, encompassing five sequential steps:

- Qualitative Data Collection through Participant Observation: Initially, an exploratory approach is adopted, leveraging participant observation to gain an in-depth understanding of current practices. This phase is instrumental in forming the initial hypotheses.

- Development of Quantitative Measures: Following the qualitative data collection and a comprehensive literature review, a quantitative survey instrument is designed. This step employs an exploratory sequential design, specifically tailored as an instrument development design.
- Designing Interventions Using the ADDIE Model: Interventions are conceptualised using the ADDIE framework, with each phase of this model meticulously planned to ensure the interventions' relevance and efficacy.
- Implementation and Iterative Refinement of Interventions: In the subsequent phase, these interventions are implemented and continually refined. This iterative process is crucial for aligning the interventions with ongoing findings and ensuring their practical applicability.
- Nationwide Student Survey and Comparative Analysis: The final step involves conducting a comprehensive student survey across the university's campuses. This phase not only validates the earlier phases but also provides quantitative data for a comparative analysis of the interventions' impact.

By adopting this longitudinal approach, the research approach meticulously captures the nuances and evolving dynamics of BL experiences and outcomes at Macromedia University. The design's comprehensiveness, combining qualitative exploration with quantitative validation, ensures a thorough investigation of the impact of SoML interventions on BL, aligning with the methodological rigor suggested by Creswell & Plano Clark (2018) and Cook & Kamalooden (2020). This holistic approach promises to yield insights with both practical implications for educational practice and theoretical contributions to the field of BL.

3.3.1 Participant Observation Method

The initial data collection phase adopts an exploratory approach, utilising participant observation as a critical method to gain an in-depth understanding of current practices at Macromedia University. This approach is instrumental in forming the initial hypotheses for the study, laying the groundwork for further research.

Participant observation, emerging from social anthropology in the early twentieth century, is a qualitative method focused on discovering the meanings people associate with their actions (Kötter & Kohlbrunn, 2020; Pfeiffer, 2020; Cook & Kamalodeen, 2019; Saunders et al., 2009; Linden, 2007). Unlike structured observation, which is quantitative and concerned with the frequency of actions, participant observation delves into the qualitative aspects of social situations. It provides an authentic view of events and interactions as they naturally occur,

capturing observable behaviours in their proper context. The participant observation was conducted within Macromedia University's BL environment. The researcher immersed herself in the group or community being studied, participating in the same events as the subjects of the investigation. This method involves selecting aspects to be observed based on the research questions and objectives, focusing on interactions and events pertinent to students' learning experiences in BL scenarios (Kötter & Kohlbrunn, 2020; Pfeiffer, 2020; Cook & Kamalodeen, 2019). The method aligns with symbolic interactionism, where the focus is on understanding individuals' identities and the processes through which these identities are constantly constructed and reconstructed (Delbridge & Kirkpatrick, 1994; Blumer, 1973). The participant observer's role is to capture these identity-construction processes within the educational setting, observing firsthand the interactions and situations that define the learning experience.

The qualitative data collected through participant observation can be systematically analysed using qualitative content analysis following Mayring's methodology (Mayring, 2010). This approach enables a theory- and rule-guided evaluation of qualitative data, supporting hypothesis generation and theory building. The analysis categorises and structures the observational data, forming a conceptual framework that guides further research. A category system is developed to analyse the observational data, ensuring each text content is assigned to only one category for clarity and discriminatory power. This system includes content and formal categories, with precise definitions and anchor examples to guide the assignment of observational data to relevant categories (Brosius, Haas, & Koschel, 2016; Mayring, 2010; 2019).

The results of the qualitative content analysis are used to form hypotheses, which are clearly defined statements asserting relationships between variables and are empirically and intersubjectively testable (Brosius, Haas, & Koschel, 2017). These hypotheses are foundational for the subsequent phases of the research, guiding the development and testing of interventions in the BL context.

3.3.2 Mixed Methods Instrument Development

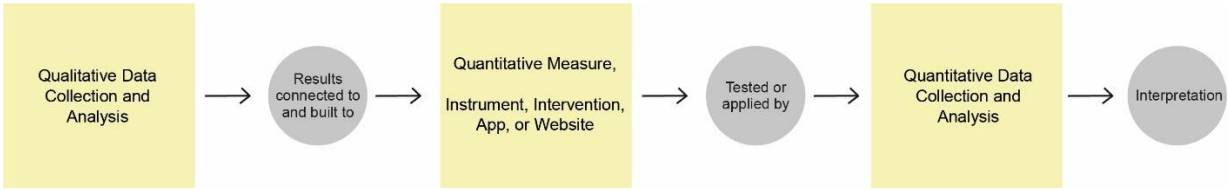
This thesis employs an exploratory sequential mixed methods design, a critical approach for developing instruments in educational research, particularly for evaluating didactic interventions in BL scenarios. This design is chosen for its efficacy in reconciling qualitative and quantitative methods, ensuring a comprehensive understanding of complex educational phenomena (Hanshaw & Hanson, 2019; Creswell & Plano Clark, 2018; Johnson & Turner, 2003; Tashakkori & Teddlie, 1998; Green, Caracelli, & Graham, 1989).

The exploratory sequential design begins with qualitative data collection, followed by the development of a quantitative phase. This process starts with a deep exploration of the research problem through qualitative methods, such as participant observation, to gather rich, contextual data. The findings from this phase then inform the development of quantitative measures for subsequent survey instruments (Creswell & Plano Clark, 2018). The qualitative phase includes participant observation at Macromedia University, providing insights into the current BL practices and student learning experiences. This qualitative exploration is data-driven and not confined to a pre-existing conceptual framework, allowing for the identification of new dependent variables and conceptual themes (Creswell & Plano Clark, 2018). The outcomes of this phase guide the creation of specific research questions and the design of a questionnaire for the online student survey, forming the quantitative phase of the study.

The instrument development variant of the exploratory sequential design is employed for developing the quantitative measure for the student survey. This variant is particularly effective when variables are not pre-established, allowing the identification of important variables for subsequent quantitative analysis (Edmonds & Kennedy, 2019).

Figure 11

Instrument Development Variant



Note. This figure is an own representation based on Cook and Kamalodeen (2019).

While this mixed methods design is central to the instrument development, it also plays a crucial role in the broader context of the single case study at Macromedia University. The sequential approach ensures that the interventions designed for the BL scenarios are grounded in empirical findings, thus enhancing their relevance and effectiveness. The qualitative insights gained initially provide a foundation for the quantitative measures, ensuring the interventions are tailored to address specific needs and challenges identified in the BL environment.

The Exploratory Sequential Mixed Methods Design is instrumental in bridging the gap between qualitative understanding and quantitative evaluation. It allows for a systematic and comprehensive approach to instrument development, ensuring that the quantitative measures are deeply rooted in qualitative insights. This design facilitates the creation of a culturally

sensitive and content-relevant instrument and aligns seamlessly with the overall objectives of the single case study at Macromedia University.

3.3.3 Intervention ADDIE Process

In this study, instructional interventions are conceptualised and developed using the ADDIE model, a systematic framework for instructional design. Reiser and Dempsey (2007) define instructional design (ID) as the process of systematic planning and shaping learning environments. This process transforms subject matters into meaningful, engaging, and understandable learning content (Briggs, Gagné, & Wager, 1992; Seel et al., 2017).

The ADDIE model, standing for Analyse, Design, Develop, Implement, Evaluate, organises, and systematises instruction and design, ensuring each phase is meticulously planned to enhance the relevance and efficacy of the interventions (Gustafson & Branch, 1997; Seels & Glasgow, 1998). This model is rooted in learning and instructional theory and focuses on developing solutions responsive to learners' needs and the learning context (Seels & Glasgow, 1998).

Each phase of the ADDIE model contributes to a generative, responsive, and validating learning design:

- Analyse: Identify performance gaps and establish learning objectives based on learners' needs and context (Kurt, 2018; Rothwell & Kazanas, 2016).
- Design: Plan the instructional strategy and learning materials, considering media types, teaching styles, and time frames (Branch, 2009; Kurt, 2018).
- Develop: Construct educational materials and resources, considering factors like development costs, available resources, and intended learning outcomes (Lee & Owens, 2004; Ellington & Aris, 2000).
- Implement: Execute the instructional plan, preparing facilitators and learners for the learning experience (Seel et al., 2017).
- Evaluate: Assess the quality and effectiveness of the instructional materials and processes, involving both formative and summative evaluations (Kurt, 2018).

The interventions are implemented in a real-world educational setting following the design phase. This implementation is an iterative and sequential process, continuously integrating feedback and observations to refine and improve the interventions. This phase transforms the instructional activities into practice, including training facilitators and learners, organising resources, and preparing the learning environment (Seel et al., 2017). The evaluation phase is

integral to this process, involving both formative and summative assessments to ensure the interventions meet their intended goals and objectives. Formative evaluation occurs throughout the implementation, guiding improvements and adjustments, while summative evaluation assesses the overall impact and effectiveness of the interventions (Kurt, 2018).

Figure 12

Five Steps of the ADDIE Model

Analyse	Design	Develop	Implement	Evaluate
Identify the likely causes of a performance gap	Verify the desired performances and the appropriate test methods	Generate and validate the learning resources	Prepare the learning environment and engage the students	Assess the quality of the teaching products and processes before and after implementation

Note. This figure is a representation based on Branch (2009).

In summary, using the ADDIE model in this study ensures a systematic, reflective, and responsive approach to designing and implementing instructional interventions. This approach aligns with the iterative nature of instructional design, as it evolves organically to reflect the changing needs of learners and the educational context (Parkes, Fletcher, & Stein, 2015).

3.3.4 Comparative Survey Analysis

The comparative survey research in this study is structured to methodically gather and analyse data from a substantial sample, ensuring the findings represent the targeted student population at Macromedia University. This survey strategy, a pivotal part of the deductive research approach, involves standardised questionnaires enabling efficient and effective data collection. This standardised approach facilitates comparability of data, essential for understanding the impact of didactic interventions on students' learning experiences and outcomes (Saunders et al., 2009).

In this thesis, the student survey is designed to be the quantitative counterpart to the qualitative participant observation. The survey aims to gather data on variables identified during the exploratory phase and supported by a literature review. This survey is administered to students enrolled in specific Statistics courses over two semesters (winter 2021/22 and summer 2022), thus adopting a longitudinal study approach. The design of the survey instrument is critical to accurately measure independent variables (IVs) related to SoML teaching practices and dependent variables (DVs) about students' learning experiences and outcomes (Schöneck & Vos, 2013). The IV in this study is the SoML teaching practice, while the DVs include aspects

of the student's learning experience (e.g., motivation, participation) and learning outcomes (e.g., competencies, future skills). The survey methodologically compares these variables across two cohorts to establish cause-effect relationships and differentiate these from potential correlations or spurious relationships. The importance of manipulation and control in the survey design is emphasised to attribute changes in DVs to the influence of the IV.

The survey implementation involves administering structured questionnaires to the selected student groups. The questionnaire design includes demographic questions and items developed from theoretical constructs and qualitative observations. It covers various indicators of learning experience and outcomes, including grades for a comprehensive understanding of the impact of SoML interventions.

For data analysis, a Multivariate Analysis of Variance (MANOVA) is used to test hypotheses and answer the research questions. This statistical technique allows for a comprehensive analysis of the relationships between multiple DVs and the IV, facilitating a deeper understanding of the SoML interventions' impact. MANOVA enables a nuanced comparison of the student survey results across different semesters, contributing significantly to the mixed methods approach of this thesis (Brosius, Haas, & Koschel, 2016).

In summary, the comparative survey research in this thesis plays a critical role in quantitatively evaluating the effectiveness of SoML interventions in BL scenarios at Macromedia University. This approach complements the qualitative participant observation and provides robust data to test the hypotheses developed, thereby enriching the overall mixed methods case study framework.

3.4 Research Quality Considerations

In the context of this thesis, ensuring the integrity and validity of the research through quality criteria is paramount, particularly in the qualitative components of the case study. These criteria establish the research findings' standards, ensuring systematic, unbiased, accurate, and consistent results. The emphasis on objectivity, reliability, and validity, as delineated by Raithel (2008), Moosbrugger and Kelava (2020), and Depping and Warzecha (2022), forms the cornerstone of the research methodology.

In this study's qualitative participant observation component, maintaining research quality is achieved through strategies informed by Baur and Blasius (2019) and Delbridge & Kirkpatrick (1994). This involves ensuring intersubjective comprehensibility and continuous reflection throughout the research process. The high ecological validity of participant observation is

balanced against the potential for observer bias, which is mitigated through transparent reporting and critical self-reflection of the researcher's role and influence. The methodology also incorporates semantic and correlative and predictive validity principles in data analysis, adhering to Mayring's (2010) framework for qualitative content analysis. In the mixed methods instrument development phase, quality is upheld by following rigorous standards of objectivity, reliability, and validity, as outlined by Raithel (2008), Moosbrugger and Kelava (2020), and Depping and (2022). This includes designing data collection tools that minimise researcher bias, employing reliable methods for data collection that yield consistent results upon replication, and ensuring that the instruments measure what they are intended to measure. The process involves diverse validity testing methods, including content, construct, and criterion-related validity assessments.

The quality of the instructional design framework is ensured through the systematic application of the ADDIE model, which involves comprehensive analysis, design, development, implementation, and evaluation phases (Branch, 2009; Seel et al., 2017). Each phase is meticulously planned and executed to enhance the educational interventions' relevance and effectiveness. This systematic approach allows for iterative improvements based on continuous feedback, ensuring that the instructional design is responsive to the learners' needs and the educational context. For the quantitative survey, adherence to quality criteria such as validity, reliability, objectivity, and ethical considerations is crucial (Fink, 2013; American Educational Research Association, 2014). This includes maintaining the confidentiality of respondent information, ensuring representative sampling and adequate response rates, and conducting the survey in a manner that respects the rights and privacy of the participants. The survey's design and administration are standardised to ensure data collection consistency and accuracy, supporting the findings' validity and reliability.

In conclusion, incorporating these quality criteria across different aspects of the research underscores the commitment to scientific rigor and credibility. By maintaining these standards, the research provides robust and reliable findings, essential for the overall validity and integrity of the thesis.

3.5 Limitations and Conclusions

3.5.1 Analysis of Limitations

This research, while comprehensive, encountered several limitations inherent to any scientific study. One significant limitation was the potential for bias in participant selection within the purposive sampling strategy. Efforts were made to minimise this bias, but it cannot be entirely

excluded. The research setting in the researcher's workplace environment might have introduced a mix of research and workplace dynamics. However, measures were taken to mitigate this.

Another constraint was the scope and scale of the study, which was limited by resources, methods, and the university setting. Ensuring appropriate sample size and context-specific research was a challenging yet essential aspect. The study's bilingual nature also presented potential risks of mistranslation, impacting the research's accuracy. Technical aspects, particularly during online sessions, posed challenges like connectivity issues and application glitches. The generalisability of the findings was limited, as the purposive sampling method doesn't yield a representative sample. Furthermore, the research's impact on students' employability was only partially addressed, and the study didn't extend to the macro level. The natural learning environment in which the study was conducted limited control over independent variables and heightened the influence of external disturbances.

The pre-selection of groups by university staff, rather than by self-selection or researcher selection, affected the internal validity. This selection, coupled with the study's focus on a single independent variable, restricted the depth of analysis possible. Nonetheless, these limitations don't negate the study's value but rather provide a foundation for further research, particularly in BL.

3.5.2 Final Remarks

The thesis established a methodological framework that justified the selection of various research methods. It commenced with a general framing incorporating levels of innovation in education, the backdrop of the Bologna Reform, and the emphasis on competence orientation. This framing underpinned the teaching methodologies at Macromedia University, which the study meticulously examined.

The research design was exploratory, utilising qualitative data collection through participant observation. It enabled an in-depth understanding of the actions and interactions within the university setting. As proposed by Mayring (2010; 2019), the qualitative content analysis facilitated a systematic and theory-guided evaluation of the qualitative data, aiding in hypothesis generation and theory building. The research also involved developing a quantitative instrument through an exploratory sequential research design, focusing on creating a culturally sensitive and contextually relevant measure. The instructional design process followed the ADDIE model, ensuring that each phase of intervention – analysis, design, development, implementation, and evaluation – was reflective and responsive to the evolving educational

context. A comparative analysis of two student surveys, conducted across different semesters, was a crucial part of the quantitative study. The use of MANOVA in the final analysis stage allowed for a nuanced examination of the relationships between dependent variables, thereby providing a comprehensive understanding of the study's findings.

In summary, this thesis not only highlighted the methodological rigour in its approach but also pointed towards potential areas for future research, particularly in enhancing BL techniques. The limitations identified throughout the study emphasise the need for ongoing research in this dynamic field of educational technology.

Chapter 4: Case Study Context

4.2 Study Participants and Sampling

The participants in this case study were thoughtfully selected from the student body of Macromedia University. This selection was a crucial aspect of the research design, ensuring that the data collected was rich, and relevant, and could provide significant insights into the research questions. The study encompassed a diverse group of participants from various faculties and programs. The primary focus was on students enrolled in the Empirical Research and Statistics course during the winter semester of 2021/22 and the summer semester of 2022. These participants were primarily undergraduate students from the Faculty of Culture, Media, and Psychology, and the Faculty of Business, Design, and Technology. This range of academic disciplines within the participant group provided a multifaceted perspective on the effectiveness of BL strategies.

In the winter semester of 2021/22, the participant group consisted of 191 students from different campuses across Germany. The demographic spread of these participants was diverse, encompassing various genders, age groups, and academic backgrounds. Similarly, the summer semester of 2022 saw an increase in the number of participants, with 660 students from across the university's campuses participating in the study. This increase in the participant pool allowed for broader data collection, thereby enhancing the validity and reliability of the research findings.

Table 4

Overview of the Students and Locations of 'Empirical Research and Statistics' in the Winter Semester of 2021/ 22

Stuttgart: 37
Berlin: 14

Munich: 26
Cologne: 46
Hamburg: 62
Leipzig: 5
Freiburg: 1
Student total: 191

Table 5

Overview of the Students and Locations of 'Empirical Research and Statistics' in the Summer Semester of 2022

Stuttgart: 94
Berlin: 61
Munich: 72
Cologne: 159
Hamburg: 213
Leipzig: 38
Freiburg: 23
Student total: 660

As explained in 3.2.2, The sampling strategy was an essential component of the research design, focusing specifically on the student body of Macromedia University in Germany. This section elucidates the sampling procedure utilised in the research. Given the qualitative nature of this study, the sample size and selection criteria were rather based on the relevance and scope of the study. Following the guidelines of Onwuegbuzie and Leech (2007), the selection of the sample was based on the relevance of the participants' experiences to the research topic. The original plan was to focus on a single campus, but the scope was expanded to include all seven campuses across the country, increasing the sample size. The focus was on a specific group of practice sessions per semester. As a result, a non-probability sampling method, specifically purposive sampling, was used. This approach allowed for the selection of a sample based on the subjective judgment of the researcher within a theoretical framework to minimise bias (Baur & Blasius, 2019; Brosius, Haas, & Koschel, 2016; Cohen, Manion, & Morrison, 2011).

Factors in the choice of non-probability sampling included the impracticality of collecting data from the general population, the need for a representative sample, the lack of a comprehensive sampling frame and the specificity of the research questions and objectives. Purposive sampling was highly appropriate for this research as it focuses on a small, information-rich sample that can provide valuable insights into the research questions. This method is often used in case studies or when selecting highly informative cases, as noted by Neuman (2005). A typical case

sample was therefore used for the study, in which the selected participants represent a typical cross-section of students at the university (Baur & Blasius, 2019). This method ensured that the sample contributed to the understanding of the research topic while being compatible with the methodological and theoretical foundations of the study.

Participants were selected based on their enrolment in the targeted course and their potential to provide meaningful data relevant to the research questions. This purposive approach was critical in identifying participants whose experiences and insights could contribute significantly to understanding the impact and effectiveness of BL strategies. The selected participants were considered representative of the typical undergraduate student population at Macromedia University, thus ensuring that the study's findings were relevant and applicable within the context of this specific academic setting. In selecting the participants, special attention was given to ensuring diversity in terms of gender, academic disciplines, and campus locations. This diversity was essential to capture a wide range of experiences and perspectives on BL. The study aimed to include voices from different backgrounds to provide a holistic understanding of the BL experience at Macromedia University.

In summary, the study participants were a diverse group of undergraduate students from Macromedia University, selected through purposive non-probability sampling. This sampling approach was aligned with the qualitative nature of the study, focusing on in-depth analysis rather than broad generalisability. The diverse demographic and academic background of the participants provided a rich and varied dataset, crucial for exploring the nuances of BL in higher education.

4.1 Macromedia University Setting

Macromedia University, situated in Germany, is a prominent higher education institution known for its modern approach to learning and teaching. The university boasts a wide array of faculties, notably the Faculty of Culture, Media, and Psychology, and the Faculty of Business, Design, and Technology. Each faculty offers specialised programs designed to blend theoretical knowledge with practical application, thus preparing students for the evolving demands of the global workforce. The university's eight campuses are strategically located across Germany, providing a diverse and multicultural learning environment. This geographical spread fosters a rich exchange of ideas and cultures and allows for a broad range of research opportunities and perspectives. The university's commitment to innovation and excellence in education is evident in its state-of-the-art facilities and its adoption of cutting-edge technology in teaching and learning processes.

This case study focuses on Macromedia University's *Empirical Research and Statistics* courses. The selection of the courses as the focal point for this research was a strategic decision, deeply rooted in its significance and representativeness within the context of German higher education, particularly at Macromedia University. This course stands out as a critical component of the curriculum, weaving together fundamental aspects of empirical research and statistical analysis, vital for shaping well-rounded, analytically adept graduates. The course reflects the core academic principles advocated by the German higher education system, particularly after the Bologna Reform. This reform catalysed a shift towards a more pragmatic and competency-based education, prioritising skills and knowledge that are directly applicable in professional settings. The course, therefore, represents this shift by emphasising practical skills and analytical thinking, preparing students for the challenges of the modern workforce.

In the German context, where empirical research and statistical competence are increasingly valued across various fields, this course provides essential skills. It equips students not just with theoretical understanding but also with the ability to apply statistical methods and research techniques in diverse professional contexts. The course's structure, integrating theoretical lectures and practical exercises, lends itself exceptionally well to blended learning (BL) approaches. BL, which combines online digital media with traditional classroom methods, aligns perfectly with the course's pedagogical objectives. It allows for an enriched learning experience where practical, interactive sessions complement theoretical knowledge.

The choice of this course offers an opportunity to explore the effectiveness and impact of BL strategies in a real-world educational setting. It serves as an exemplary model to investigate how modern teaching methodologies can enhance student engagement and learning outcomes in a core academic subject. The research objectives of this study are centred around understanding the dynamics and efficacy of BL in higher education. The Empirical Research and Statistics course, with its balanced mix of theory and practice, provides a fertile ground for examining these aspects. It is an excellent case study to explore how BL can be implemented effectively and how it influences student learning and engagement. Moreover, the course is representative of the kind of subjects that can benefit significantly from BL approaches. It involves complex concepts and methodologies that can be more effectively taught through a combination of online resources and in-person guidance.

In conclusion, the selection of the Empirical Research and Statistics course for this research is deeply intentional and strategic. It is a course that embodies the modern principles of German higher education, particularly in its emphasis on practical skills and competency-based learning.

Its structure is conducive to BL methodologies, making it an ideal candidate for exploring the research questions of this study. This course, therefore, provides a comprehensive and relevant context for investigating the effectiveness of BL strategies in higher education.

4.3 Blended Learning Course Details

The Empirical Research and Statistics course at Macromedia University, structured as a BL module, serves as a primary case study in this research. This course was meticulously designed to integrate both online and on-site learning components, leveraging the strengths of each mode to enhance the overall educational experience.

The course's structure integrates online theoretical sessions and on-site practical exercises, aligning with the basic constructs of BL to optimise learning outcomes:

- Online Components (Expert Sessions): These sessions were conducted via a digital platform, accessible to students from all campuses. These expert sessions focused on delivering theoretical content and lectures, allowing students to access learning materials flexibly and engage in discussions in a virtual environment. The online format was particularly advantageous in providing a unified learning experience for students across different locations.
- On-Site Components (Campus Sessions): The on-site elements, known as campus sessions, were held in physical classrooms. These sessions were pivotal for hands-on exercises, group discussions, and direct interaction with instructors. They offered an opportunity for students to delve deeper into the course content, apply their learning in practical settings, and foster peer-to-peer collaboration.

The course underwent several modifications between the winter semester of 2021/22 and the summer semester of 2022, reflecting an ongoing commitment to improving the learning experience based on student feedback and evolving educational needs.

- Winter Semester 2021/22: In this semester, the course was initially conducted in a hybrid format due to COVID-19 restrictions, with a mix of online and on-site participation. However, as the semester progressed, more sessions were shifted to on-site, with an option for online participation to accommodate students' needs and preferences. The course was divided into 13 units, each designed to cover specific aspects of empirical research and statistics.
- Summer Semester 2022: The following semester saw a notable increase in student enrolment, prompting a restructuring of the course. The course was offered twice per

unit to accommodate the larger student body and was fully conducted on-site, barring exceptions for special circumstances such as health issues. The semester included 14 units, with slight modifications in the content distribution from units one to six, ensuring a more comprehensive coverage of the subject matter.

The Empirical Research and Statistics course at Macromedia University, structured as a BL module, offers a relevant case study for examining the practical application of BL in higher education. Initially designed to merge online and on-site learning elements, the course's structure underwent adjustments in response to the COVID-19 pandemic and evolving educational needs. A fundamental aspect of the course's BL approach involved separating theoretical content delivery through online expert sessions and practical application in on-site campus sessions. The expert sessions, accessible digitally, provided theoretical lectures and materials, fostering flexibility and a unified learning experience for a geographically diverse student body. On-site sessions focused on hands-on exercises, group interactions, and direct engagement with instructors, emphasizing practical application and peer collaboration.

The course's evolution across semesters reflects a dynamic response to changing circumstances, initially adopting a hybrid format due to pandemic restrictions, and later transitioning to more on-site sessions. This adaptability, while accommodating student preferences and logistical challenges, raises questions about the consistent delivery of a harmonious BL experience. While the course's flexibility is commendable, it also highlights the need for a more integrated approach to BL that thoughtfully balances online and physical learning environments as per Garrison and Vaughan's (2008) definition.

Chapter 5: Exploring Current Practice

5.1 Introduction

In response to the unprecedented challenges posed by the COVID-19 pandemic, this exploratory case study focuses on the blended learning (BL) course at Macromedia University in Germany. As the country faced lockdowns starting on 16 March 2020, educational institutions, including Macromedia University, rapidly transitioned to digital platforms, eventually adopting BL as a strategic, long-term educational model. This study explores the intricacies of this transition, highlighting the efficacy of BL in fostering diverse learning environments and student engagement through the integration of face-to-face (f2f) and online modalities (Garrison & Vaughan, 2008; Alammary, Sheard, & Carbone, 2014).

Despite BL's proven advantages, as evidenced by a meta-analysis of studies between 1996 and 2008 (Means, Toyama, Murphy, Bakia, & Jones, 2009), its sudden implementation during the pandemic brought significant challenges. Students reported increased workload, absenteeism, and psychological stress (Danaii, 2022; Bortoli, 2022). The quality of online teaching was a concern, with a substantial percentage of students finding it inferior to traditional methods (Danaii, 2022). This study aims to address these issues by investigating the learning experiences and outcomes in the unique BL format of Macromedia University, which combines online lectures and on-site exercises (Emre, Masur, & Ranner, 2020). The primary research questions focus on understanding how this BL approach has impacted student engagement, learning outcomes, and overall educational experience in a post-pandemic scenario. Overall, this study is pivotal in understanding the adaptation and effectiveness of BL in a real-world setting, providing insights into how higher education can evolve to meet new challenges and diverse learning needs.

5.2 Method

This study adopts an exploratory qualitative case study approach to investigate the current practices within a specific BL course at Macromedia University. The research was designed to provide a comprehensive understanding of the BL environment, focusing on how it influences student learning experiences and outcomes.

Observational Methodology

The primary data collection method in this study was in-depth participant observation in the 'Empirical Research and Statistics' course at Macromedia University. This comprehensive approach involved attending a series of lectures and exercises in both online and on-campus settings. The objective was to meticulously observe and document the interactions, teaching methods, and student engagement in the BL environments. These observations were pivotal in capturing the subtle dynamics and intricacies of the BL setting, offering rich insights into how BL theories are practically applied and experienced in a real-world academic context.

The observational process was systematic and multi-faceted. It included not only attending the sessions but also engaging in passive observation of student behaviours, interaction patterns between students and teachers, and the overall classroom atmosphere. The researcher acted as an observer who paid special attention to how digital tools were integrated into the learning process and how this integration affected student participation and engagement. This hands-on approach provided a unique vantage point to understand the complexities of a BL course,

including aspects such as student motivation, participation levels, and the effectiveness of various teaching strategies.

Additionally, the observer noted the adaptation strategies employed by educators in transitioning from traditional teaching methods to a BL format. This included observing how lecturers balanced online and face-to-face elements to enhance learning outcomes. These observations were crucial in understanding the challenges and opportunities inherent in BL and provided valuable insights into effective instructional design for BL courses. Throughout the observation period, detailed notes were taken to ensure a comprehensive record of the proceedings. This data was later analysed to identify key themes, patterns, and insights related to BL teaching and learning processes. The findings from these observations are expected to contribute significantly to the literature on BL, particularly in the context of higher education, and offer practical implications for educators and policymakers.

This methodological approach aligns with the principles of qualitative education research, as it allows for a deep, contextual understanding of the learning environment (Creswell & Creswell, 2017). By immersing the observer in the actual teaching and learning context, this study provides a grounded perspective that is often missing in more detached research methods.

Document Analysis

The analysis of various course-related documents provided a complementary perspective to the observational data, offering a multifaceted view of the BL course. This involved an extensive review of a range of documents including lesson plans, teaching materials, student feedback forms, and course syllabi.

A detailed examination of the course syllabi and lesson plans was conducted to gain insights into the instructional objectives, content organisation, and pedagogical strategies. This analysis helped in understanding the alignment between the course objectives and the BL methods employed. The review of teaching materials, including slides, handouts, and online resources, provided a deeper understanding of the content delivery methods and the integration of digital tools in the teaching process. Student feedback forms were critically reviewed to gauge student perceptions, satisfaction levels, and the challenges faced by them in the BL environment. This feedback was instrumental in understanding the effectiveness of the BL course from the learner's perspective, highlighting areas of strength and opportunities for improvement.

By analysing these documents, the study employed data triangulation, a method crucial for enhancing the validity and reliability of qualitative research (Denzin, 1978). This approach

allowed for a more comprehensive understanding of the BL course by correlating observational data with documented evidence. The document analysis provided a rich background context, shedding light on the instructional planning and execution. It offered insights into the educators' approaches to BL and their efforts to balance traditional and digital teaching methodologies. Care was taken to ensure that all document analyses were conducted ethically, maintaining the confidentiality of any sensitive information.

Data Synthesis and Analysis

The integration of observational data and document analysis formed the cornerstone of this study, facilitating a comprehensive understanding of the BL course at Macromedia University. This synthesis was pivotal in developing a holistic view of the course structure, teaching methodologies, and student engagement within the BL environment. Observational notes and document contents were meticulously categorised to identify key themes and patterns. This categorisation process followed grounded theory principles, where data was systematically coded and compared to develop a conceptual framework (Glaser & Strauss, 1967). Themes such as student interaction, engagement levels, and the effectiveness of various teaching strategies emerged from this categorisation.

The identification of recurring themes was a crucial step in understanding the dynamics of the BL course. These themes provided insights into the challenges and successes of the BL model, highlighting areas that significantly impacted student learning experiences. The themes and patterns identified were interpreted within the broader context of existing literature on BL (Garrison & Vaughan, 2008). This interpretation involved analysing how the findings from this study aligned or diverged from established BL theories and practices.

The comprehensive analysis looked beyond surface-level observations and delved into the complexities of BL implementation. It explored how different elements of the BL course, such as digital tool integration and face-to-face interactions, collectively contributed to the learning experience. Reflective analysis was employed to ensure that the researcher's biases and perspectives did not unduly influence the interpretation of data. This reflexivity is crucial in qualitative research to maintain objectivity and credibility (Braun & Clarke, 2006). The synthesis and analysis of data were grounded in relevant theoretical frameworks. This integration provided a solid foundation for interpreting the findings, ensuring that the study's conclusions were theoretically sound and practically relevant.

Ethical Considerations

Ethical considerations were at the forefront throughout this research process, adhering to the highest standards of academic integrity and respect for participants. Key elements of these considerations included informed consent, confidentiality, and data protection. Before observation and data collection, informed consent was obtained from all participants. This process involved clearly explaining the purpose of the study, the nature of participation, and participants' rights, including the right to withdraw from the study at any time without any consequences (Resnik, 2011).

Confidentiality of the data collected was strictly maintained. The personal information of participants was anonymised to ensure privacy. Any potentially identifiable information was either omitted or altered in the reporting of the study findings, adhering to the guidelines of responsible research conduct (Sieber, 2001). Data was securely stored and handled in compliance with data protection regulations. Access to the data was restricted to the research team, and all electronic data was encrypted to prevent unauthorised access (Data Protection Act, 2018).

The research proposal, including the ethical considerations, was reviewed, and approved by the Dean and course coordinator at Macromedia University. This review ensured that the study met all ethical standards required for research involving human subjects (American Psychological Association, 2010). Throughout the research process, continuous reflection on ethical practices was conducted. This involved regularly assessing the impact of the research on participants and making necessary adjustments to maintain ethical standards.

Theoretical Framework

This study was guided by a robust theoretical framework that underpinned every aspect of the research design, data collection, and analysis. Central to this framework was a deep understanding of BL models, particularly their application and efficacy in higher education contexts (Garrison & Vaughan, 2008). This foundational concept was crucial in shaping the study’s approach to exploring the BL course at Macromedia University. The study delved into various theories of BL, examining how these approaches combine online digital media with traditional classroom methods to create a more integrated and flexible educational experience (Graham, 2006). This exploration included understanding the pedagogical benefits and challenges of BL, as well as its impact on student engagement and learning outcomes.

Additionally, the study was informed by the principles of qualitative research, which emphasise the systematic collection, organisation, and interpretation of textual material (Creswell &

Creswell, 2017). This approach enabled an in-depth exploration of the BL environment, yielding rich, detailed insights that quantitative methods might not capture. The theoretical underpinnings also played a crucial role in informing the observational and document analysis methods. These methods were carefully chosen and executed to align with the qualitative nature of the study, ensuring a comprehensive and rigorous examination of the BL course. The framework also considered broader educational theories and practices, situating the study within the larger landscape of educational research. This contextualisation helped in understanding the unique aspects of BL in comparison to other educational models.

Research Context and Relevance

The BL course at Macromedia University provided an exceptional context for exploring contemporary educational practices within the realm of BL. This setting was particularly significant given the growing emphasis on digital integration in higher education. The course represented a microcosm of the broader trends and challenges in implementing BL strategies. The choice of Macromedia University as the study's focus was strategic, reflecting the institution's commitment to innovative teaching methodologies. This university's adoption of BL methods offered a timely and relevant case for examining the effectiveness and adaptability of these approaches in a rapidly changing educational landscape.

The findings from this study are poised to make a substantial contribution to the discourse on BL. By providing empirical evidence and nuanced insights, the study can inform educators, administrators, and policymakers about effective BL strategies, potential pitfalls, and best practices for implementation. The insights garnered from this study have the potential to influence educational policy and strategy. By identifying key factors that contribute to the success or challenges of BL courses, the study can guide decision-makers in shaping policies that support effective BL implementation.

The study's findings can also inform future educational strategies, particularly in the context of higher education's evolving demands. Understanding the dynamics of BL courses at Macromedia University can provide valuable lessons for other institutions seeking to integrate or enhance their BL offerings. Although focused on a specific university, the study's implications extend beyond its immediate context. The insights gained can be applied to a global audience, contributing to the understanding of BL in diverse educational settings.

5.3 Data Collection

This study's data collection was centred around a detailed exploration of the 'Empirical Research and Statistics' course at Macromedia University. The primary aim was to investigate the current state and effectiveness of BL teaching methodologies within this specific course context.

Overview of Case Details

The 'Empirical Research and Statistics' course at Macromedia University was selected for its exemplary integration of BL techniques. This course is a critical part of the university's curriculum, reflecting contemporary trends in educational technology and pedagogy. Its comprehensive adoption of BL approaches, combining online and face-to-face elements, made it an ideal subject for examining the effectiveness and challenges of BL in higher education. The course's structure, incorporating a mix of synchronous online lectures and in-person exercises, provided a diverse range of data for analysis. This setup facilitated the study of BL's impact on various aspects of the learning experience, including student engagement, content retention, and the effectiveness of interactive elements.

Macromedia University, with its reputation for innovative educational strategies, presented a unique context for this study. The university's commitment to embracing and pioneering new teaching methodologies, including BL, positioned it as a leader in adapting to the evolving landscape of higher education. The university's diverse student body and faculty, coupled with its technological infrastructure, offered rich insights into the implementation and reception of BL approaches. These factors contributed to a comprehensive understanding of the role of BL in modern higher education.

The participants comprised a diverse group of students enrolled in the course, along with the instructors. This mix provided a range of perspectives on the BL experience, from both the learner and educator viewpoints. The student participants varied in terms of their academic backgrounds, technological proficiency, and learning preferences, offering a broad spectrum of experiences and perceptions of the BL course. The instructors, with their expertise in BL methodologies and course content, provided valuable insights into the pedagogical considerations and challenges of implementing BL.

Data Sources

The primary data collection method in this study was in-depth participant observation, which involved a comprehensive engagement with the 'Empirical Research and Statistics' course at

Macromedia University. This immersive approach allowed for a detailed examination of the teaching methods, student-teacher interactions, and student engagement within the BL environment. Observations included both online and in-person lectures and exercises, providing a holistic view of the course dynamics. This dual-mode observation was crucial in understanding how BL strategies are applied and experienced differently in digital versus physical settings.

Specific techniques used in observation included notetaking, recording verbal and non-verbal cues, and monitoring the use of digital tools in online settings. The observer also focused on student participation, the nature of interactions, and the overall classroom climate. Attention was given to the integration of technology in teaching, such as how digital platforms were used for lectures, discussions, and assignments. This provided insights into how technology facilitated or hindered the learning process in a BL context. The observational data was analysed using qualitative methods, focusing on identifying patterns, themes, and discrepancies in the BL experience. This analysis was guided by existing literature on BL and educational theory, ensuring a well-grounded interpretive framework (Merriam, 2009).

Furthermore, a range of course-related documents was meticulously analysed to complement the observational data. This included lesson plans, teaching materials, student feedback forms, and other course documentation. The analysis of these documents was pivotal in understanding the planned structure and pedagogical approach of the BL course. Lesson plans were scrutinised to understand the intended learning outcomes, instructional strategies, and the balance between online and face-to-face components. Teaching materials, such as presentation slides, reading assignments, and digital resources, were examined to gauge how information was presented and integrated into the course structure.

Analysis of student feedback forms provided crucial insights into the learners' experiences and perceptions of the BL course. This feedback helped identify areas of success and aspects needing improvement from the students' perspective. By examining student feedback, the study gained a better understanding of student engagement, satisfaction levels, and perceived challenges in the BL environment. This provided a vital learner-centred perspective on the effectiveness of the BL methods employed in the course. Document analysis added contextual depth to the observational findings, offering a more comprehensive understanding of the BL course's operation. This method allowed for validation and triangulation of the data collected, enhancing the study's overall reliability and validity. The combination of document analysis

with participant observation enriched the study's findings, providing a multi-dimensional view of the BL course at Macromedia University.

Overall, the data collection process was structured to ensure a comprehensive understanding of the BL course's operation and its impact on teaching and learning. This approach aligned with qualitative research criteria for rigor and transparency (Baur & Blasius, 2019). The synthesis of observational and documentary data facilitated a holistic view of the BL course, enabling the formulation of informed hypotheses about its effectiveness.

5.4 Qualitative Analysis

5.4.1 Descriptive Coding Process

The descriptive coding process, a cornerstone in qualitative research, involves meticulously labelling and categorising segments of observational data to encapsulate their fundamental content. In our study at Macromedia University, this process was pivotal for discerning intricate patterns in the BL environment during the COVID-19 pandemic. Methodologically anchored in objective hermeneutics and grounded theory, the approach facilitated an intricate analysis of educational dynamics (Becker, 2020; Smith, 2019).

Initial broad coding categories, including student behaviour and technological integration, were progressively refined to encapsulate more intricate aspects of the BL experience such as student engagement and content delivery (Johnson & Christensen, 2017). The constant comparison method was integral, ensuring evolving coding schemes resonated with the unfolding data, thus providing a more nuanced understanding of the pandemic's impact on BL.

Further, a methodologically robust approach, influenced by the works of Merkens (1992), Schwartz & Jacobs (1979), and Spradley (1980), ensured a high level of intersubjectivity in evaluating and drawing conclusions from the data. Systematic participant observation, as guided by Merkens, transitioned from passive perception to active search, embedding an initial phase of evaluation in observer restructuring of experiences. This process was critical in documenting and analysing the observations, with a focus on uncovering latent meanings behind educational interactions.

The evolution of protocols over time was another crucial aspect, allowing for adaptation and learning from the observation object. This led to two distinct evaluative strategies: chronological evaluation of protocols or an agnostic approach to protocol dates, focusing on significant cases (Merkens, 1992). In this study, the chronological approach, resonating with objective hermeneutics (Oevermann, Allert, Konau, & Krambeck, 1979), was chosen to

uncover hidden meanings and develop hypotheses from observed interactions. The patterns behind actions were deciphered using social science theories, with each episode analysed individually until a superior interpretative theory emerged.

5.4.2 Course Experience Themes

The study at Macromedia University, designed over a semester, employed a hybrid methodology integrating participant observation with qualitative content analysis, as guided by the principles laid out by Merkens (1992) and Creswell and Plano Clark (2018). This approach was instrumental in developing a nuanced understanding of the BL environment, particularly in the context of the COVID-19 pandemic. The evaluation strategy, rooted in qualitative content analysis, was structured into a detailed category system, encapsulating both the microsystem (individual level) and macrosystem (institutional level) aspects of BL. This system, depicted in Table 8, serves as the backbone for categorising and understanding the intricacies of the BL environment at Macromedia University.

At the microsystem level, the focus was on the general setting of BL sessions, class organisation, teaching contents, types of instruction, and student behaviour. This included detailed observations of different teaching scenarios—fully online, on-campus, and hybrid—and their impact on student engagement and learning outcomes. The analysis extended to the examination of teaching styles, usage of teaching media, and available work materials, which were crucial in understanding the dynamics of BL. Student behaviour emerged as a prominent theme, with attributes such as punctuality, confidence, engagement, and interaction being closely monitored. The behavioural aspects were linked to the broader learning experience, including indicators like effort and participation.

The macrosystem level analysis concentrated on the working characteristics of professors and lecturers, specifically their openness to implementing innovations and accessibility during the semester. It highlighted the importance of faculty adaptability and communication in a changing educational landscape, reflecting on how these factors influence the overall effectiveness and receptivity of BL initiatives within the university setting. These aspects were vital in understanding the broader institutional context within which BL was situated.

Finally, the outcomes were meticulously analysed, focusing on grades, learning success, competencies, and future skills. This comprehensive approach allowed for a deeper dive into the educational impact of BL, evaluating both the direct outcomes like grades and competencies and the more subjective aspects of the learning experience such as joy, motivation, and participation. This thematic analysis, grounded in the principles of qualitative content analysis,

offered profound insights into the BL experience at Macromedia University, capturing the complexities and nuances of student interaction and engagement in a rapidly evolving educational landscape.

Table 6

The Category System for the Participant Observation in the Winter Semester of 2021/ 22

Microsystem BL (Individual Level):
General Setting
- Date - Category - Duration - Early start - Overstay
Class Organisation

- Fully Online = Scenario A
- Fully on Campus = Scenario E
- Hybrid = Exception
- Attendance
  o Student's amount of attendees
  o The number of attendees at the beginning
  o The number of attendees at the end
  o Active on-site
  o Active online
- Homework (given or not given)
- Homework (done or not done)

Teaching Contents
- Units/ Schedule = Curriculum - Curricular changes or features during the semester - Holidays
Type of Instruction
- Levels of competencies - Learning objectives

- Teaching style
  o Pacing
  o Workload
  o Breaks were taken
- Usage of teaching media
  o PowerPoint
  o Teams/ Blackboard Chat
  o Whiteboard
  o Other media

- Work materials available:

- Recordings on Teams/ Blackboard
- Scripts on Moodle/ Blackboard
- Additional Recordings/ Material
- Word cloud
- Student quiz
- "In a Nutshell"-slides

Student Behaviour

- Student characteristics:
  - punctual
  - confident
  - active
  - engaged
  - focused
  - attentive
  - interested
  - motivated
  - hard working
  - trying (hard)
  - has fun

- Gender:
  - Female
  - Diverse
  - Male

- Participation:
  - Online attended/ not
  - Exercise attended/ not

- Student communication inside of class:
- Interaction with the professor:
  - Conversation in class
  - Group discussions
  - Chat on Teams/ Blackboard
  - Comments on Teams
  - Posts
  - Likes
  - Claps
  - E-Mails
- Interaction with other students:
  - Conversation in class
  - Group discussions
  - Group work/ learning communities
  - Chat on Teams/ Blackboard/ other media
  - Comments on Teams
  - Likes

- Student communication outside of class:

- Interaction with the professor:
  - Conversation out of class
  - Group discussions
  - Chat on Teams/ Blackboard
  - Comments on Teams
  - Posts
  - Likes
  - E-Mails
- Interaction with other students
  - Conversation out of class
  - Group discussions
  - Group work/ learning communities
  - Chat on Teams/ Blackboard/ other media
  - Comments on Teams
  - Likes

- Self-learning phase:
  - Homework
  - Recordings
  - Tutorials

Outcomes

- Grades

- Learning success:
  - Increased knowledge
  - Feeling encouraged through improved skills
  - Improved learning
  - Development of own learning strategies
  - Feeling competent
  - Feeling confident about the exam

- Competencies:
  - Deeper understanding
  - Application in course
  - Application outside of the course
  - Critical analysis

- Future skills:
  - Diverse viewpoints
  - Presenting to audience
  - Defining and solving problems
  - Developing capacity for empathy
  - Preparation/ Enhancement of career
  - Developed leadership skills
  - Preparation for future

- Trade-Off:
  - Experience
  - Outcome

Macrosystem University (Institutional Level):
Working characteristics of lecturers: - Open to implementing innovations - Easily reachable

5.4.3 Protocol Analysis

5.4.3.1 Scenario A

To analyse data from the online lecture ‘Scenario A’, a tabular overview of the category system, associated behaviours, events, processes, and their occurrence order is prepared from the transcripts (see Appendix C1). This approach leads to systematic conclusions and hypothesis formation. The process is exemplified by the protocol from October 7, 2021 (see Appendix E), which starts with monitoring student attendance and lecturer introduction, falling under the ‘classroom organisation’ category at the individual level:

> “14:00. Eighty-one students nationwide entered the session. Prof. Mothes starts the session in time.”
>
> “14:03. 120 students have attended in total by now.”
>
> “14:13. Currently, 123 students are attending.”
>
> “15:35. 73 students are still attending. The course is still going.”

The session exceeds the 90-minute limit, which is noted in the ‘general setting’ category. This exemplifies a multiple assignment. Regarding the content, which falls under the ‘didactics’ category in the guideline, the following is noted:

> “14:03. The intro by the professor is over and the recording starts.”
>
> “14:04. The presentation starts. It’s an intro into the semester and topic.”
>
> “14:13. The professor is explaining the necessity of the course.”
>
> “14:33. The presentation of the content and relevance continues, including reference to learning goals and catch-up to last semester.”

Students actively ask questions in the chat and engage by commenting on or liking posts and messages. All the chat interactions are documented with screenshots attached to the transcripts. In the ‘student behaviour’ category, this active online participation is a key focus:

> “14:08. Question 1 in chat: What happens if you have not passed scientific work?”
>
> “14:17. Question 2 in chat: The module is completed with an exam, right? Not with a term paper!?”

> "15:35. Question 3 in chat: I have no exercise at the campus (Stuttgart) entered in my timetable and also no Teams room for the exercise. There is also no contact person for Stuttgart in your Moodle room."
>
> "15:37. Question 4 in chat: Can we find the slides you just showed on Moodle? I didn't quite catch that at the beginning."

In addition to the interactions, it is observed that the lecturer does not take breaks and answers all questions at the end of each session. This represents a pattern of repeated behaviour, consistently occurring across sessions. This aspect is noted under the 'didactics' category by the researcher:

> "15:05. No breaks are taken."
>
> "15:27. No questions answered so far."
>
> "15:37. Questions are being answered by the lecturer."

Lastly, interpretative notes are taken by the participant observer as well. They include:

> "14:04. They are not allowed to speak up due to data protection."
>
> "14:13. The professor is very motivating. She is mentioning several times the importance of attending and explaining the course in detail."

Interpretative notes provide insights into the dynamics between lecturer behaviour and student engagement, categorised under 'student behaviour'. Irrelevant notes are omitted. This selective categorisation, essential for objective hermeneutics, enables a focused analysis of online lessons. The classification method aids in determining individual category connotations, deepening the understanding of each category. Text passages are tabulated (see Table 9, Bernard, 1988), enhancing data interpretation's clarity and intersubjectivity. This approach highlights the importance of selective categorisation in qualitative analysis, ensuring relevance and depth in findings.

Table 7

Example of the Categories and Assigned Quotes from the Protocol of 07.10.2021

General Settings	"15:35. 73 students are still attending. The course is still going."
Classroom Organisation	"14:00. 81 students nationwide entered the session. Prof. Mothes starts the session in time." "14:03. 120 students have attended in total by now." "14:13. Currently, 123 students are attending." "15:35. 73 students are still attending. The course is still going."

Didactics	"14:03. The intro by the professor is over and the recording starts." "14:04. The presentation starts. It's an intro into the semester and topic." "14:13. The professor is explaining the necessity of the course." "14:33. The presentation of the content and relevance continues, including reference to learning goals and catch-up to last semester." "15:05. No breaks are taken." "15:27. No questions answered so far." "15:37. Questions are being answered by the lecturer."
Student Behaviour	"14:08. Question 1 in chat: What happens if you have not passed scientific work?" "14:13. The professor is very motivating. She is mentioning several times the importance of attending and explaining the course in detail." "14:17. Question 2 in chat: The module is completed with an exam, right? Not with a term paper!?" "15:27. No questions answered so far." "15:37. Questions are being answered by the lecturer." "15:35. I have no exercise at the campus (Stuttgart) entered in my timetable and also no Teams room for the exercise. There is also no contact person for Stuttgart in your Moodle room." "15:37. Can we find the slides you just showed on Moodle? I didn't quite catch that at the beginning."

Through this presentation, intersubjectivity can be achieved at the level of the observation statements when processing the statements. The information content of the table is also increased by the fact that the matrix form is chosen. In the chosen example, the categories known from the tabular overview are retained in the rows, and rubrics such as lecturer-student interaction or student-student are added in the columns.

Table 8

Example of the 'Student Behaviour' Sub-Categories 'Lecturer-Student Interaction' and 'Student-Student Interaction' from the Protocol of 07.12.2021

Student Behaviour	
Communication Inside of Class	Lecturer-Student Interaction
	"14:08. Question 1 in chat: What happens if you have not passed scientific work?"

	"14:13. The professor is very motivating. She is mentioning several times the importance of attending and explaining the course in detail." "14:17. Question 2 in chat: The module is completed with an exam, right? Not with a term paper!?" "15:35. Question 3 in chat: I have no exercise at the campus (Stuttgart) entered in my timetable and also no Teams room for the exercise. There is also no contact person for Stuttgart in your Moodle room." "15:37. Question 4 in chat: Can we find the slides you just showed on Moodle? I didn't quite catch that at the beginning." "15:27. No questions answered so far." "15:37. Questions are being answered by the lecturer."
Communication Outside of Class	Lecturer-Student Interaction
	Not evident.

During the semester, the guideline is supplemented with further subcategories such as online and on-site participation or activity and inactivity in the session are included. The adjustments apply to the analysis of all protocols.

5.4.3.2 Scenario E

To analyse the data from the on-site exercise 'Scenario E', a second tabular overview is prepared from the protocols, outlining behaviours, events, and sequences as they occur (see Appendix F). This analysis leads to systematic conclusions and additional hypotheses, complementing insights from the online lecture analysis. The protocol from October 12, 2021, representing the first exercise and an exceptional hybrid form due to COVID-19, illustrates this process. Unlike the planned fully on-campus Scenario E, this hybrid session begins with noting student presence and lecturer introduction, categorised under 'classroom organisation' at the individual level:

> "12:14. The exercise takes place hybrid. This means that half of the course is on campus, while the other one participates online."
>
> "12:15. The session is installed by the lecturer. Nine students are in the class. Eleven are online."
>
> "12:18. 12 students are online."

Further, the following is noted regarding the content that falls under the category of ‘didactics’ in the guideline:

> “12:20. Introduction by the lecturer.”
>
> “12:43. First exercise starts.”
>
> “Note by the researcher: Teamwork for seven minutes. Four teams.”
>
> “12:52. Exercise is discussed.”
>
> “13:11. The second exercise starts. No breaks taken so far.”
>
> “13:15. Exercise is discussed.”
>
> “13:33. Exercise three.”
>
> “13:54. Class ends.”

The exercise offers much more material for in-depth observation because the students are on-site. The student’s feelings, general mood, verbally and physically communicated fears and worries, overall concentration, etc. could be better perceived and recorded by the researcher. Therefore, the transcripts of the exercise are longer. All interactions in class and possibly in the chat due to the hybrid format were documented in writing in the transcripts or attached as screenshots. They were also subsequently classified. The following was said about the category ‘student behaviour’:

> “12:25. Introduction by students. They are scared, as they don’t know what will happen in the course. They don’t have many touchpoints. They want to know how to use data and hope it is useful for their bachelor thesis.”
>
> “12:36. The lecturer asks a question on the online lecturer: Difference qualitative and quantitative research. No answers.”
>
> “Note from the researcher: In the beginning, students were shy to say something wrong.”
>
> “12:48. A student asks a question regarding the scientific writing catch-up.”
>
> “Note from the researcher: Related to last week’s online lecture.”
>
> “12:52. Thora and Lara P. answer and other students agree.”
>
> “Note by the researcher: The interaction and participation in the exercise are much higher compared to the online lecture.”
>
> “13:14. The students get more tired and less focused in class. Two students are on their phones.”
>
> “13:15. Exercise is discussed. One answer online, three in class.”

Regarding the categories ‘didactics’ and ‘student behaviour’, which occur simultaneously as yet another example of a multiple assignment, the following can be observed:

> “13:20. Lecturer actively asks students to participate more.”
>
> “13:28. Student asks to take a break. Lecturer declines but offers an incentive to end class earlier.”
>
> “13:33. Exercise three. Answers come mainly from students in class. The lecturer actively asks the online group to answer.”
>
> “13:54. Class ends. Last question from the lecturer: Were the learning goals achieved? Most active students interact with thumbs up, the others don’t answer.”
>
> “Note from the observer: High activity in class overall. The lecturer mentions that he is impressed.”

During the observation phase, initial, individual, and partly incoherent hypotheses based on the classification of the statements in the protocols into the category system are formed. The longer the observation lasts, the clearer the picture of the hypotheses becomes. A network of mutually compatible hypotheses quickly emerges (Merkens, 1992). The development process and the resulting hypotheses are described and explained in the following section.

5.5 Hypothesis Development

In the process of participant observation, initial assumptions arose that led to the development of a series of hypotheses. They were collected by the researcher and adapted when categorising the protocol passages and analysing them. The initial assumptions lead to a set of hypotheses divided into the online lecture, the exercise, and the overall course.

It was found that participation in the overall event decreased over the semester. It was consistently higher in the exercise than in the online lecture. An example of developed statements about the general course from an early phase of the observation period is the following:

> *Regularly attending students are more active.*
>
> *When the lecture is too demanding, the number of participants decreases.*

Correlations of the main categories ‘didactics’ and ‘student behaviour’, as well as the sub-categories ‘workload’, ‘pace’, and ‘breaks taken’ were observed. They are chosen as a correlation is observed between attendance and the activity of the students, i.e., their willingness to interact and thus actively participate. Besides, students complained about not being able to focus on the online lecture several times due to pace, workload, and no breaks taken. This didn’t happen in the on-site exercise. Targeting the correlation of the sub-categories ‘workload’,

‘pace’, and ‘breaks taken’ related to the type of instruction in the category ‘didactics’ and the lecturer’s teaching style in the category ‘student behaviour’ with the learning experience dimensions ‘Joy’ and ‘Focus’, the following assumptions were formulated over time:

> *When the workload during the overall course is too high, students have less fun.*
>
> *The fewer breaks are taken, the less focused the students are.*
>
> *When the workload and pace during the online lecture are continuously too high, while no breaks are taken, the focus decreases.*

Focus and joy are key components of a student’s learning experience. As the research goal of this doctoral thesis targets the impact of didactics, e.g., the type of instruction and teaching style in BL on students’ learning experience and outcomes, the above-mentioned statements serve as a guidance for the final hypotheses. This also applies to the correlation of the sub-categories ‘Workload’ and ‘Pace’ and ‘Breaks Taken’ with the learning outcomes dimension ‘Learning success’ and ‘Competencies’:

> *When the workload during the overall course is too high, the learning success decreases.*
>
> *When the workload during the overall course is too high, the acquisition of competencies decreases.*

Joy could not be observed during the observation of the online lecture. Nevertheless, it was visible during the exercise on-campus. Regarding the dimension ‘interaction’ between the lecturer and students in the category ‘student behaviour’ in the online lecture, an initial hypothesis was developed in correlation with the dimension ‘interaction’:

> *The less the lecturer uses interaction tools that are implemented into the online lecture, the fewer students interact with her.*

The findings from the observation of the online lecture support the following statement that was made based on the observation of the on-site exercise:

> *The more the lecturer uses interaction tools in the exercise for online students and personally interacts with students on-site, the more students interact with him.*

Also, the label ‘exam relevant’ was observed as being an influencing factor in both scenarios A and E towards the dimensions ‘interaction’ and ‘participation’:

> *The more content is labelled exam related, the more students interact.*
>
> *The more content is labelled exam related, the more students participate.*

The above-mentioned findings serve as a basis for the design process (see Chapter 7). Besides the online lecture, the on-site exercise was observed. Already during observations of the first exercise sessions, hypotheses regarding the category ‘didactics’ were formulated. This was due to intuitively applied didactical approaches by the lecturer, as described in 4.3.2:

> *Activating learning methods lead to students retaining content better.*

Based on the early observations, the following statements were issued:

> *When a student’s request or question is responded to immediately or within a reasonable period, the learning success is higher.*
>
> *When a student’s request or suggestion is not responded to, but an alternative incentive is offered, the focus remains higher.*

They are underpinned by observations regarding the teaching style of the professor in the category ‘didactics’ and the interaction between the lecturer and students in the category ‘student behaviour’. The following statement was formulated during a late state of the observation:

> *The less the lecturer adapts the pace and teaching style towards students’ suggestions in the online course, the fewer students interact during class.*

The findings from the observation of the online lecture are again supported by the following statements made based on the observation of the on-site exercise:

> *The more the lecturer adapts his teaching style towards students’ suggestions in the exercise, the more students interact during class.*
>
> *When the type of instruction and teaching style of the exercise are adapted towards students’ suggestions and needs, the focus remains high.*

The findings are relevant to the overall goal, as they indicate that an adaption of the teaching style could lead to a change in the learning experience. Lastly, observation results show that there is a difference between online lectures and on-site exercises when it comes to student participation and interaction. The following correlations between the exercise and the lecture were observed early on:

> *On-site exercises are visited by more students than online lectures.*
>
> *Students interact more in an on-site than online scenario.*

They were formulated in the following assumptions over time:

> *Students who don’t participate in lectures are less active in the exercises.*

The average participation in the exercise is higher than in the online lecture.

They are important findings for further research. However, in the context of this research, they are negligible, as they are not directly related to the type of instruction or the teaching style. What is crucial are findings in the category ‘student behaviour’ about implementing learning groups and providing room, namely the dimensions ‘learning groups’ and ‘group work’ for reflection in the exercise:

The more the lecturer implements learning groups in the exercise, the more students interact with each other.

The more the type of instruction, e.g., pace, acquisition of competencies, and practical implementability, in the exercise provides room for reflection, i.e., during group work, the more students interact.

Regarding the possible trade-off between the dimensions ‘learning experience’ and ‘learning outcomes’, the following statement was derived:

When the learning experience decreases, then the learning outcome decreases.

Results on this statement will be generated by comparing both semesters. As this is not part of the present study it will be addressed in Chapter 8. Therefore, testing of this statement will be deferred to further research.

Chapter 6: Survey Development

6.1 Introduction

Blended learning (BL) in higher education, a harmonious blend of face-to-face (f2f) and online teaching methods, has seen increased adoption and interest, as highlighted by experts such as Cress (2017), Alammary, Sheard, and Carbone (2014), and Atef and Medhat (2015). This approach necessitates a shift in traditional course design, aiming to maximize student engagement and learning outcomes, as discussed by Wannemacher et al. (2016) and Garrison & Vaughan (2008). The unexpected surge in BL and online courses during the COVID-19 crisis, described by Kofoed et al. (2021), presented unique challenges, including concentration issues and a lack of personal interaction affecting students' learning experiences.

Addressing these challenges requires a nuanced understanding from the students’ perspective, calling for a robust quantitative assessment tool. This study adopts an exploratory sequential design, integrating qualitative and quantitative research methods, as proposed by Creswell &

Plano Clark (2018). The initial phase, grounded in qualitative analysis through participant observation, yields crucial insights into the student experience. These insights, reflecting the real-world complexities of BL, form the foundation for the subsequent development of a quantitative survey instrument.

The exploratory sequential design, a concept elaborated by Edmonds & Kennedy (2017), facilitates data collection at different stages, allowing for an adaptive and responsive research approach. This methodology enables the study to not only capture the current state of BL in higher education but also to formulate effective interventions for its enhancement. The mixed-methods approach commences with a detailed qualitative analysis. The findings from this phase, aligned with the principles laid out by SAGE (2019), inform the construction of the quantitative survey. This survey, reflective of the overall student population at Macromedia University, is meticulously developed to capture the nuanced experiences of students engaged in BL courses. It includes an extensive assessment of both online and face-to-face components of BL, considering the diversity and complexity of student experiences.

6.2 Method

In this study, the data collected from participant observation of the on-site exercise and nationwide online session over one semester were used to develop the quantitative measure. This design requires a high level of expertise on the part of the researcher. It requires advanced skills such as knowledge of qualitative research, quantitative research, mixed methods research, and instrument development. The researcher was not only qualified but also carried out procedures to ensure that the results obtained with the developed instrument or intervention material were of high quality. To this end, she involved a subject matter expert (SME) in the development process (Creswell & Plano Clark, 2018). The quantitative instrument was developed based on the qualitative data and the extensive literature review. However, the focus of the instrument development was on the quantitative data. Therefore, as explained by Edmonds and Kennedy (2017), it provided a framework for the researcher to first develop an instrument and then test it psychometrically on a specific population.

The research problem and the purpose of this study require that the qualitative aspect is emphasised within the design. Therefore, in the first phase of the study, the researcher worked according to constructivist principles to consider multiple perspectives and gain a deep understanding (Creswell & Plano Clark, 2018). In doing so, the researcher collected qualitative data. As mentioned, this was done in the exploration of the current state. In this study, the qualitative data was analysed in the so-called ‘exploratory’ phase. It is data-driven and not

determined by a conceptual framework. This means that both qualitative data and literature were used to better understand the research problem. The reason for postponing immediate quantitative data collection is that additional conceptual leverage is required before a questionnaire can be created and a survey conducted (Creswell & Plano Clark, 2018). The analysis of the data begins with coding the text sections with deductive and inductive codes. The codes are either deductive themes, which are initially considered preliminary codes relevant to the study, or inductive themes, which are identified during the review of the data. To identify inductive codes, the data were analysed qualitatively using qualitative content analysis. This means that a generic qualitative study was conducted rather than a specific qualitative tradition such as grounded theory or case study (SAGE, 2019). In general, qualitative analysis helps to identify a broader range of issues and how people formulate their understanding of a particular event or phenomenon (Creswell & Plano Clark, 2018).

As the researcher moves to the quantitative phase, the underlying assumptions shift to a post-positivist philosophical stance to guide the need to identify and measure variables and statistical trends. In this design, multiple worldviews were used, shifting from one phase to the other (Creswell & Plano Clark, 2018). The interpretation of the two interrelated findings was based on the dialectical perspective and an associated set of assumptions of the researcher, who is herself a practising lecturer. The main concern was to answer the question of which items and scales represent the qualitative findings (Edmonds & Kennedy, 2017). To do this, the researcher identifies meaningful quotes, codes them with relevant themes, and potentially develops larger themes. A quote can be a phrase, sentence, paragraph, or larger segment of text. While a code is a theme from the literature or inductively constructed from a close reading of the data, a theme is a conceptual topic that is more abstract than a typical code (SAGE, 2019). Items are developed based on the qualitative findings and related literature. The inductively constructed codes and conceptual themes are underpinned by constructs from the literature (Busse & Walter, 2013; Jonson & Renner, 2012; Londsdale et al., 2011; Hillyard, Gillespie, & Littig, 2010; Fu, Su, & Yu, 2009; Struthers, Perry, & Menec, 2000), which were identified by the researcher through the variables that emerged during the qualitative data analysis as part of the instrument development.

After the development of the quantitative instrument, in this case, the variables and the resulting items for the student survey questionnaire, the 191 students of the BL course in the winter semester of 2021/ 2022 were asked to voluntarily participate in the online survey. Participation was possible for a period of one month, starting with the penultimate week of the semester from

10.01.2022 to the week after the exam until 11.02.2022. The survey was then repeated at the end of the summer semester of 2022. The questions and time frame were the same, except for 18 additional questions about the interventions developed in Study 3. The quantitative evaluation and thus explanation of the qualitative data is described and analysed in the 4th and last study of this dissertation.

6.3 Data Collection

The data collection was carried out in the winter semester 2021/ 22 using the participant observation method and took place in the nationwide course 'Empirical Research and Statistics', which was conducted hybrid at seven locations in Germany. Over one semester, the instrument was used to specifically observe 191 students in the online session and a selected sub-set of 25 participants at the Munich campus in the on-site exercise. The basic aim of the participant observation to perceive events and interactions as they happen was followed. In this way, the researcher gained an authentic view of what happened in the natural context of BL teaching and learning in higher education. However, only the observable behaviours were recorded, not the participants' intentions. To gain insights into the students' intentions, a quantitative instrument was developed in this study.

6.4 Qualitative Analysis

6.4.1 Code Development

As mentioned, the codes developed from the participant observation in the winter semester of 2021/ 22 are either deductive themes, which are considered preliminary codes relevant to the study, or inductive themes, which are identified during the review of the data (SAGE, 2019). In studies guided by a theoretical or conceptual framework, only deductive codes can be used. In studies that are more exploratory or data-driven only inductive codes should be used. Since this study is an exploratory sequential mixed methods study, inductive codes are preferred. The researcher is interested in a data-driven approach so that the quantitative phase is closely aligned with the participants' perspectives rather than a predetermined list of codes (SAGE, 2019).

Therefore, attention was given to inductive codes, which include actions, time scales, authority, socialisation, and absolutist language. The approach used to work both deductively and inductively was pragmatic. In other words, the researcher was interested in coding the who, what, where and when of the data. The codes refer to each of these basic areas. The 'who' was addressed by the 'student behaviour' codes. The 'where' was addressed by the 'classroom organisation' codes. The when was addressed by the 'general setting' code. The 'what' was addressed by the 'teaching contents', 'didactics', and 'learning outcomes' codes. These codes

are based on Merkens (1992) and serve as organisational codes under which more specific sub-codes are placed based on the qualitative data (SAGE, 2019). It should be noted that the codes were also used as the basis for the qualitative content analysis conducted in Study 1. This consistency is important to ensure that the studies build on each other.

6.4.2 Deductive Codes

The first step was to develop further deductive codes by analysing the existing literature on BL teaching in higher education. Looking at the available literature, the key pedagogical ideas of BL were identified by Atef and Medhat in 2015. They are *interaction, variation, transformation, flexibility,* and *integration*. Flexibility includes choice and meeting individual needs. Interaction takes place in f2f or computer mediated. The overall approach is integrative. The variations of BL include pedagogical methods, strategies, tools and learning styles. To transform BL, it is possible to change the curriculum, teacher role or instructional methods (Atef & Medhat, 2015). In this thesis, the scope for action referred to the *teacher role* and the *instructional methods*. The *curriculum* can be neglected, as it is rooted in the Bologna Reform and is not changed in the given research time frame. It serves as a basis for action. Thereby, the researcher wished to seek changes in the role of the teachers and instructions as an innovation in education in the respective BL scenarios. The deductive code 'transformation' served as a conceptual framework outlined as the winter semester of 2021/ 22 and the summer semester of 2022. This was because the sub-codes 'teacher role' and 'instructional methods' represented the instruction and implementation of the course in the winter semester of 2021/ 22 compared to the summer semester of 2022. The scope for action built the foundation of the analysis and design of the interventions within the instructional design process (see Chapter 7).

Looking at the literature, it became clear that the main idea of BL is to enhance the learning environment by incorporating online learning tools (Alammary, Sheard, & Carbone, 2014). In higher education, learning is based on social constructivism, which gives knowledge a socially constructed meaning. This means that learning is an experience and reflection of a social context. In this context, the online learning aspect offers a range of manageable, content-rich tools as well as knowledge-sharing and collaboration tools (e.g., wikis, blogs, forums) (Walker & Baets, 2008). Based on Alammary, Sheard, and Carbone (2014) BL contain both f2f and computer-mediated portions and thoughtfully integrates them with different instructional methods such as lecture, discussion group, and self-paced activity. Interaction happens in f2f and computer-mediated environments (Atef & Medath, 2015). These social interactions promote reflection-in-action in on-site exercise and reflection-on-action outside of class, at

home, or in learning groups (Baumgartner, 2013; Riel & Sparks, 2009). Building and maintaining relationships that underlie the success of the reflection process is more feasible in a classroom setting (Atef & Medath, 2015).

Furthermore, the implementation of BL in higher education aims to have a positive effect on students' learning experience (Vaughan, 2007), their learning success (Rovai & Jordan, 2004; Graves & Twigg, 2006) and their flexibility (Kresch & Evans, 2015; Atef & Medath, 2015; Vaughan, 2007), i.e., choice of learning place and time. Learning from home is particularly beneficial in this regard (Vaughan, 2007). Atef and Medath (2015) emphasise the value of flexibility through choice and meeting students' individual needs. Based on the literature, students' needs include student-centred learning (Meacham, 2016), and collaboration among students and with the lecturer (Churches, 2008). They also need practical and relevant information as well as individualised, immediate, exciting, engaging, technologically advanced, and visually based learning (Chicca & Shellenbarger, 2018), as well as effective, efficient, and enjoyable use of the tools and technologies available (Kirschner & De Bruyckere, 2017). BL aims to make students transform themselves into active learners. By communicating their needs and interests to their teachers they become more successful (Atef & Medath, 2015). The overall goal is thereby the improvement of student's competencies (Emre, Masur & Ranner, 2020) and to eventually develop future skills (Ehlers, 2022), such as self-learning and self-management (Liu, 2018) and self-assessment through pausing formal learning and continuing anytime (Shail, 2019).

With the empirical review of the literature, it could be derived that, the *learning experience* is the deductive code concept that is determined by the sub-codes *interaction* and *flexibility*. Furthermore, the sub-codes *learning success, acquisition of competencies* and *future skills* are to be grouped as the deductive code concept *learning outcomes*.

Table 9

Dependent Variables from Literature

Learning Experience	Interaction Flexibility
Learning Outcomes	Learning Success Acquisition of Competencies Future Skills

Although these deductive code concepts and respective sub-codes have emerged from the literature, the overall picture is not yet clear. Especially regarding the learning experience, it is

not clear which aspects besides interaction and flexibility play a crucial role in BL, especially concerning the disadvantages of the status quo (SAGE, 2019).

6.4.3 Inductive Codes

Once the conceptual framework was elaborated, the second step was to determine the inductive codes. To get a clearer picture of the given inductive codes, they were generically derived as descriptive and interpretative codes from the participant observation (SAGE, 2019). Below is an example of descriptive code development derived from the protocol of 07.10.2021.

Table 10

Descriptive Codes Example: Protocol from Unit 1 on 07.10.2021

81 students nationwide entered the session. Prof. Mothes starts the session on time. 120 students have attended in total by now. The intro by the professor is over and the recording starts.	**Participation** **Teaching Style**
The presentation starts. It's an intro to the semester and topic.	**Teaching Style** **Course Content** **Curriculum**
All students are **muted** and have the **camera turned off**. Questions shall be **posted into the chat**, as well as **answered after class**. Students interact with **thumbs up** and a **first question** in the chat. They are not allowed to speak up due to data protection.	**Data Protection** **Media Usage** **Communication** **Interaction**
The professor is very **motivating**. She is **mentioning** several times the **importance of attending** and **explaining the course in detail**.	**Teaching Style** **Interaction** **Participation** **Curriculum** **Course Content**
Currently, 123 students are **attending**. The professor is **explaining** the necessity of the course. Besides the students, Prof. Mothes, the researcher, and another lecturer are **participating**. One more **question is asked**. Also, the other lecturer **introduces** himself in the chat. One student is **not actively participating**.	**Teaching Style** **Participation** **Interaction** **Curriculum** **Course Content** **Communication** **Media Usage**
The **presentation** of the **content and relevance** continues, including reference to **learning goals** and **catch-up** to last semester. 118 are still **attending**. No **new questions** so far.	**Teaching Style** **Course Content** **Curriculum** **Competencies** **Participation** **Interaction**
73 still attending. Course ended. Question: Learning goal achieved? Wishes for the future?	**Participation** **Interaction**

	Teaching Style
Recording ended. Two more questions in the chat.	**Interaction**

All codes from this example were strictly descriptive. Descriptive codes are topics that are lower on the conceptual ladder than interpretive codes. Interpretive codes are more abstract and may require multiple viewings of the data to consider the subtext (Merkens, 1992). Table 13 showed an example of interpretative codes from the text of the protocol from Unit 2 on 14.10.2021.

Table 11

Interpretative Codes Example: Protocol from Unit 2 on 14.10.2021

"15:17. Important feedback in the chat: 'The lecture today somehow went way too fast for me... Is it perhaps possible in the future that you approach the lecture a little slower? I found it really difficult to follow you for 90 minutes at this pace. No offence meant.' And '...maybe a little break in between...'. The first message gets 9 likes. Note from researcher: Too much content for one session, focus not possible within 90 minutes. Students are overwhelmed."	**Interaction** **Feedback** **Focus** **Pacing** **Breaks** **Workload**

This example of an interpretative code suggested the student's lack of focus was not only due to pace. Even though students did not specifically say it, the amount of content and lack of breaks seemed to play a role in this situation. It indicates that students were overburdened with the factors of speed, quantity, and lack of breaks.

The entire development process of inductive codes was not presented in this study. The example given was merely indicative. This was because, in studies that aim at theory building, numerous interpretive codes may be given. In more descriptive studies, the focus may only be on surface-level codes. In the present generic study, the focus was on descriptive codes. Therefore, interpretative codes could be neglected for the applied instrument-development variant. Nevertheless, interpretative codes played a fundamental role in study 3, where theory building from the given qualitative data is based on a grounded theory variant of Schatzman and Strauss (1973). In this context, the researcher carried out an analysis of all protocols of the online session in the winter semester of 2021/ 22, which can be found in Appendix H.

6.4.4 Combined Codes

As mentioned earlier, the researcher used primary codes based on the development of problem lists by Merkens (1992) which were: general setting, classroom organisation, teaching contents, didactics/ type of instruction, student behaviour and learning outcomes to organise more specific sub-codes. It should be noted that the sub-codes attendance, media usage, work materials, teaching style, student characteristics, instructor characteristics, participation, communication inside of class, interaction both with professor and with students, communication outside of class, interaction both with professor and with students, self-learning phase, learning success, competencies, and future skills have their own sub-codes. The last two code concepts or categories are based on a 2021 meta-analysis of current future skills (Ehlers, 2022) and the current curriculum of Macromedia University (Emre, Masur, & Ranner, 2020). Below is the final structure of the combined deductive and inductive codes based on literature and the qualitative analysis of the participant protocols from the winter semester of 2021/ 22. The presentation was based on axial coding, i.e., the assignment of categories to subcategories based on their properties and dimensions (Strauss & Corbin, 1998).

General Setting

- Date
- Category
- Duration

Classroom Organisation

- Online
- On-site
- *Attendance*
    - Amount
    - Duration
    - Activity
- Homework

Teaching contents

- Curriculum
- Curricular Changes
- Holidays

Didactics/ Type of Instruction

- Levels of competencies
- Learning objectives
- *Teaching style*

    - Pacing
    - Workload
    - Breaks
- *Usage of media*
    - Presentation
    - Chat
    - Other media
- *Work materials*
    - Recordings
    - Scripts
    - Additional Materials
    - Interventions

Student Behaviour

- *Student Characteristics*
    - punctual
    - confident
    - active
    - focused
    - attentive
    - interested
    - motivated
    - hard working
    - trying hard
    - having fun
- *Gender*
    - Female
    - Diverse
    - Male
- *Participation*
    - Online
    - Exercise
    - Interventions
- *Instructor Characteristics*
    - Open for Innovation
    - Easily Accessible
- *Communication Inside of Class*
    - *Interaction with Professor*
        - Conversations
        - Group discussion
        - Chat
        - Comments
        - Posts
        - Likes

        - Claps
        - E-Mails
    - *Interaction with Students*
        - Conversations
        - Group discussion
        - Group work
        - Chat
        - Comments
        - Likes
- *Communication Outside of Class*
    - *Interaction with Professor*
        - Conversations
        - Group discussion
        - Teams chat
        - Posts
        - Comments
        - Likes
        - E-Mails
    - *Interaction with Students*
        - Conversations
        - Group discussion
        - Group work
        - Chat
        - Comments
        - Likes
- *Self-learning Phase*
    - Homework
    - Interventions
    - Recordings
    - Tutorials

Learning Outcomes

- Grades
- *Learning success*
    - Increased knowledge
    - Feeling encouraged
    - Improved learning
    - Own learning strategies
    - Feeling competent
    - Feeling confident
- *Competencies*
    - Deeper understanding
    - Application in course
    - Application out of course

    - Critical Analysis
- *Future Skills*
    - Diverse viewpoints
    - Presenting to audience
    - Defining & Solving Problems
    - Capacity for empathy
    - Enhanced career
    - Leadership skills
    - Preparation for future

Many of the codes are self-explanatory as they are descriptive, but some interpretative codes require a short definition, which was included below.

Student characteristics

Students' characteristics can be observable, i.e., punctual, active, focused, attentive, confident, and eager. They can further be interpretive, i.e., interested, motivated, and diligent. Both types should be included in any questionnaire. The non-observable ones should be highlighted as such.

Instructor characteristics

While the teaching style was considered separately, two characteristics of the teachers emerged as crucial for improvement. That the teacher is open to innovation and easily accessible. The former refers to student suggestions for improving teaching and the latter to accessibility in and after class.

Learning success

The learning success derives from the learning objectives and includes increased knowledge of the subject matter, improved learning such as the development of own learning strategies, and feelings of encouragement, competence, and security in the subject matter.

Competencies

As competence development is a central topic of higher education teaching, it is highlighted separately. It is about deeper understanding, the applicability of knowledge and critical analysis.

Future Skills

Future skills are the overarching goal of the lifelong learning concept. Students should be able to apply their skills in any professional context after graduation. These future skills set them apart from others in the labour market.

6.4.5 Analytical Reports

The following report is an example of an analytical code report on a particular code, the interaction with the professor. A similar analysis was done for all code concepts and the results can be found in Appendix I.

Communication Inside of Class: Interaction with Professor

In-class communication was applied to any text segment containing the words ‘interact’ or ‘interaction’, ‘ask’ or ‘asked’, ‘question’, ‘answer’, ‘response’, ‘reaction’ or ‘react’, ‘suggest’, ‘raise hands’ or ‘hands up’, ‘feedback’, and similar terms. Communication can be documented descriptively, with the absence and manner being open to interpretation. The in-class communication code report – a report of all quotes coded with this code – reveals a range of participants’ experiences, from simply liking a chat message to providing course-wide feedback on the professor’s teaching style.

This is an example of student feedback for the protocol of unit 2 from 14.10.2021:

> “15:17. Important feedback in chat: Session is too fast, no breaks, hard to follow. The message gets 9 likes.”
>
> “15:20. Professor tells students (no reaction to chat, yet) that she won’t finish the session in time and will record the missing part.”
>
> “15:22. Second feedback in chat: Asking for a short break.”
>
> “15:26. Professor ends presentation. Answers question in chat: Solution to provide a second part as extra recording. Suggests a break, 14 students put their hands up to do so after being asked. Slowing down is suggested as well.”

Reports on codes like this allowed the researcher to see the range of what is important to the participants and give clues as to how this code can be measured as a variable in the next, quantitative phase. This made it possible to be specific in the question formulations. The results served as the basis for the next quantitative phase, which is a student survey. This means that the qualitative content analysis provided important material for the development of the measure for the quantitative phase, which is a questionnaire for the online student survey (see Chapter 7).

6.5 Quantitative Construction

6.5.1 Questionnaire Construction

After analysing the qualitative data and conducting a generic qualitative study, a questionnaire was developed to check whether the qualitative results were statistically generalisable. This

built the interface in this mixed-methods study. The research thereby moved from a qualitative to a quantitative study focusing on the measurement of variables. In the transition from qualitative analysis to the development of a questionnaire, codes became variables, themes became scales and quotes become survey items (SAGE, 2019). The focus of this study was on specific examples of questionnaire development, i.e., how the codes could be used as variables measured by specific question items. This section provided examples of how the research constructed questionnaire items to further assess the codes (SAGE, 2019).

In general, a good questionnaire should be valid, reliable, clear, interesting, as long as necessary, and as short as possible (Jenn, 2006). To make the questionnaire as clear as possible, it was decided to use only one type of scale. This decision was primarily based on the circumstances and the research subject. The students in the sample conducted their bi-annual student survey during the same period as the student survey provided by this research. At the same time, they were about to hand in their papers and exams. Therefore, the workload was already high. The questionnaire was kept as simple as possible and fitted the design of the student survey. Overall, it was a comprehensive, quantitative survey of the students' personal opinions. To construct questionnaire items, using ordinal scales to capture the variables was considered. Ordinal scales assign numbers to objects to reflect a ranking for an attribute. Even though the order matters in these questions, the difference between the answers on the scale is not uniform (SAGE, 2019; Nemoto & Beglar, 2014). Another survey option was the interval scale question, e.g., a scale ranging from extremely likely to extremely unlikely (Nemoto & Beglar, 2014). They are used to capture the respondent's level of feeling about the topic in question. The level of feelings is captured by presenting respondents with a multi-level scale and asking them where they are on the scale (Jenn, 2006). Also, the Guttman scale is a common choice as it is used for hierarchical and highly structured constructs (SAGE, 2019).

In the present study, a Likert scale question type was used. According to Nemoto and Belgar (2014), the advantages of Likert scale questionnaires are that (a) data can be collected relatively quickly from large numbers of respondents, (b) they can provide very reliable estimates of people's abilities, (c) the validity of interpretations drawn from the data can be established by a variety of means, and (d) the data they provide can be profitably compared, contrasted and combined with qualitative data collection techniques such as open-ended questions, participant observation, and interviews (Nemoto & Belgar, 2014). Usually, the ordinal scale level of the Likert scale consists of five, seven or eleven characteristic values. For the example mentioned, gradations from "I do not agree at all" to "I agree completely" were suitable (Jenn, 2006). A

typical 5-point Likert scale was chosen for the questionnaire in this study. It was a gradual response scale on which respondents revealed their attitude towards a certain topic. It dealt with characteristics, in this case, the code concepts, that stand for a certain topic, e.g., student concentration. An item is a pre-formulated statement that describes a positive or negative fact regarding the characteristic. For the characteristic "difficulty concentrating", for example, the statement "I could not concentrate all the time" was formulated. Using the Likert scale, the students subjectively rated the extent to which this sentence applied to them (SAGE, 2019).

6.5.2 Inductive Variables

Below are examples of how codes from this study were used as inductively developed variables for questionnaire items. To avoid repetition, not all codes from the qualitative analysis are listed below. Instead, representative variables were selected that were constructed from sub-codes from each primary code for illustrative purposes.

6.5.2.1 Effort

The code 'working hard' captures a non-observable student characteristic that indicates the effort students put into their studies. Hard work was not explicitly mentioned in the protocols. The closed questions below are a way to better assess how the participants experienced working hard, i.e., putting effort into the course, in their own experiences. The presented items for the variable 'effort' are based on the constructs of Busse and Walter (2013), as will be explained in detail in 5.5.3.

During the semester, I worked hard to learn "Empirical Research and Statistics".

1 Strongly disagree	2	3	4	5 Strongly agree

I tried very hard to learn with more than just the given course material (e.g., repeats of sessions, and material on Moodle).

1 Strongly disagree	2	3	4	5 Strongly agree

I spent as much time as possible learning "Empirical Research and Statistics".

1 Strongly disagree	2	3	4	5 Strongly agree

6.5.2.2 Interaction with Students

Like the interaction with the professor, the interaction among students in the online course only took place via chat. In the on-campus exercise, they were able to talk to their lecturer directly. They could also communicate with their lecturer outside of class in person or via email and MS Teams. With their professor, they could only communicate via email or Teams outside of class. Interaction can only be observed in online classes and the exercise, not outside of class. Communication in the form of interaction with other students was mentioned in most protocols. The statements below represent a way to better assess how the participants experienced the interaction within and outside of class. The items for the variable 'interaction' were based on literature (Jonson & Renner, 2012; Fu, Su, & Yu, 2009).

I exchanged a lot of information with other students about the subject "Empirical Research and Statistics".

1 Strongly disagree	2	3	4	5 Strongly agree

In general, I was cooperative with my fellow students in the subject "Empirical Research and Statistics".

1 Strongly disagree	2	3	4	5 Strongly agree

I even collaborated a lot with my fellow students on the subject "Empirical Research and Statistics".

1 Strongly disagree	2	3	4	5 Strongly agree

Outside the course "Empirical Research and Statistics", the collaboration with fellow students was helpful for learning.

1 Strongly disagree	2	3	4	5 Strongly agree

6.5.2.3 Competencies

Competencies were again non-obtainable and related to learning outcomes. They built a basis for achieving the given learning objectives. They were anchored in the Europe-wide Bologna

Reform. The main stages of the underlying taxonomy were understanding, applying, and analysing what has been learned. With the closed questions below, it was possible to find out to what extent learning success was given by gaining competencies. The items of the variable 'competencies' were based on literature (Jonson & Renner, 2012; Fu, Su, & Yu, 2009; Hillyard, Gillespie, & Littig, 2010).

I have understood the basic ideas of the knowledge taught.

1 Strongly disagree	2	3	4	5 Strongly agree

I can apply the course content of "Empirical Research and Statistics".

1 Strongly disagree	2	3	4	5 Strongly agree

I applied my experiences outside the classroom and learned from the practical applications.

1 Strongly disagree	2	3	4	5 Strongly agree

I was able to learn how to critically analyse ideas and arguments during the course "Empirical Research and Statistics".

1 Strongly disagree	2	3	4	5 Strongly agree

To understand the development process of the items, their deductive construction is described in the next section. In general, the items are based on the constructs available from the literature. These constructs were determined using the inductively developed variables presented.

6.5.3 Deductive Items

The inductively developed variables of the sub-codes of the code concept 'learning experience' are 'joy', 'motivation', 'effort', 'participation', 'interaction', and 'focus'. The items deriving from them are based on the constructs of existing literature in the field of innovation in higher education. The development of the items for the present study is presented below.

6.5.3.1 Joy

In 2013, Busse and Walter conducted a longitudinal study on motivational changes and their causes, in which they examined foreign language learning motivation in higher education (Busse & Walter, 2013). Based on their constructs, the following items were developed:

Table 12

Overall Course Items for the Code Concept 'Joy'

I really enjoy learning German.	J1 I enjoyed the course.
Learning German is a challenge which I enjoy.	J2 Learning Empirical Research and Statistics was a challenge which I enjoyed.
I find learning German really interesting.	J3 I found learning Empirical Research and Statistics interesting.
Learning German is one of the most important aspects of my life.	J4 Personally, learning Empirical Research and Statistics was important to me.

Note. This table is based on Busse and Walter (2013).

The following item was excluded from the questionnaire due to its similarity to J2:

J5 I liked the challenges that learning Empirical Research and Statistics posed.

Besides joy, which can be a trigger for intrinsic motivation, the items mainly focussed on motivation, in general, were investigated in this study.

5.5.3.2 Motivation

In science, motivation is viewed from different perspectives. In this doctoral thesis, the focus was on the current and original motivation of students, as well as reasons for a possible change:

Table 13

Overall Course Items for the Code Concept 'Motivation'

Own item.	PM1 At the beginning of the course, my motivation was high.
I would describe my present state of motivation for studying German as somewhat low at the moment.	PM2b I would describe my present state of motivation for studying Empirical Research and Statistics as somewhat low at the moment.
Have you experienced any motivational changes during the term?	PM4 The factors I would attribute these changes to are in teaching.

If so, to what factors would you attribute these changes?	
Has anything happened in your personal life that has influenced the way you feel about your studies?	PM5 The factors I would attribute these changes to are in my personal life.

Note. This table is based on Busse and Walter (2013).

An own item is included to complement the others. In addition, the following items are excluded from the questionnaire due to their similarities to PM2b, PM4 and PM5:

PM2a I would describe my present state of motivation for studying Empirical Research and Statistics as high at the moment.

PM3 I have experienced motivational changes during the term.

PM6 The changes have affected my attitude towards studying Empirical Research and Statistics.

As a last indicator by Busse and Walter (2013), the effort was also investigated.

6.5.3.3 Effort

Regarding effort, the questionnaire targets three scenarios: overall course, lecture, and exercise. Depending on the scenario, the questions vary:

Table 14

Overall Course Items for the Code Concept 'Effort'

I am working hard at learning German.	E1 I was working hard to learn Empirical Research and Statistics.
I try very hard to read more than just set texts in newspapers /magazines.	E5 I tried very hard to learn with more than just given course material.
I spend as much time as possible on language learning.	E6 I spent as much time as possible learning Empirical Research and Statistics.

Note. This table is based on Busse and Walter (2013).

The following items were excluded, as they are too similar to the implemented ones:

E3 It was too much effort to use anything other than the given course material (e.g., rewatching sessions; material on Moodle) for learning.

E4 I am the kind of person who makes great efforts to learn Empirical Research and Statistics.

E8 I can honestly say that I really did my best to learn Empirical Research and Statistics.

Further, the effort was measured in the online lecture specifically, whereby the remaining items are placed in the questionnaire:

Table 15

Online Lecture Items for the Code Concept 'Effort'

I can honestly say that I put a lot of effort into German language classes.	E2 I can honestly say that I tried very hard to keep up with 'Empirical Research and Statistics' classes.
I try to learn as many new words as possible during language classes.	E7 I tried to learn as much as possible during 'Empirical Research and Statistics' classes.

Note. Table based on source (Busse & Walter, 2013).

Lastly, items were developed by Busse and Walter (2013) regarding the effort students put into the on-site exercise:

Table 16

On-Site Exercise Items for the Code Concept 'Effort'

I often feel that it takes too much effort to really engage with a piece of translation. (3)	E2 I spend a lot of time on course assignments.
I put as much effort as possible into language assignments. (2)	E3 I put as much effort as possible into course assignments.
I spend a lot of time on translations. (1)	E4 I often felt that it took too much effort to really engage with an exercise.
I spend a lot of time improving my grammar where I feel it to be necessary.	E5 I spent a lot of time improving my knowledge where I felt it to be necessary.
Honestly, I do not have much time to spend on language work.	E6 Honestly, I did not have much time to spend learning at home.
I try to learn as many new words as possible during language classes.	E7 I tried to learn as much as possible during the exercise.

Note. This table is based on Busse and Walter (2013).

6.5.3.4 Participation

Regarding student participation, both lecture and exercise were again considered individually. The items are based on the study from Lonsdale, Sabiston, Taylor, and Ntoumanis in 2011, who investigated student's motivation for physical education by examining the psychometric properties of the *Perceived Locus of Causality Questionnaire* and the *Situational Motivation Scale*:

Table 17

Online Lecture Items for the Code Concept 'Participation'

There may be good reasons to do this activity, but personally, I don't see any.	P1 There may have been good reasons to participate, but personally, I didn't see any.
I do this activity, but I am not sure if it is worth it.	P2 I participated in the online lecture, but I am not sure if it was worth it.
I do this activity, but I am not sure it is a good thing to pursue it.	P4 I participated in the beginning but did not pursue it.
Because I am supposed to do it.	P5 I participated only because I am supposed to do it.

Note. This table is based on Lonsdale et al. (2011).

Four items were excluded in the process of developing the questionnaire, as their content is redundant to the selected ones:

P3 I didn't participate frequently because I didn't see what the online lecture brings to me.

P6 I participated only because it is something that I have to do.

P7 I participated only because I felt I had to do it.

P9 I participated frequently because I think this activity is good for me.

For the on-site exercise the identical items were used, except that 'online lecture' is replaced with 'exercise':

Table 18

Online Lecture Items for the Code Concept 'Participation'

There may be good reasons to do this activity, but personally, I don't see any.	P1 There may have been good reasons to participate, but personally, I didn't see any.
I do this activity, but I am not sure if it is worth it.	P2 I participated in the exercise, but I am not sure if it was worth it.
I do this activity, but I am not sure it is a good thing to pursue it.	P4 I participated in the beginning but did not pursue it.
Because I am supposed to do it.	P5 I participated only because I am supposed to do it.

Note. This table is based on Lonsdale et al. (2011).

The same items are excluded. Furthermore, besides participation, the interaction was measured in different scenarios.

6.5.3.5 Interaction

The first scenario interaction is measured in is the overall course. Thereby, the items are based on the construct of Johnson and Renner who conducted research in 2012 investigating the effect of the flipped classroom model on secondary computer applications courses. In their research student and teacher perceptions, questions and student achievement were targeted. Besides, Fu, Su, and Yu developed a scale to measure learners' enjoyment of e-learning games in 2009, namely EGameFlow. Items were chosen from both research teams, as the constructs involve teaching and learning on- and offline:

Table 19

Overall Course Items for Code Concept 'Interaction'

Q1. I communicated a lot with other students.	I1 During the semester, I communicated a lot with other students.
S1 I feel cooperative towards other classmates.	I2 In general, I felt cooperative towards other classmates.
S2 I strongly collaborate with other classmates.	I3 I even strongly collaborated with other classmates.
S3 The cooperation in the game is helpful to learning.	I4 The cooperation with classmates outside the course was helpful to the learning.

Note. This table is based on Jonson and Renner (2012) and Fu, Su, and Yu (2009).

Regarding the chosen items, the first one was taken from Johnson and Renner (2012), while the others were from Fu, Su, and Yu (2009). All of them target interaction between students. The first one is general, while the others relate to feelings of cooperation and collaboration.

Furthermore, interaction is measured between students within the lecture and exercise. Thereby, the following two items are placed in the student-student interaction during the lecture:

Table 20

Online Lecture Items for the Student-Student Code Concept 'Interaction'

S4 The game supports social interaction between players (chat, etc).	I5 The type of instruction in the exercise supported social interaction between us students (chat, etc).
S6 The game supports communities outside the game.	I6 The type of instruction in the exercise supported communities outside the exercise.

Note: This table is based on Jonson and Renner (2012) and Fu, Su, and Yu (2009).

In addition, the interaction between the online lecturer and students was measured:

Table 21

Online Lecture Items for the Lecturer-Student Code Concept 'Interaction'

Q1 I communicated a lot with other students.	I1a I communicated a lot with the professor.
S1 I feel cooperative towards other classmates.	I1b The professor communicated a lot with us students.
S2 I strongly collaborate with other classmates.	I2 During the semester, I felt that the professor was cooperative towards us students.
S3 The cooperation in the game is helpful to learning.	I3 The professor strongly collaborated with us students.
S4 The game supports social interaction between players (chat, etc).	I4 The cooperation with the professor was helpful to the learning.
S5 The game supports communities within the game.	I5a The professor supported social interaction between students (chat, etc) within the lecture.
S6 The game supports communities outside the game.	I5b The professor supported social interaction between students (chat, etc) outside the lecture.
H9 The game provides new challenges with appropriate pacing.	I6 The professor provided new learning content with appropriate pacing.
H10 The game provides different levels of challenges that tailor to different players.	I7 The professor provided different levels of competencies that tailor to different students.
K4 The game motivates the player to integrate the knowledge taught.	I8 The professor motivated us students to integrate the knowledge taught.

Note. This table is based on Jonson and Renner (2012) and Fu, Su, and Yu (2009).

Further, the interaction between students in the exercise was investigated:

Table 22

On-Site Exercise Items for the Student-Student Code Concept 'Interaction'

S3 The cooperation in the game is helpful to learning.	I4 The cooperation with classmates during the exercise was helpful to the learning.
S4 The game supports social interaction between players (chat, etc).	I5 The type of instruction in the exercise supported social interaction between us students (group work, etc).
S6 The game supports communities outside the game.	I6 The type of instruction in the exercise supported communities outside the exercise.

Note. This table is based on Jonson and Renner (2012) and Fu, Su, and Yu (2009).

As a last measure, the interaction between the online lecturer and students was explored:

Table 23

Online Lecture Items for the Lecturer-Student Code Concept 'Interaction'

Q1. I communicated a lot with other students.	I1a I communicated a lot with the lecturer.
S1 I feel cooperative towards other classmates.	I1b The lecturer communicated a lot with me.
S2 I strongly collaborate with other classmates.	I2 During the semester, I felt that the lecturer was cooperative towards us students.
S3 The cooperation in the game is helpful to learning.	I3 The lecturer strongly collaborated with me.
S4 The game supports social interaction between players (chat, etc).	I4a The cooperation with the lecturer during the exercise was helpful to the learning. I4b The cooperation with the lecturer outside the exercise was helpful to the learning.
S5 The game supports communities within the game.	I5a The lecturer supported social interaction between students (chat, etc) within the exercise.
S6 The game supports communities outside the game.	I5b The lecturer supported social interaction between students (chat, etc) within the exercise.
H9 The game provides new challenges with appropriate pacing.	I6 The lecturer provided new learning content with appropriate pacing.
H10 The game provides different levels of challenges that tailor to different players.	I7 The lecturer provided different levels of competencies that tailor to different students.
K4 The game motivates the player to integrate the knowledge taught.	I8 The lecturer motivated us students to integrate the knowledge taught.

Note. This table is based on Jonson and Renner (2012) and Fu, Su, and Yu (2009).

As a last indicator for the research dimension learning experience, the focus was measured.

6.5.3.6 Focus

Student focus was investigated based on Fu, Su, and Yu (2009). Thereby, both the online lecture and on-site exercise were explored using the same items, only exchanging the words 'lecture' and 'exercise':

Table 24

Online Lecture Items for the Student's Code Concept 'Focus'

C1 The game grabs my attention.	F1 The lecture grabbed my attention.
C2 The game provides content that stimulates my attention.	F2 The lecture provided content that stimulated my attention.

C5 Generally speaking, I can remain concentrated on the game.	F5 Generally speaking, I remained focused in the lecture.
C7 I am not burdened with tasks that seem unrelated.	F7 I was not burdened with content that seemed unrelated.
C8 Workload in the game is adequate.	F8 The workload in the lecture was adequate.

Note. This table is based on Fu, Su, and Yu (2009).

Two items were excluded in the process, as they are too similar to F1 and F2:

F3: Most of the lecture activities were related to the learning content.

F4: During the lecture, I didn't feel distracted by the learning content.

Table 25

On-Site Exercise Items for the Student's Code Concept 'Focus'

C1 The game grabs my attention.	F1 The exercise grabbed my attention.
C2 The game provides content that stimulates my attention.	F2 The exercise provided content that stimulated my attention.
C5 Generally speaking, I can remain concentrated on the game.	F5 Generally speaking, I remained focused on the exercise.
C7 I am not burdened with tasks that seem unrelated.	F6 I was not distracted from tasks we had to focus on.
C8 Workload in the game is adequate.	F7 I was not burdened with tasks that seemed unrelated.

Note. This table is based on Fu, Su, and Yu (2009).

In addition to developing items for the learning experience, items for the code concept 'learning outcomes' were developed regarding the sub-codes 'learning success', 'competencies', and 'future skills'.

6.5.3.7 Learning Success

To develop items for learning success regarding the overall course, besides Johnson and Renner (2012) and Fu, Su, and Yu (2009), also Struthers, Perry, and Menec (2000) were added, as they examined the relationship among academic stress, coping, motivation, and performance in college which adds up to the feeling of being competent:

Table 26

Overall Course Items for the Code Concept 'Learning Success'

K1 The game increases my knowledge.	LS1 The course increased my knowledge.

H7 I am encouraged by the improvement of my skills.	LS5 I am encouraged by the improvement of my skills.
H8 The difficulty of challenges increase as my skills improved.	LS6 My skills improved as the difficulty of learning content increased.
Q6. The availability of course materials, communication, and assessment tools helped me improve my learning.	LS7 The availability of course materials, communication, and assessment tools helped me improve my learning.
Q8. During the last unit, I explored my own strategies for learning.	LS8 During the lecture I explored my own strategies for learning.
K1 The game increases my knowledge.	LS9 I feel competent in Empirische Forschung und Statisitik.
H7 I am encouraged by the improvement of my skills.	LS10 I feel confident in writing the exam in Empirical Research and Statistics.

Note: This table is based on Jonson and Renner (2012), Fu, Su, and Yu (2009), and Struthers, Perry, and Menec (2000).

Two items were excluded in the process, as they are too similar to the existing ones. LS4 is removed as is not relevant to the research:

LS2 I want to know more about the knowledge taught.

LS3 Overall, I have learned a lot in the exercise.

LS4 I have worked on assignments in this course that have dealt with real-life applications and information.

While the feeling of being competent is rather related to learning success, competencies are directly connected to the learning goals and the instruction of the courses. Therefore, the items refer to the success of the implementation of the lessons to achieve competencies.

6.5.3.8 Competencies

Besides the recent sources of Johnson and Renner (2012) and Fu, Su, and Yu (2009), another construct was added from Hillyard, Gillespie, and Littig (2010) who investigated university students' attitudes about learning in small groups after frequent participation. Their items add up to a more detailed description of competencies acquired:

Table 27

Overall Course Items for the Code Concept 'Competencies'

K2 I catch the basic ideas of the knowledge taught.	C1 I gained a deeper understanding of the knowledge taught.

K3 I try to apply the knowledge in the game.	C2 I tried to apply the gained knowledge in the course.
Q7 I applied my out-of-class experience and learn from its practical applications.	C3 I have applied my out-of-class experience and learned from its practical applications.
Critically analysing ideas and arguments.	C7 During the course I was able to critically analyse ideas and arguments.

Note: This table is based on Jonson and Renner (2012), Fu, Su, and Yu (2009), and Hillyard, Gillespie, and Littig (2010).

Three items were excluded, as they were redundant:

C4 My skills gradually improved through the course.

C5 I am encouraged by the improvement of my skills.

C6 My skills improved as the difficulty of learning content increased.

Adding up to acquiring competencies, the overriding goal is to achieve future skills.

6.5.3.9 Future Skills

In 2010, Hillyard et al. developed items that come closest to the definition of future skills. Due to that, they were implemented in the questionnaire:

Table 28

Overall Course Items for the Code Concept 'Future Skills'

Appreciating diverse viewpoints.	FS1 In the course, I improved my skill to appreciate diverse viewpoints.
Presenting to an audience.	FS3 I improved my ability to present to an audience.
Defining and solving problems.	FS4 I could define and solve problems.
Developing a capacity for empathy.	FS5 Further, I was developing a capacity for empathy.
Preparing for or enhancing a career.	FS6 Besides, the lecture was preparing me for or enhancing a career.
Chances to develop leadership skills.	FS7 It offered chances to develop leadership skills.
Preparing for advanced education.	FS8 Overall, the course was preparing me for my future.

Note: This table is based on Hillyard, Gillespie, and Littig (2010).

One item was removed, as it is irrelevant to the present research:

FS2 I was able to communicate ideas to others.

All in all, 93 items were developed based on six constructs. They build the foundation for the first questionnaire implemented at the end of the winter semester of 2021/ 22. Items regarding the SoML implementation are added to the second questionnaire at the end of the summer semester of 2022.

6.5.4 Additional Deductive Items

The additional items for the summer semester of 2022 were added after the design and implementation of the interventions. The ID process is described in Study 3. Nevertheless, the development process is similar to the previous items and therefore presented at this point. The inductively developed interventions are 'word cloud', 'student quiz', and 'in-a-nutshell slides'. They are based on the learning objectives of the course that are provided based on the curriculum (see 4.2.1.1.). The objectives are rooted in the Bologna Reform and therefore Bloom's Taxonomy (Bloom, 1956). The focus will be mainly on the three low-level thinking order skills (LOTS) 'remembering', 'understanding', and 'applying' (Churches, 2008). This decision-making process is described in 6.4.1.

6.5.4.1 Word Cloud

In 2011, Maldonado et al. developed items that cover the survey of students' opinions on interventions in education. They are implemented in the questionnaire regarding the joy, usefulness, task accomplishment, and improvement of learning through understanding, applicability, and performance of the 'word cloud':

Table 29

Items for the Experience of the New Learning Method 'Word Cloud'

ELM 1 I enjoy learning by using the Peru EDUCA portal.	SML-WC 1 I enjoyed working with the word cloud.
ELM 2 I find the Peru EDUCA portal useful in my studies.	SML 2 I found the word cloud useful for learning Empirical Research and Statistics.
ELM 3 Using the Peru EDUCA portal in my studies enables me to accomplish tasks more quickly.	SML-WC 3 Using the word cloud enabled me to remember Empirical Research and Statistics terms better.
ELM 4 Using the Peru EDUCA portal helps me do better than others in my studies.	SML-WC 4a Using the word cloud has enabled me to understand Empirical Research and Statistics terms better.

	SML-WC 4b Using the word cloud has enabled me to apply Empirical Research and Statistics terms better. SML-WC 4c Using the word cloud has helped me to perform better in my studies.

Note: This table is based on Maldonado, Khan, Moon, and Rho (2011).

Item SLM-WC 3 stands for the first learning level 'remember'. Item EML 4 is considered in a differentiated way in the student survey, as a clear distinction is made between SML-WC 4a 'understanding', SML-WC 4b 'applying' and SML 4c 'performance'. This distinction can provide important information on the improvement of learning on the different levels in comparison to the previous semester.

6.5.4.2 Nationwide Student Quiz

For the nationwide 'student quiz', the same construct was used to determine students' opinions on the applied intervention. As the quiz is not meant to be conducted in class but during self-study time at home, the questions were adapted accordingly:

Table 30

Items for the Experience of the New Learning Method 'Student Quiz'

ELM 1 I enjoy learning by using the Peru EDUCA portal.	SML-SQ 1 I enjoyed learning with the quiz at home.
ELM 2 I find the Peru EDUCA portal useful in my studies.	SML-SQ 2 I found the quiz useful for learning Empirical Research and Statistics.
ELM 3 Using the Peru EDUCA portal in my studies enables me to accomplish tasks more quickly.	SML-SQ 3 Using the quiz enabled me to remember Empirical Research and Statistics terms better.
ELM 4 Using the Peru EDUCA portal helps me do better than others in my studies.	SML-SQ 4a Using the quiz has enabled me to understand Empirical Research and Statistics terms better. SML-SQ 4b Using the quiz has enabled me to apply Empirical Research and Statistics terms better. SML-SQ 4c Using the quiz has helped me to perform better in my studies.

Note: This table is based on Maldonado, Khan, Moon, and Rho (2011).

As with the word cloud, item SLM-SQ 3 stands for the first learning level ‘remember’. Item EML 4 is divided into SML-SQ 4a ‘understanding’, SML-SQ 4b ‘applying’ and SML-SQ 4c ‘performance’ to provide important information about the improvement of learning at the different learning levels.

6.5.4.3 In-a-Nutshell Slides

To measure students’ opinions of the ‘in-a-nutshell’ slides, the construct of Maldonado et al. was again used. The slides were shown at the end of each online lecture to summarise the content of the lesson. In addition, they are meant to be a basis for learning for the exam. To find out how valuable they were, the students were surveyed:

Table 31

Items for the Experience of the New Learning Method ‘In-a-Nutshell’ Slides

ELM 1 I enjoy learning by using the Peru EDUCA portal.	SML-IN 1 I enjoyed learning with the ‘in-a-nutshell’ slides.
ELM 2 I find the Peru EDUCA portal useful in my studies.	SML-IN 2 I found the ‘in-a-nutshell’ slides useful for learning Empirical Research and Statistics.
ELM 3 Using the Peru EDUCA portal in my studies enables me to accomplish tasks more quickly.	SML-IN 3 Using the ‘in-a-nutshell’ slides enabled me to remember Empirical Research and Statistics terms better.
ELM 4 Using the Peru EDUCA portal helps me do better than others in my studies.	SML-IN 4a Using the ‘in-a-nutshell’ slides has enabled me to understand Empirical Research and Statistics terms better. SML-IN 4b Using the ‘in-a-nutshell’ slides has enabled me to apply Empirical Research and Statistics terms better. SML-IN 4c Using the ‘in-a-nutshell’ slides has helped me to perform better in my studies.

Note: This table is based on Maldonado, Khan, Moon, and Rho (2011).

Like before, item SLM-IN 3 stands for ‘remember’, item EML 4 is split into SML-IN 4a ‘understanding’, SML-IN 4b ‘applying’ and SML-IN 4c ‘performance’ to provide information about improving student’s learning at the different learning levels.

6.5.5 Additional Changes

Adding up to the interventions, three breaks were scheduled for each online session, during which questions could be answered. The rationale for this is explained in Study 3. They are not

stand-alone interventions. During the summer semester of 2022, one of the three breaks was extended to 10 minutes at the request of the students. Besides and in addition to the student survey evaluation, the grades of all semesters from the summer semester of 2019 until the summer semester of 2022 are compared at the end of the summer semester of 2022 to determine whether students achieved better grades due to SoML instructions or not. Thereby, the grades of a total of 2.563 students are compared. Finally, it was important to determine whether there was a trade-off between the research dimensions 'learning experience' and 'learning outcomes'. The results of comparing the student surveys and grades, as well as the possibility of a trade-off, are presented in Study 4.

6.5.6 Cognitive Psychological Effects

In addition to the development of the items, basic cognitive psychological effects in the arrangement of the items were considered. The questionnaire was designed to reduce effects such as the question order effect, which states that a particular order of questions can produce context effects. The basic idea of such context effects is that respondents consider the importance of the previous items when determining their understanding of the question for a single item, either by including the importance of the previous items in the evaluation dimension for the current item, the so-called assimilation effect, or by deliberately not including them, the so-called contrast effect (Ender, 2009).

In the questionnaire, the questions were divided into four or five categories depending on the semester. The first part of the survey starts with the socio-demographics of the respondents, which include personal questions such as age, gender, campus, semester, and previous studies. Beforehand, the reason for the survey as well as the personal questions are explained to the respondents. A general statement aims to prepare the participants and to normalise sensitive questions (Jenn, 2006). This is followed by the experience of the course in the questionnaire for the winter semester of 2021/ 22. In the summer semester of 2022, the questionnaire begins with the experience of the new learning methods, which is followed by the experience of the course. This has both content-related and strategic reasons. Since the questionnaire with 93 or 112 questions takes about 12 to 15 minutes, there was a possibility that students will not finish it. Therefore, the demographic questions and the 'main questions' about the interventions and the course, in general, were asked at the beginning. This is followed by questions about the online lecture and finally about the on-campus exercise. In terms of content, the questions were divided into thematic blocks to explain to the respondents what the block of questions was about before beginning it. In addition, the blocks were divided into five sub-units. A minimum of two

and a maximum of ten questions were asked per sub-unit. Additionally, motivational gamification aspects, i.e., Gifs, a numerical code to be deciphered for a nationwide competition and encouraging words are built in between the blocks to give respondents an accurate overview of their progress.

Chapter 7: Instructional Design

7.1 Introduction

Based on the large-scale literature review as well as the results of the participant observation in study 1, disadvantages were revealed for students in blended learning (BL) teaching in higher education concerning the learning experience, as well as a deterioration of learning outcomes. In terms of the learning experience, they were found in the subcategories of joy, motivation, effort, participation, interaction with students, interaction with lecturers and focus, as well as in the learning outcomes in the form of learning success, competencies, future skills, and grades. Since the overall aim of this dissertation was not only to explore the status quo but to improve teaching and learning in higher education BL, didactic interventions were designed with the help of the nationwide course coordinator, who acted as a subject matter expert (SME) (Branch, 2009). To design valuable interventions, it was elaborated from the literature that students' learning experience and outcomes could be improved by enhancing the instructional design (ID) methods applied with a combination of micro-learning (ML) and social learning, the so-called social micro-learning approach (SoML) (Göschlberger, 2016).

The aim of improving BL with SoML was to achieve predefined learning goals and competencies in higher education based on constructivist learning theories (Vygotsky, 1962; Bruner, 1960; Dewey, 1929; Piaget, 1923). SoML was found to be a promising approach for several reasons. Firstly, paused repetition can improve cognitive knowledge and pace, as well as long-term learning (Shail, 2019; MacLeon, Reynolds, & Lehmann, 2018; Bersin, 2017; Meacham, 2016; Kang, 2016). Secondly, micro-lessons and spaced learning may help to reduce the forgetting curve and lessen mental exhaustion (Shail, 2019; Ebbinghaus, 1885). Thirdly, the use of gamification increases user engagement and can create a higher intrinsic motivation to learn (Göschlberger & Bruck, 2017). Additionally, micro-learning (ML) provides the opportunity for self-assessment, higher engagement, and the use of different forms of media (Ehlers, 2022; Shail, 2019). Finally, the concept of lifelong learning is promoted as self-directed learning such as self-management, self-monitoring, and motivation are improved (Liu, 2018; Sofianopoulou & Kamilali, 2012; Garrison, 1997). The novel approach of SoML combines both

extensions of ML and social learning theory to achieve higher engagement, active members, and collaboration in communities of practice (CoPs) (Lave, 1988).

The present thesis aimed to explore the research gap from a formal, didactic perspective. It provided its own definition, based on Göschlberger and Anderst-Kotsis (2018) and Glahn and Gruber (2018): "Social micro-learning is defined in the context of higher education BL as a concept for developing technology-enhanced, bite-sized learning interventions that are applied situatively to communities of practice as a practical implementation of the social dimension of learning" (Willberg, 2022). To effectively incorporate SoML interventions into BL teaching in higher education, it was necessary to integrate micro-content units into the existing macro units, which included both face-to-face (f2f) and online learning. This integration was informed by qualitative data analysis and evaluation of participant observation during the winter semester of 2021/22, using a variation of grounded theory by Schatzman and Strauss (1973). This approach identified anomalies in students' learning experience and outcomes, which were systematically linked to the curriculum, lecturer role, and teaching methods used. The approach was based on key pedagogical concepts by Atef and Medath (2015), ensuring the connection of discovered cases to the transformation category of key pedagogical ideas in BL's definition. This facilitated innovation in these areas. Based on validated performance gaps, interventions were designed using the iterative instructional design (ID) process ADDIE (Branch, 2009).

7.2 Method

In this study, the didactic interventions were designed based on qualitative data and literature. The design process applied was ADDIE, an acronym for *Analyse, Design, Development, Implementation,* and *Evaluation* (Branch, 2009). ADDIE is a product development paradigm which was applied to intentional learning environments in the context of this study. It can be described as a systematic model using a systems approach to knowledge acquisition and human learning (Branch, 2009). The study took place during the winter semester break of 2022. At the beginning of the summer semester of 2022, the interventions were implemented in the nationwide course 'Empirical Research and Statistics' at Macromedia University in Germany. During the semester, the course was observed, changes were monitored, and the interventions were adjusted when and where necessary. At the same time, there was a constant exchange between the researcher, the programme coordinator, who serves as an SME by providing expertise and content knowledge to help create relevant and effective learning modules, and the nationwide lecturers of the exercise, who provided feedback from practice. The SME acted as a partner in the design process. After Branch (2009), SMEs become partners in the ID process

when their ideas in a finished learning product are properly represented and their contributions are valued. Adjustments were made within an iterative repetition of the last two steps of the ADDIE model.

The initial phase of the ADDIE model was the analysis phase, which involved evaluating student performance and identifying potential causes for performance deficits within the scope of action for BL transformation. Interpretative codes were identified by analysing the qualitative data, and theory building was based on a grounded theory variant developed by Schatzman and Strauss (1973). The design phase followed the analysis phase, with significant cases deriving from the qualitative analysis serving as the foundation for the development of interventions. Instruction was identified as a potential intervention to address the performance gap resulting from a lack of knowledge and skills. In the development phase, learning resources were created and validated in close collaboration with the SME. The implementation phase involved preparing both lecturers and learners for the instructional methods, which were introduced and simultaneously evaluated by the researcher to assess the quality of the teaching products and processes before and after the implementation.

7.3 Data Collection

The process outlined in this study is the development of the interventions based on the elaboration of significant cases from the qualitative data. For this purpose, data from participant observation was collected, analysed, and compared. The data collection was carried out in the winter semester 2021/22 by means of participant observation (see Chapter 5) to specifically observe students and teachers in their actions. To interpret the data, this study aims to identify significant anomalies that may have led to performance gaps in the observed nationwide BL programme ‘Empirical Research and Statistics’ at Macromedia University of Applied Sciences.

The interventions developed in this study were specifically designed for the course ‘Empirical Research and Statistics’ at the Macromedia University of Applied Sciences and confirmed the intended target group. The target group is a random sample. The design development is based on 191 course participants from seven locations in Germany. The interventions were designed to be implemented in the same course in the following semester. Participants of the study were 660 students from seven locations in Germany in the summer semester of 2022.

7.4 ADDIE Process

7.4.1 Analysis

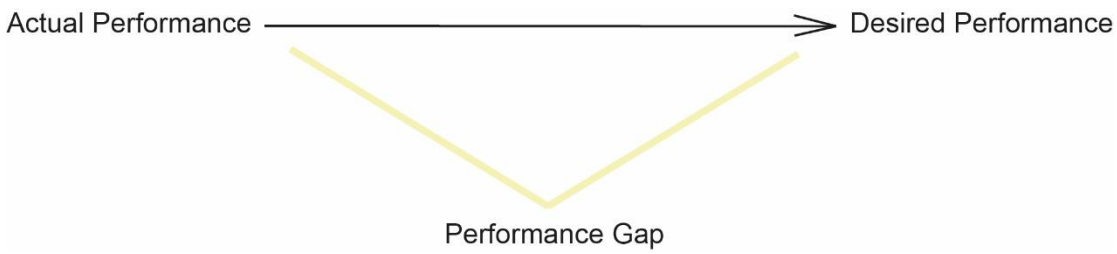
To be able to propose how university didactics and especially BL teaching can be made more attractive to students to sustainably improve their learning experiences and outcomes, the analysis aimed to seek and find explanations for certain phenomena. For this purpose, significant cases of events, persons or things were identified, considering the external conditions and the individual situation of the students. The description of the various significant cases concretised the characterisation of the lessons presented in the protocols regarding their teaching conception. This was particularly helpful in showing in which cases interventions were useful and in concluding the future of teaching. The framework applied both to the evaluation procedure proposed by Schatzman and Strauss (1973) and to objective hermeneutics when it came to classification by Schütz (1974). In the first step of the analysis, it was recommended to search the material for significant cases and to note the characteristics of these cases. Subsequently, correlations between the occurring anomalies and performance gaps were searched for (Merkens, 1992).

In the previous studies presented in this thesis, axial coding was used for both deductive and inductive codes. The deductive code ‘transformation’, based on Atef and Medath (2015), served as the conceptual framework outlined in the winter semester of 2021/ 22 and the summer semester of 2022. This was because its sub-codes ‘teacher role’ and ‘instructional methods’ represented the teaching and delivery of the course in the winter semester of 2021/ 22 compared to the summer semester of 2022. The third sub-code ‘curriculum’ was neglected because it was prescribed nationwide by the Bologna Reform (see 3.1.2) and could not be changed in the context of this study. Thus, the aim was to find out how the behaviour of the teachers and the instructions applied affected the experience and outcomes of students’ learning. These significant cases each represent a phenomenon, i.e., a problem, a question, an event, or an incident that was considered important through the analysis of the protocols (Strauss & Corbin, 1998). Within this conceptual framework, the analysis was subdivided by distinguishing four levels for the search for significant cases. These were in the winter semester of 2021/ 22 a) the student learning experience and b) the student learning outcomes. The categories and subcategories developed are subordinate to both levels. A third level of c) SoML interventions was added in the summer semester of 2022. The fourth level was the d) trade-off, which was targeted in Chapter 8.

To figure out significant cases in the protocols, a systematic search for anomalies related to performance gaps in student's learning experience and outcomes was conducted. The difference between the actual performance and the desired performance was referred to as *performance discrepancy*. As presented in Figure 16, three general categories of reasons for performance discrepancy existed: (1) limited resources, (2) lack of motivation and (3) lack of knowledge and skill. The purpose of instruction was to close the achievement gaps caused by a lack of knowledge and skill (Branch, 2009).

Figure 13

Three Main Causes for a Performance Gap



Note. This figure is an own representation based on Branch (2009).

Thus, in this study, the causes of achievement discrepancies could be found by searching the data for significant cases of anomalies in the 'teacher role' and 'instructional methods' (Atef & Medath, 2015). This guaranteed two things: that improvable performance gaps existed and that innovations in teaching were possible. Thereby, the aim was to find connections between the sub-codes 'joy', 'motivation', 'effort', 'participation', 'interaction', and 'focus' of the code concept 'learning experience' and the spotted anomalies. The same applied to the code concept 'learning outcomes' regarding the sub-codes 'learning success', 'competencies', and 'future skills'. In this context, interpretative codes were developed on which the significant cases were built. In the following, not all identified cases will be presented. Instead, examples will be provided regarding the research dimensions of learning experience and outcomes.

Table 32

Level I: Learning Experience

Unit 1 No evidence.	
Unit 2 "14:39. Student raises hand. The professor does not react. Student puts hand down again."	**Disregard** **Lack of Response** **Lack of Knowledge** **Delayed Response**

"15:17. Feedback in chat: Today's lecture went way too fast for me... Is it possible in the future for you to take the lecture a little slower? I found it really difficult to follow you for 90 minutes at that pace. No offence. The message gets 9 likes." "15:19. Professor tells students that she won't finish the session in time and will record the missing part. No reaction to message in chat, yet." "15:22. Second feedback in chat: ...perhaps a short break in between..." "15:29. The professor answers the questions in the chat. Her solution is to provide a second part as an extra recording. She suggests a break and asks students to raise their hands if this is appreciated. 14 students do so. Slowing down is suggested as well." "15:30. Session is over. Three students clap."	**Lack of Time**
Unit 3 "14:32. Student asks in chat: Did anyone get that? The question is not answered by the professor." "15:00. Almost no interaction except for one chat message." "15:27. Question from the chat is not targeted by the professor yet." "15:37. Session is over. Chat questions cannot be answered. The professor tells the students to get their questions answered via e-mail or in the exercise."	**Disregard** **Lack of Response** **Lack of Knowledge** **Delayed Response** **Lack of Interaction** **Demotivation** **Irritability** **Annoyance** **Lack of Time**
Unit 4 "14:12. Question in the chat. Not answered, yet." "14:21. Almost no interaction except from one chat message." "15:36. The lecturer answers the question."	**Disregard** **Delayed Response** **Lack of Interaction**
Unit 5 "14:02. One student puts a hand up. No answer. The student puts the hand down again." "14:41. Comment in chat from a colleague regarding the content." "14:50. No interaction." "15:33. The professor addresses the comment in the chat and asks the commentator to interact, but he is already gone."	**Disregard** **Lack of Response** **Lack of Knowledge** **Lack of Interaction** **Delayed Response** **Lack of Time** **Demotivation**
Unit 6 "14:18. Message in chat regarding content. No answer so far." "15:15. No more interactions." "15:31. The lecturer answers the question in two sentences."	**Disregard** **Lack of Response** **Lack of Knowledge** **Lack of Interaction** **Delayed Response** **Lack of Time**
Unit 7	**Disregard**

"14:03. Message in chat regarding participation. No answer, yet." "14:09. Message in chat regarding the exam. No answers so far." "14:35. No more interaction." "15:31. The professor answers the first question barely. She only says thank you for the question and mentions that she hopes that everyone can use the videos. She answers the second question in detail. Yet, she can't provide an answer regarding the exam type."	**Lack of Interaction** **Delayed Response** **Lack of Time**
Unit 8 (new topic) "14:03. Question in chat: Is the program necessary for the exam? The lecturer answers immediately for the first time." "14:17. Two more questions regarding the exam. No answer, yet." "14:35. No more interactions." "15:33. The professor answers questions quickly."	**Controversy** **Lack of Response** **Lack of Knowledge** **Lack of Interaction** **Delayed Response** **Lack of Time** **Demotivation** **Irritability** **Annoyance**
Unit 9 "14:10. No questions or interactions so far." "14:43. Question in chat regarding the exam." "15:48. The professor answers the question."	**Disregard** **Lack of Interaction** **Delayed Response**
Unit 10 "14:00. The professor mentions that one student has asked her about the exam and was very worried and concerned. She wants to take the worries away." "14:03. Message in chat about the summaries at the end of every slide." "14:15. No more questions or interactions." "15:28. The professor answers the question in the chat with yes. Wishes Merry Christmas. One student replies with: 'You, too.'" "15:29. No more questions."	**Disregard** **Lack of Interaction** **Delayed Response**
Unit 11 "14:17. No interaction so far." "14:56. Message in chat not related to the class. One student wants to connect with other management students. The message gets one like." "15:39. The professor reads the message."	**No Interaction** **Demotivation**
Unit 12 "14:10. No interaction so far." "15:25. Question in chat regarding the exam."	**Lack of Interaction** **Demotivation**

"15:35. The professor reads the message and answers it. One student asks how to prepare best. The professor answers that a good strategy is to connect the in-a-nutshell slides with the exercise."	

Note. *This table is an example of the significant case analysis of 'Anomalies in interaction with Professor in Scenario A 'fully online'' in the protocols of the winter semester of 2021/ 22.*

The protocol analysis of the significant case 'Anomalies in Interaction with Professor in Scenario A 'fully online'' gave insights into the connection between the lack of interaction from the professor and the decrease of, i.e., interaction, knowledge, and motivation from the student's side. For example, when a student raised their hand and the professor did not reply within a short period, the hand was lowered again. The interpretative codes 'disregard', 'lack of response', and 'lack of knowledge' resulted from the repetitive behaviour of the professor, which was to not answer chat messages or raised hands in a reasonable timeframe. This led to students not getting their questions answered and therefore a lack of knowledge. Also, when a question was asked and not answered by the lecturer in an appropriate time frame, it became less relevant and got out of context. Besides, the lecturer saw on her screen that questions were being asked and intentionally decided not to answer them. This controversial action became obvious in Unit 8, where the lecturer answered the question asked immediately. Additionally, the students experienced other online classes where questions were answered immediately. This led to an increase in 'demotivation', 'irritability', and 'annoyance'.

Regarding the code concept 'learning outcomes', the aim was to find connections between the sub-codes 'learning success', 'competencies', and 'future skills' and the sub-codes 'teacher role' and 'instructional methods' of the conceptual framework 'transformation'. This search for significant cases required even more elaboration of interpretative codes, as the learning outcome was less obvious in the protocols. Besides, it showed after the examination, by comparing the grades.

Table 33

Level I: Learning Outcome

Unit 1 No evidence.	
Unit 2 "14:39. Student raises hand. The professor does not react. Student puts hand down again." "14:46. No breaks are taken."	**Lack of Knowledge** **Lack of Breaks** **Delayed Response** **Content Overload**

“15:17. Feedback in chat: Today’s lecture went way too fast for me... Is it possible in the future for you to take the lecture a little slower? I found it really difficult to follow you for 90 minutes at that pace. No offence. The message gets 9 likes.” “15:17. Note from the observer: Too much content, focus not possible within 90 minutes.” “15:19. No reaction to message in chat. The professor tells students that she won’t finish the session in time and will record the missing part.” “15:22. Second feedback in chat: ...perhaps a short break in between...” “15:29. The professor answers the questions in the chat. Her solution is to provide a second part as an extra recording. She suggests a break and asks students to raise their hands if this is appreciated. 14 students do so. Slowing down is suggested as well.” “15:30. Session is over. Three students clap.”	
Unit 3 “14:01. The professor hopes that the students watched the video she prepared after the last session.” “14:03. Prof. continues with content without revision. She speaks fast again and uses many technical terms. She explains everything in detail.” “14:32. Question in chat: Did anyone get that? Not answered, yet.” “15:27. 57 students are still there. Question from chat not targeted by the professor, yet.” “The session is over. The chat questions can’t be answered. Prof. tells students to get questions answered via mail or exercise.” “Note from the researcher: Verbal feedback from last exercise session: slides are too full. Slides are still overloaded.”	**Lack of Monitoring** **Lack of Revision** **Lack of Knowledge** **Delayed Response** **Content Overload**
Unit 4 “14:03. Prof. continues with content without revision. She speaks fast again and uses many technical terms. She explains everything in detail.” “15:10. No breaks taken so far. 50 students are still participating. Only 3 students from Munich are still participating.” “Lecturer answers questions. New one: To hurry up.” “Note: Students were leaving the session continuously.”	**Lack of Revision** **Lack of Knowledge** **Delayed Response** **Lack of Breaks** **Content Overload** **Too Much Overtime**
Unit 5 “14:02. Hand up from student. No answer, hand down again.” “14:41. The professor speaks very fast and takes no breaks.” “15:33. The professor addresses the comment in the chat and asks the commentator to say something, but he is already gone.”	**Disregard** **Lack of Revision** **Lack of Knowledge** **Delayed Response** **Lack of Breaks**

“Note from the researcher: Students have a hard time following. Too much information and the professor speaks too fast. Breaks needed!” “Note from the researcher: Prof. has much knowledge but fails to adapt to students’ needs. They feel lost and can't follow.”	**Content Overload** **Too Much Overtime**
Unit 6 “14:01. The professor mentions again (2nd time) that the group is smaller.” “15:24. No breaks taken.” “Note from the researcher: Only because students are online doesn’t mean they are following the session.” “15:31. The professor answers the question in two sentences.” “Note from the researcher: The professor increases her speed, in the end, to squeeze everything in the session. The slides are overloaded. It is impossible to read and listen simultaneously.”	**Lack of Knowledge** **Delayed Response** **Lack of Breaks** **Content Overload** **Lack of Time** **Too High Speed**
Unit 7 “14:03. Message in chat: For many it’s too fast and hard to focus within 90 min without breaks. Need to rewatch it afterwards. No answer, yet.” “14:09. No answers so far. The professor speaks fast as always.” “15:31. The professor answers the first question barely. She only thanks for the question and hopes everyone can use the videos. She answers the second question in detail, but doesn’t give a clear answer regarding the exam, e.g., which one it will be, as it is not decided, yet.” “Note from the researcher: Fewer students than ever are participating.”	**Lack of Knowledge** **Delayed Response** **Lack of Breaks** **Content Overload** **Lack of Focus** **Lack of Time** **Too High Speed**
Unit 8 (new topic) “14:03. Question in chat: Is the program necessary for the exam? The lecturer answers immediately for the first time.”	**Controversy**
Unit 9 “14:00. The professor mentions that she hopes that more students participate in today’s session.” “14:10. The professor speaks very fast, and the slides are very full. No questions or interactions so far.” “15:29. The professor mentions that she wants to finish class for the recording even though it will be overtime.” “15:46. Only eleven students are still in the online session, and it is still going. The students must rewatch the session if they want to be up to date.” “15:48. The professor rushes through the last slides. She mentions that the exercise can be used to understand the topic. Nine students are left. Now the professor answers the question.”	**Lack of Knowledge** **Delayed Response** **Lack of Breaks** **Content Overload** **Lack of Time** **Too High Speed** **Too Much Overtime**
Unit 10	**Delayed Response**

“14:03. Message in the chat: Is the summary at the end most relevant for the exam?” “14:15. The professor speaks very fast, and the slides are very full.” “15:28. The professor answers the question from the chat.” “Note from the researcher: The professor hasn’t changed her teaching style ever since the session started. Even though the students asked for it.”	**Lack of Breaks** **Content Overload** **Too High Speed** **Frustration**
Unit 11 “The professor speaks very fast, and the slides are very full. No more questions or interactions so far.”	**Lack of Breaks** **Content Overload** **Too High Speed**
Unit 12 “14:00. The professor mentions that only a few students are in the last session.” “14:24. Only 31 students are still online. The professor speaks fast as always.” “Note from the researcher: The professor speaks fast, and the slides are way too full. Also, she doesn’t talk about the exam.”	**Lack of Knowledge** **Content Overload** **Lack of Breaks** **Too High Speed**

Note. This table is an example of the significant case analysis of ‘Anomalies in learning success in Scenario A ‘fully online’’ in the protocols of the winter semester of 2021/ 22.

In the analysis of the significant case ‘Anomalies in Learning Success in Scenario A ‘fully online’’ it became clear that some interpretative codes overlapped with those of the other cases. For example, ‘lack of knowledge’ was an interpretive code identified concerning the learning experience and outcomes. Regarding learning success, it is related to the decreasing number of students attending and the continuous ‘leaving’ of students within the session. The interpretative codes ‘lack of revision’, ‘lack of response’, and ‘lack of knowledge’ resulted from the repetitive behaviour of the professor, i.e., not repeating course content or answering chat messages or raising hands in a reasonable time frame. As was well known from the literature, a lack of repetition results in less retention of learned content (Ebbinghaus, 1885). In addition, students’ questions were not answered, so they again lacked knowledge. It could be concluded that if a question was asked and not answered by the lecturer in a reasonable time frame, it lost relevance and was taken out of context.

As a result of identifying significant cases of anomalies in students’ learning experience and outcomes due to the role of the lecturer and instructional methods applied, performance gaps were uncovered and validated. The performance gaps related to the code concept of ‘learning experience’ were caused by:

- Delayed Response

- Lack of Response
- Lack of Time
- Lack of Monitoring
- Lack of Revision
- Content Overload
- Lack of Breaks
- Too Much Overtime
- Too High Speed
- Lack of Interaction

Further, performance gaps were uncovered and validated in connection to the code concept 'learning outcomes' caused by:

- Lack of Breaks
- Delayed Response
- Content Overload
- Lack of Monitoring
- Lack of Revision
- Too Much Overtime
- Lack of Time
- Too High Speed

As discussed, the identified performance gaps provided space for action. To ensure that the room for change was connected to the teachers' lack of knowledge and skills and not a lack of motivation or resources, the identified performance gaps were sorted below according to Branch (2009):

Lack of resources described performance gaps caused by either limited technical capacity, limited cognitive capacity, or limited process capacity. In the following Table C, the performance gaps were subdivided into three categories:

Table 34

Three Categories of Performance Gaps

Limited Process Capacity	Lack of Breaks Content Overload Lack of Time Too High Speed Lack of Response
Limited Cognitive Capacity	Not evident
Limited Technology Capacity	Lack of Monitoring

	Too Much Overtime

Lack of motivation is described as performance discrepancies caused by an unwillingness of the person to perform the task. This was not evident in the research phase conducted. Nevertheless, it was not completely ruled out as no data was available on how the lecturers worked on the other campus. Therefore, they were not specifically considered in the development of the interventions, only in the implementation phase. However, the SME knew all the lecturers and was able to share this with the researcher.

Lack of knowledge and skill indicated that the performance gaps were caused by the lack of intellectual or psychomotor skills to perform the task. Thus, instruction was the most suitable response. In the following Table 14, the performance gaps directly caused by lack of knowledge and skill as well as the resulting consequences are presented:

Table 35

Example of Performance Gap caused by 'Lack of Knowledge and Skill'

Lack of Knowledge and Skill	Delayed Response Lack of Revision

Furthermore, seven of the ten performance gaps were not due to one but two interrelated reasons. Lack of knowledge and skill was related to a lack of process capacity when it came to lack of breaks, time, and response, as well as content overload and too high speed. This was because the curriculum was fixed, and the lecturer acted with the best intention to finish the course with all the content and still answer the questions at the end of each session. Both were not possible in the time allotted. The overloading with content was therefore double-edged because although the content was dictated by the curriculum and therefore the core problem lay in the process, the slides were far too overloaded with content which derived from the actions of the course coordinator.

Lack of time and too high speed were difficult to tackle, as the given timeframe and content were pre-defined, yet it was again in the hands of the course coordinator to adapt them accordingly by following the approach of constructive alignment (Biggs & Tang, 2011). Furthermore, lack of knowledge and skill as well as limited technology capacity led to lack of interaction and too much overtime as the original tool Microsoft (MS) Teams was not an educational platform and therefore not as suitable as Blackboard. When comparing both platforms, the session in MS Teams did not end after five minutes of extra time. At the same

time, the lecturer herself did not know how to interact with the students during the session and didn't end the sessions on time. The resulting achievement gaps were:

Table 36

Performance gaps attributable to two categories

Lack of Knowledge and Skill/ Limited Process Capacity	Lack of Breaks Content Overload Lack of Time Too High Speed Lack of Response
Lack of Knowledge and Skill/ Limited Technology Capacity	Lack of Interaction Too Much Overtime

Following the assessment of actual performance, desired performance was determined to improve the student learning experience and outcomes based on the analysis. This was done by considering key aspects from the existing literature on the implementation of BL in higher education, as well as opportunities for improvement through ML and social learning components. To best represent them and thus the achievement of desired performance, the possible extensions were subdivided following the teaching methods of Alammary, Sheard and Carbone (2014):

Lectures: Building on constructivist learning theories (Vygotsky, 1962; Bruner, 1960; Dewey, 1929; Piaget, 1923), improving student learning outcomes in lectures based on these theories to achieve predefined learning goals and competencies seems to be a promising approach. In this context, the repetition of core topics at the micro level is an important driver to increase retention. ML takes advantage of the primary and recency effect, i.e., using ML at the beginning or end of the lesson also increases retention (Shail, 2019; Bersin, 2017; Meacham, 2016). In doing so, spaced learning helps to lower the forgetting curve (Ebbinghaus, 1885). Social learning, on the other hand, offers a new epistemology of learning that focuses on active cognition vis-à-vis concepts and representation (Culatta, 2019). Furthermore, ML leads to lower mental fatigue due to explicit practice and planned breaks. This in turn leads to circumventing severe cognitive decline and improving past performance (Shail, 2019). Overall, ML as a support to macro-learning forms a fruitful co-existence. This is because micro-content is problem-oriented and assumes that the learner needs help in a particular area while macro-learning insists that an entirely new topic is to be learned (Bersin, 2020). In terms of the learning experience, for example, ML increases enthusiasm for learning (Liu, 2018; Penrose, 2008). One

example is the One-Minute Professor (Jiang & Su, 2017), which used micro-videos, micro-teaching cases and micro-exercises to increase students' enthusiasm for learning. In this method, little but core knowledge is taught in a short time. Moreover, micro-information interconnectedness may occur (Liu, 2018). According to Reimann (2010), macro-session components can be reused for ML units so that they do not appear as separate units. As explained further, this is particularly important for exercises where students can interact on-site and for self-learning phases where students need to plan their learning in terms of time and space.

Discussion groups: Learning requires social interaction. It is a key component of situated learning as it enables higher engagement and more active members (Lave, 1988) and collaboration in communities of practice (CoPs). The approach assumes that centralised curation of learning content is not possible because knowledge evolves too quickly. Instead, a CoP uses micro-content to share, discuss and develop knowledge (Göschlberger, 2016; Wrenger, 1998). During the campus exercise, students often met in discussion and learning groups. Here, the theory of social learning provides an important foundation, as it describes learning through observation (OL), imitation and modelling (Bandura, 1977). There is an interaction of environmental and cognitive elements that influences how students learn, both on the learning experience and outcomes level. In this process, learning is influenced by attention, motivation, attitudes, and emotions (Cherry, 2019). Vygotsky's (1978) social development theory supports this approach as it explains how cognitive development requires social interaction. Situated learning is a key component of Vygotsky's theory (Lave & Wenger, 1991; Vygotsky, 1978). It has been applied in various contexts of technology-based learning activities, focusing on problem-solving, a key competency and future skill (Ehlers, 2022; Cognition & Technology Group at Vanderbilt, 1993). Situated learning requires knowledge to be presented in an authentic context, i.e., in environments and applications where that knowledge normally occurs (Lave & Wenger, 1991). It has been shown that building and maintaining relationships with other students and the instructor that underpin the success of the reflection process is more feasible in a classroom setting (Atef & Medath, 2015). Regarding the learning experience, various communicative and collective action structures on the micro level are available. Baumgartner (2013) emphasises that in the context of learning, building, and maintaining relationships is necessary to promote reflection-in-action through learning with and from others at the micro level (Baumgartner, 2013). The use of gamification increased user engagement and created a higher intrinsic motivation to learn (Göschlberger & Bruck, 2017). Situated learning supported learning with and from each other (Glahn & Gruber, 2018).

Besides, ML provided a higher level of engagement, as different forms of media were used (Shail, 2019). Thereby, informal learning (discovery) and formal learning (didactics) can be combined with social learning in the form of OL (Bandura, 1977) and situated learning (Lave & Wenger, 1991). In both formal and informal digital learning environments, it is recommended by experts to connect students, teachers, and experts as well as what is learned in class and the relationship between theory and practice (Glahn, 2017; Gikas & Grand, 2013). This requires current digital learning tools (Hart, 2022).

Self-directed learning activities: Learning from home is particularly beneficial for students as they value flexibility through choice (Atef & Medath, 2015; Vaughan, 2007). In addition, ML provides the opportunity for self-assessment, which is a future skill that allows students to pause and resume at any time (Ehlers, 2022; Shail, 2019). Furthermore, the use of paused repetition avoids mental fatigue (MacLeon, Reynolds, & Lehmann, 2018). Instead, students' cognitive knowledge and pace are improved (Shail, 2019; Bersin, 2017; Meacham, 2016), as is their long-term learning (Kang, 2016). In this regard, integrating social learning activities increases interactions and promotes reflection-in-action in the field and reflection-on-action not only in learning groups but also outside of class and at home (Baumgartner, 2013; Riel & Sparks, 2009). Students' attention can be targeted because micro-units are limited in time, content and cost and it is possible to shift certain parts of learning to times of high attention (Göschlberger & Bruck, 2017). This means that self-learning and self-management (Liu, 2018) is promoted through micro-teaching and these, as well as increased interaction, are considered future competencies (Ehlers, 2022). Finally, the concept of lifelong learning is promoted, as self-directed learning such as self-management, self-control and motivation is improved (Sofianopoulou & Kamilali, 2012; Garrison, 1997).

Based on the literature review, the desired performance was outlined to get an idea of the scope and extent of the performance gap. The methodology for quantifying these performance gaps commenced with the systematic review of the material to identify anomalies and discrepancies in the teaching and learning processes. To quantify the performance gaps, a detailed analysis was conducted. Each identified performance gap, such as delayed response, lack of interaction, and content overload, was evaluated in terms of its actual performance against the desired performance. The primary cause of each gap, such as the lecturer's failure to interact or respond in a timely manner, was identified, and its impact was quantified as a percentage of the total performance gap. For example, if the actual performance observed in a session was characterised by a lack of interaction, and the desired outcome was scheduled and timely

interaction, the primary cause (e.g., the lecturer's failure to interact) was assigned a percentage value. This value represented the extent to which this cause contributed to the overall performance gap in that area.

The calculation of these percentages was critical in understanding the scale and impact of each issue within the teaching and learning process. By aggregating the percentage values to sum up to 100%, the study provided a comprehensive and quantifiable view of the distribution of various factors contributing to the discrepancies. This approach not only highlighted the most significant areas in need of improvement but also allowed for a targeted and data-driven response in the subsequent phases of the ADDIE process. According to Branch (2009), the following table was developed to capture the performance gap, the desired performance, the reason, and the influence on the performance gap:

Table 37

Performance Gap and Its Primary Cause with the Percentage of the Impact

Actual Performance	**Desired Performance**	**Primary Cause**	**Per cent of the Performance Gap**
Lack of Revision	Increased repetition opportunities through gamification for learning at home and in the exercise.	When coordinating the course, the course coordinator didn't provide repetition opportunities other than rewatching the recordings and scripts.	**25%**
Content Overload	Content reduction and displacement to asynchronous self-study time in consultation with the SME and based on the curriculum.	The professor didn't reduce the content as course coordinator as she didn't know how due to the overloaded curriculum (lack of knowledge; limited process capacity).	**15%**
Lack of Interaction	Scheduled and timely interaction between the professor and students inside the session.	The lecturer didn't interact with the students during the session only before and after (lack of knowledge). The possibilities didn't suit the classroom setting (limited technology capacity).	**15%**

Lack of Breaks	Planned breaks are taken after 20-30 minutes.	The professor didn't take breaks as she thought she didn't have time for it (lack of knowledge). This is due to the overloaded curriculum (limited process capacity).	**10%**
Lack of Time	Same timeframe but less content during expert sessions in consultation with the SME and based on the curriculum.	The professor didn't have enough time as she didn't know how to reduce the content as course coordinator due to the overloaded curriculum (lack of knowledge; limited process capacity).	**10%**
Too High Speed	Reduced speed through more time due to less content in expert sessions in consultation with the SME and based on the curriculum.	The professor didn't have enough time and therefore spoke too fast (lack of knowledge; limited process capacity).	**5%**
Lack of Response	Planned breaks are taken after 20-30 minutes. They are used to respond to occurring questions.	The professor didn't have enough time and therefore didn't respond to all questions (lack of knowledge; limited process capacity).	**5%**
Delayed Response	Timely answering of questions and existing opportunities to ask questions via email and in the exercise.	The professor didn't answer any questions during the session only at the end, which was often way overrun time (lack of knowledge).	**5%**
Lack of Monitoring	A new learning platform is introduced with integrated assessment tools.	The initial platform MS Teams was not used (lack of knowledge) and is not suitable to track student behaviour in a statistically valid way (limited technology capacity).	**5%**
Too Much Overtime	A new learning platform is introduced with automatic	The professor didn't have enough time and therefore didn't finish on time (lack	**5%**

	termination after five minutes of overrun time.	of knowledge; limited process capacity).	
			Total = 100%
Purpose statement: The didactic interventions aim to provide valuable methods to improve the current instructional design in blended learning at Macromedia University of Applied Sciences and thereby increase the learning experience and learning outcomes of students in higher education in the long term.			

Considering the identified achievement gaps, desired performance causes and their impact on the achievement gaps, according to Atef and Medath (2015), a change in the areas of 'curriculum', 'teacher role' and 'teaching methods' is not necessary to this extent. Instead, the focus is on changing 'teaching methods' to improve students' learning experiences and outcomes. It is seen as the main driver of innovation in higher education BL. The 'teacher role' is only addressed secondarily in this study because, while it is possible to adjust the role of the national professor, it is only partially possible to influence the behaviour of lecturers at all sites. The 'curriculum' cannot and should not be changed either, but the presentation of the content and its distribution can.

The analysis phase of ADDIE proceeds with five more phases. They include the determination of instructional goals, confirmation of the intended audience, identification of required resources, determination of potential delivery systems, and finally the composition of a project management plan. Since this study aims to improve existing BL scenarios, the steps are presented based on the learning objectives that are provided based on the curriculum. They are rooted in the Bologna Reform and therefore Bloom's Taxonomy (Bloom, 1956). The focus will be mainly on the three low-level thinking order skills (LOTS) 'remembering', 'understanding', and 'applying' (Churches, 2008). This decision is based on the evolution of Bloom's Taxonomy to be more relevant and beneficial to current digital learning environments and to improve collaboration.

Based on this foundation, SoML elements were added as a novel enhancement of the teaching methods developed based on the theories presented. They served as a practical approach to combining social learning and ML (Göschlberger, 2016). In this context, gamification was seen as a factor in increasing user engagement and students' intrinsic motivation to learn (Göschlberger & Bruck, 2017). Furthermore, situated learning was a key component to support the process of learning with and from each other (Glahn & Gruber, 2018). Besides, ML provided the opportunity for self-assessment, a future skill that allows students to pause and

continue at any time while the use of paused repetition avoided mental fatigue (Ehlers, 2022; Shail, 2019; MacLeon, Reynolds, & Lehmann, 2018). For self-learning, according to Reimann (2010), macro-session components were reused for ML units to combine lectures and exercises. Learners' attention was targeted because micro-units were limited in time and content, thus certain parts of learning were shifted to times of high attention (Göschlberger & Bruck, 2017).

The resources and delivery systems needed to transform the teaching methods into digital learning activities were preselected (see Table G). In both semesters, the curriculum was pre-defined by the nationwide course coordinator, the dean, and the central office. The exam was created by the course coordinator in consultation with them. To constructively align the course content with the exam, the coordinator provided PowerPoint slides for both the online lecture and the exercise. Furthermore, scripts were uploaded on the learning platform Moodle in the winter semester and Blackboard Collaborate in the summer semester. What was also different was the platform on which the online lecture is held. The digital learning environment switched from MS Teams in the winter semester to Blackboard Collaborate in the summer semester. For the design of the interventions, additional tools for learning were considered for the on-site exercise rooms available at campus Munich. The planning department planned the rooms and provided the information in the student's schedules and lesson plans. Besides, the lessons were staffed with lecturers for the exercises on campus and the nationwide professor.

Table 38

Resources Needed for the Transformation of the Instructional Methods Into Digital Learning Activities

Content Resources	Curriculum PowerPoint slides Scripts Exam
Technology Resources	Moodle MS Teams Blackboard Ultra Blackboard Collaborate + Additional tools for learning
Instructional Facilities	Digital learning environment Rooms on campus
Human Resources	Professor Lecturers

Based on Branch's (2009) nine-step estimation procedure, the delivery options under

consideration and the estimated duration for each delivery option under consideration were identified.

Table 39

Delivery Systems and Length of Time

Scenario A: Fully Online	90 minutes
Scenario E: Fully on Campus	105 minutes
SoML Intervention	< 10 minutes

Note: A ML unit is defined as within seconds until three minutes (Göschlberger & Anderst-Kotsis, 2019) but timeframes up to ten minutes are accepted (Bersin, 2020).

Finally, the four key points of the project management plan were presented: the core ID team members, significant constraints, scheduled tasks and a final report. Each project was measured in terms of quality and resources such as time and cost.

Table 40

Four Key Points of the Project Management Plan

Core Instructional Design Team Members	Researcher Course coordinator and SME
Significant Constraints	Curriculum Teaching period and location Constructive alignment
Scheduled Tasks	Units Lesson plan
Final Report	Report to the Didactics Commission for further implementation and a possible handout for lecturers

Summing up, since the achievement gaps were due to a lack of knowledge and skill on the part of the teachers, it was considered possible and sensible to improve the teaching didactically. An analysis summary was provided (see Appendix K).

7.4.2 Design

The design phase aimed to verify the desired performances and appropriate test methods. The main procedures associated with the design phase were considered, including conducting a task inventory, establishing performance objectives, developing test strategies, and calculating return on investment. The four steps for conducting a task inventory after Branch (2009) were followed by (1) repeating the purpose statement, (2) reaffirming the instructional goals,

identifying the primary performance tasks and (4) specifying prerequisite knowledge and skills. To reaffirm the instructional goals the following table presents an overview of the purpose statement and the respective instructional goals:

Table 41

Complementary Purpose Statements and Goal Statements

Purpose Statement	**Instructional Goals**
The didactic interventions aim to provide valuable methods to improve the current instructional design in blended learning at Macromedia University of Applied Sciences and thereby increase the learning experience and learning outcomes of students in higher education in the long term.	(1) Describe to the students the interventions and their function, and the role of the researcher. (2) Explain to them the changes in the curriculum, lesson design, and applied digital learning tools. (3) Prepare a lesson plan together with the researcher that seamlessly integrates the interventions. (4) Teach the course 'Empirical Research and Statistics' using the implemented interventions. (5) Evaluate the quality of the new lesson design through the researcher's participant observation

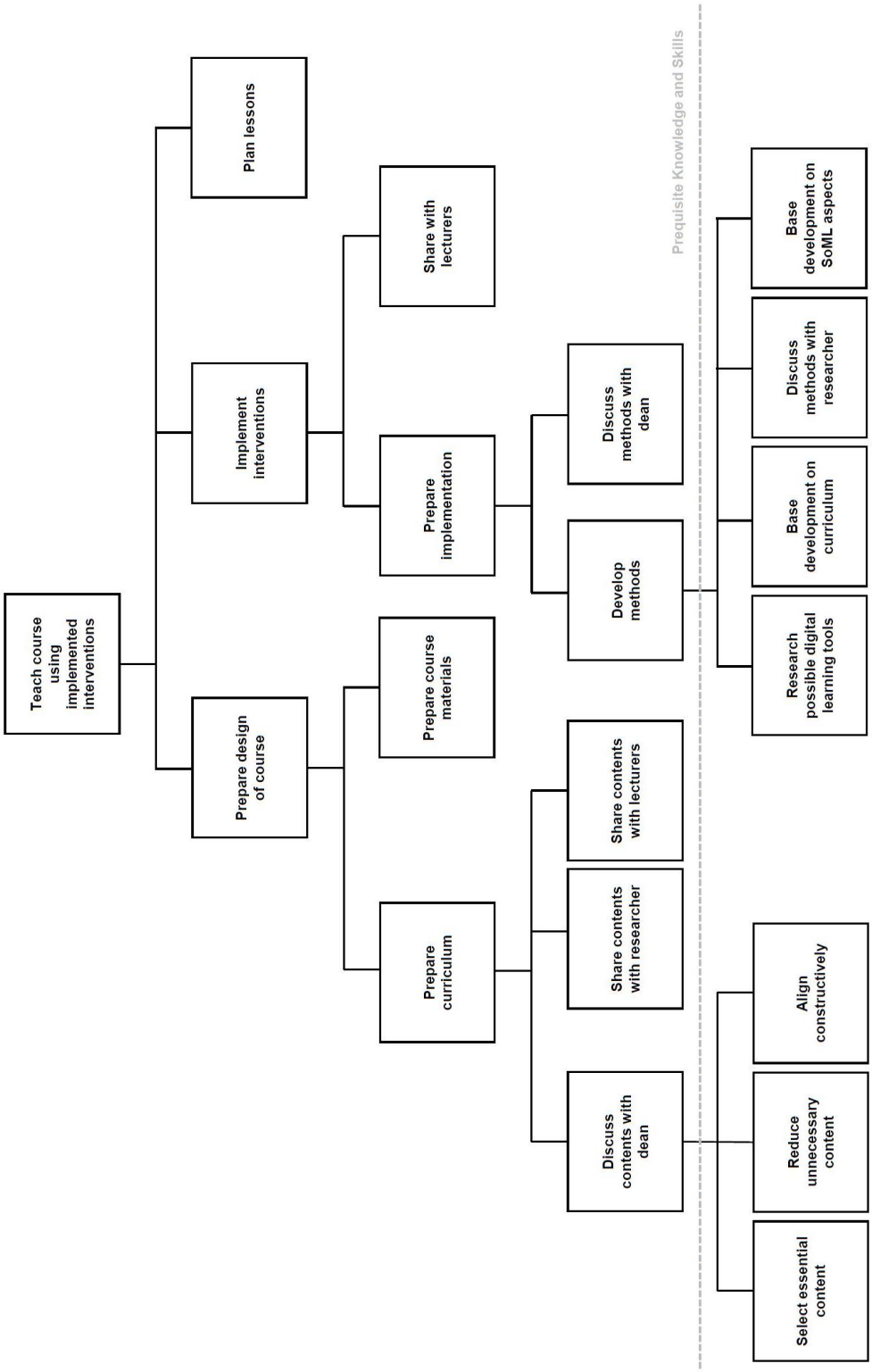
Note. This table is based on Branch (2009).

Based on the instructional goals, the primary performance tasks are identified. For this, the researcher worked in close cooperation with the course coordinator. The primary performance tasks were divided into prerequisite knowledge and skills, as the course coordinator was also an expert in the topic, an expert in instructional design, a research expert and expert knowledge in constructive alignment. Selecting essential content, reducing unnecessary content, and aligning the resulting content with the final exam is only possible, as the course coordinator oversees developing the course design, interacting with the nationwide examination office, and discussing her decisions with the dean of the faculty.

To give an example, the single goal inventory of the fourth instructional goal "Teach the course 'Empirical Research and Statistics' using the implemented interventions" is presented (see Figure 17). The written summary of all five goal inventories can be found in Appendix L.

Figure 14

Goal Inventory of the Instructional Goal



Note. This figure is an own representation based on Branch (2009).

While the instructional goals provided the general expectations, the performance objectives described the specific scope for action and therefore the action plan for each intervention. Thereby, a performance objective consisted of three components: (1) performance, asking about what the student will do, (2) condition, providing the important circumstances under which the performance could be expected, and (3) criterion, describing the quality of performance that is acceptable (Branch, 2009). Thereby, the performance objective provided a way of assessing when a particular desired performance had been achieved.

As mentioned previously, the focus regarding the cognitive domain was on the three LOTS 'remembering', 'understanding', and 'applying'. As an addition, collaboration elements were added to improve learning in digital environments (Churches, 2008). The following describes a performance objective based on 'remembering':

(1) Students collaborate on a three-minute task to remember key terms. The digital learning method uses spaced repetition, primacy and recency effects, and situated learning to improve students' long-term retention.
(2) A weekly time slot at the beginning or end of the exercise must be provided, as there is no possibility of collaboration of this kind and no time in the online lecture. A tool must be available that meets the requirements. The lecturer must be able to implement the method.
(3) The instructional method is designed by the course coordinator and the designer-practitioner-researcher. The number of participants is visible.

To test the objectives, a test strategy was developed after Branch (2009). To generate a successful testing strategy, it was important to find answers to the question if (1) the student performed as required, (2) the student met the criteria for the performance, and (3) the student performed under the specified conditions. The following table gives an example of a task, description, and test strategy.

Table 42

Example of the Task, Description, and Test Strategy

Task	**Objective**	**Test Item**
Let students repeat key terms	Let students repeat key terms to increase their knowledge regarding the research process, research methods, and basic concepts of statistics.	Integrate a digital learning tool into the beginning of every exercise that is collaborative, entertaining, and promotes remembering key terms.

As a last step of the design phase, the return on investment is usually calculated. In the case of this study, there were no additional costs. The Design Brief can be found in Appendix M.

7.4.3 Development

The development phase has the purpose to create and validate selected learning resources (Branch, 2009). This was done in close cooperation with the SME. The main procedures associated with the development phase were considered including creating content, selecting supporting media, developing guidance for students and teachers, conducting formative revisions, and conducting a pilot test. The development phase resulted in having all the learning resources for the whole ADDIE process available.

To generate teaching and learning content, instructional strategies were developed that were both conceptually and theoretically grounded. Constructivism-based and student-centred strategies provided the framework for achieving the performance objectives. Therefore, the planned activities were aligned with the performance target and the character of the students. The interventions were developed to complement the existing course design. Therefore, the focus was on students' learning experience and outcomes. The aim was to improve the identified performance deficit by improving current performance through instructional strategies in the form of interventions, thereby aiming for the desired performance. A teaching strategy in this context is defined as the organisation and sequence of learning activities (Branch, 2009). Based on this, the learning activities were developed as an attempt to arrange a series of external events to facilitate the interpretation, construction, and manifestation of knowledge and skills for students. The events in the instructional strategy varied according to the context, resources, and needs of the learners. Each episode of a complete instructional strategy included a beginning, middle and end (Branch, 2009).

In the BL course 'Empirical Research and Statistics', which was aimed to be enriched with interventions, each unit of the course had its topic and was divided into three parts. As can be seen in Chapter 5, the online lecture in Unit 1 started on 07.10.2021 with an introduction to the relevance and basics of empirical social research and statistics. The first exercise on 12.10.2021 aimed at the scientific question 'Starting from the beginning but thinking from the end'. Here, the respective topic was introduced at the beginning of the lesson and the associated learning objectives, which were to be achieved upon completion, were explained. The main part dealt with the topic of the lesson. In the end, there was a wrap-up and questions were answered or feedback was provided.

The university's didactic framework concept *mPower* prescribed that "*mPower* enables flexible study programmes in the blended learning format, which are located in different weightings between the poles of physical presence (synchronous) and structured self-learning activities (asynchronous) according to their specific forms of implementation" (Emre, Masur, & Ranner, 2022, p. 8). The consistent intensification of active and interactive learning was thereby the most important success factor. Further, crucial aspects of BL include that online and f2f are linked, while a considerable part of the study is to be done in self-study time. The basis was the inverted classroom approach. Thereby, a large part of the knowledge transfer was shifted to the students' self-learning time. The consolidation of what has been learned then takes place in collaborative and accompanied learning processes at various analogue and digital learning locations (Emre, Masur, & Ranner, 2022).

To improve scenarios A 'fully online' and E 'fully on-site', as well as student's ability to learn on their own in the self-study phases, the interventions were developed based on Gagné's Nine Events of Instruction. The method was used for organising different teaching strategies within the framework of a single lesson (Gagné, Wage, Golas, & Keller, 2005). Many effective application frameworks implement the theory of beginning, middle and end of teaching strategy development. However, this study focused on a single application framework to clarify the individual steps of developing each intervention. For the development process, the SME was presented with the following scopes for action based on the performance gaps:

1. The first and main performance gap of the current lesson design was 'Lack of Revision'. It was elaborated due to a lack of knowledge and skill of the professor. So far, when constructing the course, the course coordinator didn't provide repetition opportunities for the self-study time other than rewatching the lecture recordings and scripts. To increase students' retention, the scope for action emerged in an increase of asynchronous learning opportunities. Another opportunity for action was to repeat key aspects in the online session or the exercise.
2. The second main performance gap of the course instruction was 'Content Overload'. It was elaborated that this is due to a lack of knowledge and skill, as well as a lack of process capability. To reduce content based on the curriculum, an alternative was provided by shifting it from the online lecture to the on-site exercise. This created a basis for linking lecture and exercise more closely. Another option was to provide additional content in the self-study time and give homework. Nevertheless, a reduction of dispensable content to some extent was unavoidable.

3. The third gap between actual and desired performance was ‘Lack of Interaction’. The gap was broad and complex to close. In general, the lecturer didn’t interact with the students during the session only before and after due to lack of knowledge. Nevertheless, the classroom setting wasn’t suitable to provide any possibilities either. To solve this issue, closing the fourth and fifth performance gaps ‘Lack of Breaks’ and ‘Lack of Time’ could provide possibilities to increase interaction. Besides, they are reasons for other performance gaps, such as ‘Too High Speed’, ‘Lack of Response’ and ‘Delayed Response’, the reduction of which could also increase interaction. As the professor didn’t have enough time, she spoke too fast and didn’t respond to all questions. If planned breaks were taken after 20-30 minutes, they could be used to respond to questions that arise. Besides, as the professor didn’t answer any questions during the session except at the end, which was often way overrun time, timely answering of questions within the breaks was a possible solution as an addition to existing opportunities to ask questions via email and in the exercise.
4. Lastly, the performance gap ‘Lack of Monitoring’ could be closed due to a change of learning tool. The initial platform MS Teams was not used by the professor and is not suitable to track student behaviour in a statistically valid way due to lack of knowledge and skills and limited technology capacity. As Blackboard Collaborate was introduced as a new learning platform with integrated assessment tools, this gap could be closed. Further, the performance gap ‘Too Much Overtime’ could be closed as well, as the new learning platform provided an automatic termination after five minutes of overrun time.

Based on the given scopes for action to close the performance gaps, interventions were developed as learning episodes following the SoML definitions of Willberg (2022) and Göschlberger and Anderst-Kotsis (2019). The key points of both definitions are that interventions based on the SoML concept are technology-enabled, bite-sized learning opportunities that can be applied situationally to communities of practice (Willberg, 2022). In this context, a micro-unit is digital, interactive, self-contained, and self-explanatory. It can be presented without further context and comprises a single learning activity that can be completed within seconds to three minutes. The learning activity provides immediate performance feedback (Göschlberger & Anderst-Kotsis, 2019).

The interventions are identified as social micro-learning due to their specific characteristics and implementation methods. The development of learning resources was done in close collaboration with SMEs. This collaboration ensured that the content was both conceptually

sound and practically relevant. The instructional strategies developed were based on constructivist learning theories and centered around student experiences and outcomes. This approach aligns with the principles of SoML, which emphasize learner-centeredness and active engagement. The learning activities were designed to facilitate the interpretation, construction, and manifestation of knowledge and skills for students. This design approach is in line with the SoML concept, which focuses on creating bite-sized, self-contained learning units that are easily accessible and comprehensible.

Each instructional strategy included a beginning, middle, and end, tailored to the context, resources, and needs of the learners. This approach reflects the adaptive nature of SoML, where learning is contextualized and personalized. The interventions were developed based on Gagné's framework, which provides a structured approach to designing effective learning experiences. This methodological approach is consistent with SoML, as it allows for the creation of targeted, concise learning episodes. The interventions aimed to enhance student engagement and interaction, both crucial elements in SoML. By improving scenarios like 'fully online' and 'fully on-site', the interventions targeted active and interactive learning, which is central to SoML. The interventions were designed in alignment with the university's didactic framework concept mPower, which prescribes a blend of synchronous and asynchronous learning activities. This alignment ensures that the interventions are well-integrated into the existing educational framework and are representative of SoML principles.

The use of digital platforms like *Blackboard Collaborate* and interactive software like *Mentimeter* for the interventions is indicative of the technology-enabled aspect of SoML. These tools facilitate micro-learning by providing platforms for short, interactive learning experiences. To accomplish the performance objectives as well as the remaining ADDIE procedures, supporting media was selected as the next step of the development process. It was already mentioned that Blackboard Collaborate was introduced as a new digital learning platform in the summer semester of 2022. As an additional promising digital learning tool, the interactive presentation software Mentimeter was introduced (Hart, 2022). To support the 'Type of Learning' of students on the three LOTS 'remembering', 'understanding', and 'applying' with SoML activities based on collaborative reflection in and on action to improve learning in digital environments (Churches, 2008), supporting media was developed and chosen.

Table 43

Media Selected or Developed for the 'Type of Learning'

LOTS	Media selected or developed to support the 'Type of Learning'
Remembering	Media: Scripts, PowerPoint slides, In-a-Nutshell slides, recordings
	Distribution: Blackboard Collaborate; Blackboard Ultra
Understanding	Media: Video tutorials, word cloud, student quiz
	Distribution: Blackboard Collaborate; Mentimeter
Applying	Media: Student quiz
	Distribution: Blackboard Collaborate

Based on the scopes for action and supporting media a total of four learning episodes were developed. Each formed a self-contained intervention and was tabulated. An example is provided in the following Table L for the learning episode of the intervention 'Increase Retention' developed to repeat content from the online lecture in the exercise. This involved creating an opportunity for increasing students' ability to recall key terms through collaboration in the exercise. By placing the exercise at the beginning of the on-site session, the primary and recency effect was exploited. In addition, by limiting the timeframe based on ML, the focus was enhanced. Furthermore, by recalling and repeating knowledge together, situated learning was achieved at the lowest level of Bloom's Taxonomy. Finally, the media for the intervention were selected. In this case, it was the PowerPoint slides for the beginning, the interactive presentation tool *Mentimeter* for the main content and the whiteboard for the practice, feedback, and closure. At the end of each introductory exercise, there was a smooth transition to the next learning episode: the review of the student quiz, which was the main content of each on-site exercise. The description and the corresponding tables for all four learning episodes can be found in Appendix N.

Table 44

Example: Learning Episode of the Intervention at the Beginning of the Exercise: 'Increase Retention'.

Event	Instructional Strategy	Lecturer or Student	Media
Motivation	Based on the primary and recency effect and situated learning, the first exercise at the beginning of every on-site exercise session is aimed at remembering content from the last lecture using collaborative aspects in an ML activity.	Student: Forms initial thoughts about the content of the course.	PowerPoint slides

Objective	Be familiar with the content and implementation of the exercise.	Lecturer: Informs the students that they will be expected to remember content from the last online session.	
Prerequisite	Define the exact task (max. 1) and time frame (max. 3 minutes).	Student: Contributes to the exercise by following the lecturer's instructions.	
Content	Introduction: This exercise aims to make you remember key terms from the last online session.	Lecturer: Presents the task and timeframe.	Mentimeter
	Concept	Student: Shares key terms that are remembered.	
	Theory	Lecturer: Directs students' attention to specific relevant content.	
	Practice	Student: Recalls knowledge and skills already possessed about the topic.	
Guided Practice	Scrutinise the selected key term and the concept behind it.	Lecturer: Discusses a variety of content related to the key term and related concepts.	Whiteboard
Independent Practice	Apply the appropriate knowledge and skills.	Student: Proposes appropriate answers and objections based on her or his knowledge.	
Feedback	Provide opportunities for the students to correct their answers.	Teacher or Student: a. Suggests alternatives to achieve the same results. b. Provides "what if" questions.	
Assessment	Inform the student about her or his performance relative to the objective criteria.	Teacher: Provides additional explanations about what most students got correct and the thing	

		that was commonly mistaken.	
Closure	Summarise and reinforce the following ideas: • What were the key terms remembered? • What was missing? • What is important for this session?	Student: Takes notes and reviews them in preparation for the next learning episode.	

Note. This table is based on Gagné, Wager, Golas, and Keller (2005).

Based on Branch (2009), each episode of intentional learning was mediated by the lecturer. Instructional media were used to transition students from the known to the unknown, from the easy to the difficult, from the simple to the complex, and from the concrete to the abstract. The media were chosen to facilitate each teaching event. It was avoided to groom teaching events for a particular medium. As the interventions were based on the developed learning episodes as well as the existing *mPower* concept of Macromedia University, counselling took place exclusively within the framework of regular preparation and feedback meetings between the course coordinator and the lecturers. The nature of the meetings will be described in the following sections. Besides, before implementing a new didactic concept, it is usually revised with the help of formative revisions. Since the SoML interventions were developed for an existing BL course, they were implemented and evaluated in the field. The pilot test was also conducted in the field.

7.4.4 Implementation

In the implementation phase, the preparation of teachers and learners took place resulting in an implementation strategy (Branch, 2009). Thus, the goal was to prepare the learning environment and involve all stakeholders in a meaningful way, in this case, the professor, the lecturers and the students. The first step was to prepare the course coordinator, Professor Dr Mothes, who co-developed the interventions as an SME and was therefore familiar with each step of the research process. In the second step, the lecturers were prepared by providing them with information on how to use the interventions in every lesson throughout the semester. In the final step, students were prepared.

Before implementing the interventions, the course coordinator had to consult with the Dean of Faculty about the curriculum, content, and scope. The consultation took place during the winter semester break of 2022. After the consultation, a preparatory meeting was held between the course coordinator and the researcher on 08.03.2022 from 12:00 to 13:00. It aimed to present

the final implementation of the interventions to the researcher and to discuss the exact process of implementation. The minutes of this first preparatory meeting can be found in Appendix O. In a second preparatory meeting on 09.03.2022 from 15:00 to 16:00, the lecturers were prepared by the course coordinator in the presence of the researcher. The minutes of the preparation can be found in Appendix P. As only twelve of the sixteen lecturers from all campuses nationwide were present, the course coordinator provided an additional video explaining the need for and benefits of the interventions in the MS Teams group created each semester for sharing between lecturers (see Appendix S). The final step was to prepare the students. This was done in the context of the respective first lesson, in the online lecture on 17.03.2022 and the first exercise on campus on 22.03.2022. The minutes of these can be found in Appendix T. The process was similar to the ADDIE process without interfering much with the normal process of preparing the lecturers.

For the implementation strategy, the following steps were defined for all participants:

Table 45

Implementation Strategy in Ten Steps

Steps 1-10	**Parties involved**	**Description**
Step 1	Course coordinator	Upload quiz every week with one week's notice.
Step 2	Course coordinator	Weekly course announcements 2-3 days before the next event. If necessary, an addendum after the event in case of open questions on the part of the students.
Step 3	Course coordinator, researcher, lecturers	Presentation of interventions to teachers in a scheduled preparation meeting before the first course starts.
Step 4	Course coordinator, lecturers, students	Presentation of the interventions in the first online lecture and tutorial at all sites.
Step 5	Course coordinator/ lecturer, researcher, students	Presentation of the researcher as a didactics expert in the online lecture and exercise at the Munich campus.
Step 6	Course coordinator/ lecturer, students	Implementation of interventions in each online lecture and exercise.
Step 7	Students	Delivery of the quiz and revision of the In-A-Nutshell slides in the self-study phase.
Step 8	Course coordinator, researcher, lecturers	Feedback in monthly feedback meetings with the researcher, course coordinator and teachers.

Step 9	Researcher	Analysis and evaluation of interventions in the field.
Step 10	Course coordinator, researcher	Adaptation and re-implementation of the interventions based on the analysis.

The execution of the ten steps of the implementation strategy is presented in Appendix U. By preparing all parties involved, the implementation phase was complete.

7.4.5 Evaluation

In evaluation, it is important to identify perception, learning, and performance as the three main levels related to the course design (Branch, 2009). In this study, these areas were divided into learning experience and outcomes related to instructional design with the interventions. Classroom learning and classroom performance were observed. Participant observation specifically explored the interventions and their value to BL teaching. The choice of evaluation instruments was based on the existing study design, as participant observation had already been conducted in the winter semester and a student survey at the end. It should be noted that although one course was observed on-site, the implementation of the other exercises could not be observed. In addition to the observation, the minutes of the feedback discussions with the teachers were therefore also used. Thus, insights were gained from the nationwide teachers in monthly scheduled MS Teams video calls. They were scheduled via Doodle. The first meeting was held on 04.04.2022 from 10:00 to 11:00. All impressions gained were recorded in corresponding minutes (see Appendix W).

For the analysis, the grounded theory variant of Schatzman and Strauss (1973) was used, at the beginning of the ADDIE process. In the observation, the focus was on the significant cases, more concretely how the interventions played out in them. The aim was to iteratively improve the interventions within students' learning experience and outcomes to get as close as possible to closing the achievement gaps. Following Kirkpatrick's (1998) evaluation model, the evaluation of the protocols was conducted according to the first two of the following four criteria:

1. The reaction of students, what they thought and felt about the training.
2. The behaviour of students, their extent of improvement in behaviour and skills, as well as implementation and application.
3. The student learning, i.e., the resulting increase in knowledge or skills.

4. The outcomes, such as the impact on the company or environment resulting from the trainee's performance.

The first intervention was the 'word cloud', which was developed to reduce the 'lack of revision' performance gap in the overall course. It was applied in the exercise. Table N shows an example of how the interpretative codes of the reaction of students to 'Word Cloud' from the protocols of Units 1, 2, and 3 in the summer semester of 2022 were developed.

Table 46

Interpretative Codes Example: Reaction of the Students to the 'Word cloud' from the Protocols of Units 1, 2, and 3 in the Summer Semester of 2022

Reaction of Students	Interpretation
Unit 1 "11:37. After a short introduction the first SoML intervention starts. A word cloud to repeat the contents of the first expert session. Note: Students are a bit hesitant but then they start adding a lot of words." "11:44. Lecturer asks about certain terms. Student answers correctly."	**Hesitation** **Curiosity** **Knowledge**
Unit 2 "11:40. Official exercise starts with a word cloud. Note: Students seem to like the tool. They answered with many words." "11:44. Lecturer discusses terms and goes into detail with some of them. Gives examples in another context."	**Joy** **Knowledge**
Unit 3 "11:35. Lecturer asks students how they liked the last online session. One mentions that it is easier to repeat the slides at home. Note: Students seem thankful and less overwhelmed." "11:37. They start with the word cloud." "11:44. They discuss the key terms. Student answers correctly." "11:47. The lecturer gives an example. He refers to the online session. Note: The lecturer uses practical examples. Students chat a bit."	**Content Overload** **Thankfulness** **Compensation** **Knowledge** **Activity**

As this example of the evaluation shows, the problem of 'Content Overload' still existed. This was already foreseeable before the implementation due to the existing curriculum. However, it was clear that 'Lack of Knowledge' is reduced by the intervention with the code 'Knowledge'. In addition, new codes emerged, such as 'Hesitation', 'Curiosity', and 'Thankfulness'.

Table 47

Interpretative Codes Example: Behaviour of the Students to the 'Word cloud' from the Protocols of Units 1, 2, and 3 in the Summer Semester of 2022

Behaviour of Students	Interpretation
Unit 1 "11:37. After a short introduction the first SoML intervention starts. A word cloud to repeat the contents of the first expert session. Note: Students are a bit hesitant but then they start adding a lot of words." "11:44. Lecturer asks about certain terms. Student answers correctly."	**Participation** **Interaction** **Revision** **Retention**
Unit 2 "11:40. Official exercise starts with a word cloud. Note: Students seem to like the tool. They answered with many words." "11:44. Lecturer discusses terms and goes into detail with some of them. Gives examples in another context."	**Have Fun** **Participation** **Interaction** **Revision** **Retention**
Unit 3 "11:35. Lecturer asks students how they liked the last online session. One mentions that it is easier to repeat the slides at home. Note: Students seem thankful and less overwhelmed." "11:37. They start with the word cloud." "11:44. They discuss the key terms. Student answers correctly." "11:47. The lecturer gives an example. He refers to the online session. Note: The lecturer uses practical examples. Students chat a bit."	**Participation** **Revision** **Retention** **Interaction**

Regarding the behaviour in the first three exercises, situations such as 'Lack of Revision', 'Lack of Knowledge' and 'Lack of Interaction' have been transformed into 'Revision', 'Retention', and 'Interaction'. An important point is the perception of the 'Participation' as well as the feedback 'Duration' of the students regarding the scheduled breaks (see Appendix X). Both play an important role in the overall learning experience and outcomes of the students. This is discussed in more detail in Study 4. Furthermore, all four criteria after Kirkpatrick (1998) especially the student learning and outcomes will be central there.

As a result of identifying significant cases of improvements in students' learning experience and outcomes due to the role of the lecturer and instructional methods applied, performance gaps were reduced. The improvements in the performance gaps related to the code concept 'learning experience' were caused by:

- Timely Response

- Monitoring
- Revision
- Retention
- Interaction
- Limited Overtime
- Slower Speed

Nevertheless, the following still occurred:

- Lack of Response
- Lack of Time
- Content Overload
- Lack of Breaks
- Too High Speed

Further, improvements in the performance gaps were uncovered and validated in connection to the code concept ‘learning outcomes’ caused by:

- Breaks
- Timely Response
- Monitoring
- Revision
- Limited Overtime

But still, the following occurred:

- Content Overload
- Too Short Breaks
- Lack of Time
- Too High Speed

An improvement of the interventions has taken place in the form that one of the three breaks was extended to 10 minutes to allow the students to refocus (Shail, 2019; Bersin, 2017; Meacham, 2016). The students were also studying more at home, which again emphasises the role of the lecturer (Atef & Medath, 2015). The focus thereby was on the topics of exam relevance and in-a-nutshell summaries. The students were further encouraged by the teacher to actively participate in the word cloud. In addition to these two tools, the course coordinator had pre-recorded and provided video tutorials for each statistics unit, as well as R-scripts that could be used to follow the steps. The R-scripts could then be used in the exercise and only needed to be minimally modified to solve the exercise questions in the quiz. Overall, all learning content per unit was specifically aligned with the lecture content, including the quiz. The lecture content, in turn, was aligned with the learning objectives in this module and was thus intended to be ideal preparation for the exam (Biggs & Tang, 2011).

Chapter 8: Comparative Evaluation

8.1 Introduction

The introduction of blended learning (BL) in higher education has gained popularity in recent years. Over the years, BL has proven to be an effective approach to accommodate an increasingly diverse student population while adding value to the learning environment by incorporating online learning tools (Alammary, Sheard, & Carbone, 2014). It has been seen as a promising improvement in teaching and learning in higher education (Emre, Masur, & Ranner, 2020). Key assumptions of BL in this regard include the thoughtful integration of face-to-face and online learning, a fundamental rethinking of course design to optimise student engagement, and the restructuring and replacement of traditional face-to-face teaching (Wannemacher, Jungermann, Scholz, Tercanli, & Villiez, 2016; Garrison & Vaughan, 2008). However, before it was as widely exploited as it should have been, BL was suddenly introduced in higher education in March 2020 due to the COVID-19 crisis. In this context, students reported several problems during and after the pandemic that were directly related to BL, especially the online component. For example, they reported significant concentration problems. They also complained about the lack of f2f contact and interaction with lecturers and fellow students, which reduced learning success compared to traditional f2f classes (Kofoed, Gebhart, Gilmore, Moschitto, 2021). To explore these problems with BL as implemented during the pandemic, the previous study, which in turn built on the two preliminary studies, developed interventions based on participant observation that was used in a one-semester nationwide course “Empirical Research and Statistics” at Macromedia University of Applied Sciences.

The present quantitative study aimed to measure, compare and thus test the hypotheses and research questions of the entire underlying dissertation regarding the learning experience and learning success of the students through the introduction of the interventions. In the previous Study 3, the students’ responses and behaviours were observed concerning the interventions, while this tests the student’s learning experience and outcomes in relation to the implemented interventions. This study thus tested the significance of the interventions devised. The first aim of this quantitative study was to test the hypotheses. The results of the participant observation were tested by comparative analysis of the two student surveys at the end of the respective semesters, the winter semester of 2021/ 22 and the summer semester of 2022, within the research period. The second and overall main objective was to answer the main research question and sub-questions of this thesis (see Section 1.5). To achieve this goal, causal relationships were measured between the respective semester with and without interventions

and the students' assessment of their learning experience and outcomes. The influence of one independent variable (IV) and several dependent variables (DV) was measured according to Brosius, Haas, and Koschel (2016). The chosen survey design specified exactly which IV had to be measured to test the hypotheses. As stated in Study 2, the IV in this work was the semester and the DVs were 'learning experiences' (joy, motivation, focus, effort, participation, and interaction) and 'learning outcomes' (learning success, competencies, future skills, and impact on grades). In addition, a trade-off between the two DVs was tested using correlation analysis between the variables. To be able to attribute the measured changes in the DVs to the influence of the IV (and not to other influencing factors), the two student groups completed the survey independently of each other and at different times during the longitudinal study.

8.2 Data Collection

Based on the given participant observation data in the winter semester of 2021/ 22 (see Chapter 5), variables were determined from codes, i.e., themes developed deductively from the literature or constructed inductively from a close reading of the data using an exploratory sequential design (see Chapter 6). The development of the measurement instrument made it possible to survey the specifically selected target group to find out their opinion on the status quo of teaching and learning in BL classes in in the winter semester of 2021/ 22 as well as their opinion on the interventions implemented in the summer semester of 2022. The participants in in the winter semester of 2021/ 22 comprised 191 students from seven locations in Germany. All students were asked to participate in the first student survey consisting of 93 questions. 64 students participated whereby 34 completed the entire questionnaire. In the summer semester of 2022, 660 students from seven locations in Germany took part. All students were asked to participate in the second survey consisting of 112 questions. 109 took part whereby 52 completed the entire questionnaire. A total of 173 students participated across the two surveys and 86 answered all the questions. This enabled a comparison of the quantitative data, allowing conclusions to be drawn about the value of the interventions.

8.3 Analysis

This study aimed to compare the responses from the two student surveys conducted at the end of the winter semester of 2021/ 22 and the summer semester of 2022. Specifically, the study aimed to test the overarching research question and sub-questions and the supporting hypotheses. The aim was to prove that there would be significant differences in the means of the DVs. The influence of the IV, the respective semester, and the DVs 'learning experiences' of the students, including enjoyment, motivation, focus, effort, participation, and interaction,

and their ‘learning outcomes’, i.e., learning success, competencies, future skills, and impact on grades, were measured. In addition, a trade-off between the two DVs was tested. To be able to attribute the measured changes in the DVs to the influence of the IV and not to other influencing factors, two groups completed the survey independently and at different times during the longitudinal study.

The data was subjected to initial processing where the data was cleaned, and outliers were removed. Several descriptive analyses were conducted to gain a better understanding of the composition of the sample. Several T-tests were then conducted to identify possible relationships between the variables. However, the T-test is limited in its ability to account for interactions between DVs. Therefore, a multivariate analysis of variance (MANOVA) was conducted with the DVs identified as significant by the T-tests. The MANOVA allowed for a more comprehensive analysis of the relationships between the variables as it can account for interactions between the DVs. As a result, more weight was given to the MANOVA results in the final evaluation of the hypotheses. In addition, a correlation analysis was conducted to determine the presence of trade-offs between the variables.

In summary, the combination of data processing, descriptive analysis, T-tests, MANOVA and correlation analysis allowed for a thorough investigation of the potential relationships between the variables and an evaluation of the hypotheses.

8.4 Results

8.4.1 Descriptive Statistics

To analyse the results, a descriptive evaluation was first carried out. This involved describing the sample according to age, gender, and geographical characteristics such as semester, campus, and previous studies.

Table 48

Number of Students and Their Ages

		Frequency	Percentage	Valid Percentages	Cumulated Percentages
Valid	18	3	1.7	1.8	1.8
	19	36	20.7	21.6	23.4
	20	68	39.1	40.7	64.1
	21	27	15.5	16.2	80.2

	22	10	5.7	6.0	86.2
	23	11	6.3	6.6	92.8
	24	4	2.3	2.4	95.2
	25	6	3.4	3.6	98.8
	27	2	1.1	1.2	100.0
	Total	167	96.0	100.0	
Absent	**System**	**7**	**4.0**		
Total		**174**	**100.0**		

Table 50 describes the number of participants 174 in total and their ages. Seven students did not enter their age. The other 167 range from 18 to 27, while 68 students (39.1%) are 20 years old. 75.3% of the students are between 19 and 21 years old.

Table 49

Number of Students and Their Genders

		Frequency	**Percentage**	**Valid Percentages**	**Cumulated Percentages**
Valid		7	4.0	4.0	4.0
	Diverse	1	.6	.6	4.6
	Male	41	23.6	23.6	28.2
	Female	125	71.8	71.8	100,0
	Total	174	100.0	100.0	
Absent	**System**	**7**	**4.0**		
Total		**174**	**100.0**		

The table above describes the gender of the students. One student identified as diverse. 41 students were male (23.6%) and 125 students were female (71.8%).

Table 50

Number of Students and Their Campus of Study

		Frequency	**Percentage**	**Valid Percentages**	**Cumulated Percentages**
Valid		6	3.4	3.4	3.4
	Berlin	15	8.6	8.6	12.1

	Frankfurt	9	5.2	5.2	17.2
	Freiburg	4	2.3	2.3	19.5
	Hamburg	33	19.0	19.0	38.5
	Cologne	27	15.5	15.5	54.0
	Leipzig	16	9.2	9.2	63.2
	Munich	42	24.1	24.1	87.4
	Stuttgart	22	12.6	12.6	100.0
	Total	174	100.0	100.0	
Absent	**System**	**7**	**4.0**		
Total		**174**	**100.0**		

Table 52 describes the campus the students studied at. 42 students studied in Munich. Students from every campus took part in the survey. The lowest participation was from Freiburg (2.3%) and the highest was from Munich (24.1%).

Table 51

Number of Students and the Respective Semesters

		Frequency	**Percentage**	**Valid Percentages**	**Cumulated Percentages**
Valid	2	148	85.1	87.6	87.6
	3	11	6.3	6.5	94.1
	4	5	2.9	3.0	97.0
	5	1	.6	.6	97.6
	6	2	1.1	1.2	98.8
	7	2	1.1	1.2	100.0
	Total	169	97.1	100.0	
Absent	**System**	**5**	**2.9**		
Total		**174**	**100.0**		

The fourth table describes the semester the students were in. 148 (85.1%) are in the second semester of their bachelor's degree. Five students did not enter their semester. This makes a total of 169.

Table 52

Number of Students and the Previous Studies

	Frequency	Percentage	Valid Percentages	Cumulated Percentages
	4	2.3	2.3	2.3
Yes	40	23.0	23.0	25.3
No	130	74.7	74.7	100.0
Total	**174**	**100.0**	**100.0**	

Table 54 illustrates if students had studied before their current degree. 40 students had done so, which makes 23% and 130 (74.7%) had not completed training before.

Table 53

Overview of the Participation in the 'Online Lecture' in the Winter Semester of 2021/ 22 and the Summer Semester of 2022

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
WS*	123	107	75	68	49	55	48	53	42	41	48	31	-
SS**	365	364	264	241	187	199	175	157	165	139	133	148	156

Note. *The Winter Semester of 2021/ 22 has 191 enrolled students. **The Summer Semester of 2022 has 660 enrolled students.

Table 55 shows the number of participants in the scenario 'online lecture' for each semester. At the beginning of the winter semester of 2021/ 22, 123 of 191 (64.4%) students participated. After half of the semester, it was 55 (28.8%) students. In the last session, 31 students participated (16.2%). The greatest difference is 92 (-74.8%) in session 12. In the summer semester of 2022, initially, 365 (55.3%) of the students participated. Halfway through the semester, 187 (the mean value of 199 and 175) students participated, which is 28,3%. In the last session, 156 (23,6%) students participated. The greatest difference is 232 in session 11, which is a reduction of 232 (-63,6%).

Table 54

Overview of the Participation in the 'On-site Exercise' in the Winter Semester of 2021/ 22 and the Summer Semester of 2022

Unit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**

WS*	18	17	12	9	-	11	9	3	6	4	6	7	-
SS**	21	16	-	-	15	17	-	18	14	12	13	16	-

Note. * The Winter Semester of 2021/ 22 has 23 active participants. ** The Summer Semester of 2022 has 22 active participants.

Regarding the scenario 'on-site exercise', Table 56 shows that in the winter semester of 2021/ 22 18 of 23 (87.3%) of students participated in the first exercise. Halfway through the semester, 9 students participated (391%). In the last session, 7 (30.4%) took part. The greatest reduction was in session 8 with 3 (-87%). In the summer semester of 2022, 21 of 22 (95.5%) students participated in the first session. Halfway through the semester, 18 (82%) participated. In the end, 16 (72%) took part. The greatest difference is in session 10 with 12 (-54,5%).

Table 55

Overview of the Development of the Grade Point Average from the Summer Semester of 2019 Until the Summer Semester of 2022

Term	Average*	Average**
SS 22	2.5333	3.3614
WS 21/ 22	3.6000	3.8656
SS 21	2.7931	3.1958
WS 20/ 21	2.8076	3.1884
SS 20	2.6050	2.8824
WS 19/ 20	2.6961	3.1569
SS 19	2.5555	2.8638

Note. The German grades system ranges from 1.0 (best grade) to 5.0 (not participated/ not passed). * Only of students that passed the exam. ** Of all students.

The last table of the descriptive statistics shows the differences in grades since the implementation of the course 'Empirical Research and Statistics' in the summer semester of 2019. In the summer semester of 2022, the students had an average of 2.5333 of all students participated and passed the exam, making it the lowest average since its implementation. The overall average of all students is 3.3614.

8.4.2 Inferential Statistics

To begin the inferential statistics, the IV and DVs were presented.

Table 56

Independent and Dependent Variables

Independent Variable	Dependent Variables
Semester	**Learning Experience** Joy Motivation Focus Effort Participation Interaction
	Learning Outcomes Learning Success Competencies Future Skills Impact on Grades

An independent samples t-test was conducted and used as ‘pre-screening’ to identify the most important variables. As Table 59 illustrates, the following DVs were significant: joy, focus, and interaction (with the professor in the online lecture) regarding the learning experience and learning success and competencies regarding the learning outcomes.

Table 57

Results of the Independent Samples Tests (Levene Tests and T-Tests)

		Levene's Test of Variance Equality		T-Tests for Equality of Means							
		F	Sig	T	df	Significance		Mean Difference	Differences for Standard Error	95% confidence interval of the difference	
						Unilateral p	Bilateral p			Lower Value	Higher Value
Learning Success*	Variances are equal	.256	.614	-3.348	133	<.001	.001	-.50295	.15021	-.80007	-.20583
	Variances are not equal			-3.336	104.496	<.001	.001	-.50295	.15074	-.80186	-.20404
Competencies *	Variances are equal	4.142	.044	-3.071	131	.001	.003	-.46807	.15243	-.76961	-.16653
	Variances are not equal			-3.240	120.335	<.001	.001	-.46807	.14449	-.75414	-.18200
Future Skills*	Variances are equal	1.089	.299	-1.522	128	.065	.130	-.22205	.14588	-.51069	.06659
	Variances are not equal			-1.565	107.018	.060	.121	-.22205	.14190	-.50336	.05926
Interaction**	Variances are equal	.000	.996	-3.445	127	<.001	<.001	-.55721	.16174	-.87726	-.23716
	Variances are not equal			-3.362	91.462	<.001	.001	-.55721	.16573	-.88639	-.22803
Effort*	Variances are equal	.103	.749	-1.975	142	.025	.050	-.33424	.16925	-.66882	.00034
	Variances are not equal			-1.994	123.790	.024	.048	-.33424	.16761	-.66600	-.00248
Motivation*	Variances are equal	.012	.913	1.266	144	.104	.208	.13019	.10285	-.07311	.33635
	Variances are not equal			1.250	119.292	.107	.214	.13019	.10412	-.07597	-.11261
Joy*	Variances are equal	.018	.893	-2.760	145	.003	.007	-.39052	.14150	-.67020	-.11084
	Variances are not equal			-2.780	130.192	.003	.006	-.39052	.14047	-.66842	-.11084
Focus*	Variances are equal	.009	.925	-2.960	127	.002	.004	-.47469	.16039	-.79208	-.15730
	Variances are not equal			-2.969	99.752	.002	.004	-.47469	.15991	-.79196	-.15743

* In the overall course. ** With the professor in the online lecture.

In the following, the significant DVs are presented. Based on them, the MANOVA is conducted.

Table 58

Significant Dependent Variables from T-Tests

Independent Variable	Dependent Variables
Semester	**Learning Experience** Joy Focus Interaction (with the professor in the online lecture)
	Learning Outcomes Learning Success Competencies

The independent samples t-tests were limited in their ability to account for interactions between the DVs. Therefore, a MANOVA was conducted in a further step.

8.4.3 MANOVA

Table 59

Results from the MANOVA Tests of Intermediate Subject Effects

Source	Dependent Variable	Type III Square Sum	df	Mean of Squares	F	Significance
Semester	Learning Success*	6.123	1	6.123	8.683	.004
	Competencies*	5.825	1	5.825	8.055	.005
	Joy*	2.463	1	2.463	3.301	.072
	Focus*	6.791	1	6.791	8.759	.004
	Interaction***	9.358	1	9.358	11.869	<.001

* In the overall course. ** With the professor in the online lecture.

The table with the between-subjects effects is the most interesting as it shows that the four DVs ‘focus’, ‘interaction (with the professor in the online lecture)’, ‘learning success’, and ‘competencies’ are intersubjectively significant and that the DV ‘joy’ is not significant.

Table 60

Significant Dependent Variables from the MANOVA

Independent Variable	Dependent Variables
Semester	**Learning Experience** Focus Interaction (with the professor in the online lecture)
	Learning Outcomes Learning Success Competencies

8.4.4 Trade-Off

Finally, the trade-off between learning experience and learning outcomes is tested by correlation effects. The correlation analysis was conducted as follows. All learning experience variables were summed, and all learning outcomes variables were summed. Then, whether both correlated was tested. As tables 4.13.1 and 4.13.2 show, there was a significant positive correlation between the two variables. The conclusion is therefore that there is no trade-off.

Table 61

Correlations Effects Between the Learning Experience and Outcomes After Pearson

		Learning Outcomes	**Learning Experience**
Learning Outcomes	Pearson-Correlation	1	.722**
	Significance (2-sided)		.000
	N	135	135
Learning Experience	Pearson-Correlation	.722**	1
	Significance (2-sided)	.000	
	N	135	148

** The correlation is significant at the 0.01 level (2-sided).

Table 62

Correlation Effects Between the Learning Experience and Outcomes After Spearman

			Learning Outcomes	**Learning Experience**
Spearman-Rho	**Learning Outcomes**	Pearson-Correlation	1.000	.706**
		Significance (2-sided)		<.001
		N	135	135
	Learning Experience	Pearson-Correlation	.706**	1.000
		Significance (2-sided)	<.001	
		N	135	148

** The correlation is significant at the 0.01 level (2-sided).

By conducting the MANOVA, it was possible to elaborate on whether the hypotheses could be confirmed or not. In the following, each hypothesis is tested. The hypotheses target the relationship between the IV, the respective semester, the DVs, the learning experience, and the students' outcomes.

Table 63

Verified and Non-Verified Hypotheses

H1: The learning outcome of blended learning lessons in higher education is higher with social micro-learning interventions than without.	The first hypothesis was verified, as the learning outcome was significantly higher in the summer semester of 2022, where the SoML interventions were implemented compared to the winter semester of 2021/ 22 without the implementation.
H1.1: Lessons with social micro-learning interventions show higher student learning success compared to lessons without.	The first sub-hypothesis was verified, as the learning success was significantly higher in the semester where the SoML interventions were applied.
H1.2: Teaching with social micro-learning interventions shows an increase in students' acquisition of competencies compared to teaching without interventions.	The second sub-hypothesis was verified. Again, the acquisition of competencies was significantly higher in the summer semester compared to the winter semester.
H2: The learning experience of blended learning lessons in higher education is higher with social micro-learning interventions than without.	The second hypothesis could only partly be verified. While the focus and interaction where significantly higher in the semester where SoML interventions were implemented, the significance of improving student's joy and participation were not significantly higher in the MANOVA, only in the T-Test.
H2.1: Lessons with social micro-learning interventions show an improvement in students' joy compared to lessons without interventions.	The first sub-hypothesis of the second hypothesis could not be verified, as it was not significant within the MANOVA, only in the T-test.
H2.2: Teaching with social micro-learning interventions shows an improvement in students' focus compared to teaching without interventions.	The second sub-hypothesis of the second hypothesis could be verified, as the focus was significantly higher within the summer semester compared to the winter semester.
H2.3: Lessons with social micro-learning interventions show an increase in student interaction compared to lessons without.	The third sub-hypothesis of the second hypothesis could be verified, as the interaction was significantly higher within the summer semester compared to the winter semester.
H3: When the learning experience increases, then the learning outcome increases.	Due to the analysis of correlation effects, it was possible to evaluate that the learning experience and outcomes correlated and that there was no trade-off. Therefore, the hypothesis could be verified.

Chapter 9: Findings, Discussion, Limitations, Implications, Recommendations, and Conclusions

9.1 Findings and Discussion

The dissertation's theoretical underpinning, as indicated in the comprehensive literature review, explores the integration of information and communication technology (ICT) in education, the evolution of blended learning (BL) in higher education, and the specific niche of Social Micro-Learning (SoML). This review also examines relevant learning theories, particularly constructivism and social learning, and their applicability in teaching and learning in higher education. The literature underscores the benefits of integrating technology into teaching and learning processes, highlighting advantages such as flexibility, enhanced learning experiences, and positive impacts on learning outcomes and institutional management (Saunders 2002; 2004; Virkus, 2008; Le Rossignol, 2009; Kolo & Breiter, 2009; Gogela & Ntwasa, 2015; Lee & James 2018; Bladergroen & Chigona, 2019).

Conversely, challenges such as maintaining concentration and personal contact during BL courses have been identified, with findings suggesting that first-semester students may struggle with focus during lengthy online classes, leading to diminished participation, interaction, and learning effectiveness. The research hypothesised that early semester students might lack necessary skills to maintain focus in online classes, resulting in reduced learning outcomes and limited interaction with peers and lecturers.

9.1.1 Exploring Current Practice

In Chapter 5 of this study, a multifaceted approach was employed to investigate the dynamics of BL in higher education. The initial phase of the study involved participant observation, capturing events and interactions in the natural context of students and lecturers. This observation led to the identification of several factors influencing the student learning experience in BL. Notably, it was found that an excessive workload and a lack of adaptation in teaching style based on student feedback negatively impacted the learning experience. These preliminary findings underscore the importance of considering workload reduction and the adjustment of teaching approaches to improve BL pedagogy. Additionally, a potential relationship was observed between limited interaction between lecturers and students, despite the incorporation of interactive tools, leading to a decrease in the learning experience. This finding highlights the need for strategies that can boost interaction rates and enhance student learning experiences.

The study involved 191 university students observed nationwide online, with a focused participant observation of 25 students at the Munich campus from October 2021 to January 2022. The observations were conducted both during online sessions and on-site exercises over one semester. This approach enabled the researcher to develop hypotheses based on the analysis of participant protocols. Two main hypotheses and four sub-hypotheses were formulated, focusing on how workload, lecturers' teaching style, interaction rate, and the use of available interactive tools in online teaching might influence the student learning experience in BL higher education.

To answer the main research question: "How valuable is it for higher education to support blended learning with social micro-learning interventions?" hypotheses are formulated. Based on the qualitative analysis of participant observation, the final hypothesis H1 and two sub-hypotheses H1.1 and H1.2 related to the research sub-question "How can the implementation of social micro-learning interventions enhance the learning outcomes of students?" were developed:

H1: The learning outcome of blended learning lessons in higher education is higher with social micro-learning interventions than without.

> *H1.1: Lessons with social micro-learning interventions show higher student learning success compared to lessons without.*
>
> *H1.2: Teaching with social micro-learning interventions shows an increase in students' acquisition of competencies compared to teaching without interventions.*

The hypotheses target the observed correlation of the category 'didactics' with the dimension 'learning outcomes' and the indicators 'competencies', and 'learning success'. No hypothesis was developed for 'future skills', as it is an abstract topic that cannot be observed immediately. Instead, it will show in the future and must be forwarded to further research. Furthermore, the final hypothesis H2 and four sub-hypotheses H2.1, H2.2, and H2.3 related to the main research sub-question "How can the implementation of social micro-learning interventions enhance the learning experience of students" were developed:

H2: The learning experience of blended learning lessons in higher education is higher with social micro-learning interventions than without.

> *H2.1: Lessons with social micro-learning interventions show an improvement in students' joy compared to lessons without interventions.*
>
> *H2.2: Teaching with social micro-learning interventions shows an improvement in students' focus compared to teaching without interventions.*

H2.3: Online lessons with social micro-learning interventions show an increase in student interaction with their professor compared to lessons without.

They target the possible correlation between the sub-categories ‘workload’, ‘pace’ and ‘breaks taken’ from the type of instruction in the category ‘didactics’ and the dimension ‘learning experience’ with the indicators ‘joy’, ‘effort’, ‘focus’, ‘interaction’, and ‘participation’. Thereby, the observed correlation between the category ‘didactics’ and the lecturer’s teaching style in the category ‘student behaviour’ was covered. It must be noted that interaction targets only the interaction in the online lecture with the professor, as this was observed as being a crucial factor. No hypothesis was developed for the category ‘motivation’. It was not possible to observe the students’ motivation in direct relation to the category ‘didactics’. Nor was a separate hypothesis developed for the category ‘participation’. The researcher was able to observe the number and period of participants but was not able to operationalise it as a hypothesis. However, the observation of student participation, as well as the development of grades from the implementation of the course until the summer semester of 2022, will be included in the descriptive statistics of Chapter 8 as well as the discussion section. Lastly, no hypothesis was derived from the participant observation regarding students’ ‘effort’, as it was not obvious that the effort increased during the summer semester of 2022.

Lastly, a hypothesis was formulated regarding the third main research sub-question “How likely is a trade-off?”:

H3: When the learning experience increases, then the learning outcomes increase.

The study’s preliminary results suggest that the learning experience diminishes when the workload is excessively high throughout the course and the lecturer does not adapt their teaching style to the students’ suggestions. Furthermore, it was discovered that the decrease in students' learning experience could be influenced by the lack of interaction of the lecturer with students during the online course, despite the presence of didactically implemented interaction tools. An increase in the interaction rate was hypothesised to potentially improve the student's learning experience. Additionally, a possible correlation was found between the amount of reflective space provided by the teaching form used, the increased support of learning groups by the lecturer, and the interaction rate of students with each other, which could also enhance the learning experience.

Overall, these findings provide a solid basis for further research and innovation in teaching practices in BL higher education. They suggest that reducing the workload, adapting teaching styles based on student feedback, increasing lecturer-student interaction, and facilitating

reflective opportunities and learning group support could significantly improve the student learning experience in a BL environment.

9.1.2 Instrument Development

Chapter 6 details the intricate process of creating an effective measurement tool to evaluate the impact of SoML interventions in a BL environment. This chapter is critical in outlining the methodological rigor and innovative approach employed in the study, distinct from the observational focus of Chapter 5.

The research employed a mixed-methods approach, specifically an exploratory sequential design, to understand the challenges associated with the introduction of BL from the student's perspective. This choice of design was crucial in capturing the multi-layered nature of the BL experience from the students' perspective. It also allowed the study to explore both the subjective and objective aspects of the learning environment in depth to develop a comprehensive understanding of the students' learning experiences and outcomes. To develop a population-based questionnaire for this purpose, the exploratory sequential approach was used to designing a study that combines both qualitative and quantitative data collection and analysis in a sequence of phases.

In considering the study design, the researcher conducted a qualitative and a quantitative part. The qualitative phase laid the groundwork for the instrument development. Here, a conceptual framework was established using both deductive and inductive coding. Deductive codes were derived from an extensive literature review, focusing on broader concepts such as 'learning experience' and 'learning outcomes', encompassing sub-codes like 'interaction', 'flexibility', 'learning success', 'competencies', and 'future skills'. In contrast, inductive codes were derived from detailed participant observations, capturing more specific, context-driven elements such as 'participation', 'communication', 'teaching style', 'course content', 'media usage', 'focus', and 'pacing'. Transitioning to the quantitative phase, these codes were then operationalised into variables for the development of a Likert Scale questionnaire. This questionnaire aimed to measure aspects related to 'learning experience' (including 'joy', 'motivation', 'effort', 'participation', 'interaction', and 'focus') and 'learning outcomes' ('learning success', 'competencies', and 'future skills'). The questionnaire's items were crafted based on the constructs of existing literature in the field of innovation in higher education, ensuring both relevance and theoretical grounding.

Crucially, the study involved a broad participant pool, encompassing 191 students in the winter semester of 2021/22 and 660 students in the summer semester of 2022, spanning seven locations

in Germany. This wide reach allowed for a comprehensive assessment and comparison of teaching and learning in BL lessons across different contexts and time frames. The addition of supplementary items in the post-intervention phase of the summer semester of 2022 was a strategic move. These items were designed to specifically evaluate the impact of the instructional design interventions implemented during this period. The development process of these interventions, described as ‘word cloud’, ‘student quiz’, and ‘in-a-nutshell slides’, followed a similar approach to the earlier items, ensuring coherence and consistency in the instrument.

The overarching goal of the instrument development was to create a quantitative measure that is content-relevant, culturally sensitive, and capable of inductively generating variables from a specific population. This approach was essential for the study’s aim to identify key variables for subsequent quantitative analysis, making the research findings generalisable beyond the immediate study population. The exploratory sequential design proved to be an effective approach for this study, bridging the qualitative and quantitative aspects of the research. It allowed for the refinement of research questions and methods based on collected data, demonstrating flexibility and responsiveness to the emerging insights. This design was especially suitable for developing tools based on a small number of participants that could be generalised to a larger population.

In summary, Chapter 6 presents a comprehensive and methodologically sound development of assessment instruments, integral to measuring the effectiveness of SoML interventions in the BL context. The systematic development of these instruments, capturing both qualitative and quantitative data, offered a holistic view of the students’ learning experiences and outcomes. This approach provided a detailed analysis of the impact of the implemented interventions, contributing significantly to the understanding of how SoML can enhance learning in a BL environment.

9.1.3 Instructional Design

Chapter 7 of this study presents an insightful and comprehensive exploration into developing effective instructional interventions within the context of BL in higher education. This chapter, distinct from the instrument development and participant observation discussed in the previous sections, focuses on the systematic approach to creating instructional interventions grounded in constructivist learning theories and the ADDIE model.

The study’s approach to instructional design (ID) was deeply rooted in constructivist learning theories, with the intent to extend and enrich existing ID practices in BL. The employment of

the ADDIE model, an acronym for Analysis, Design, Development, Implementation, and Evaluation, provided a structured and iterative framework for designing and refining these interventions. This systematic approach was crucial to ensure that the interventions were not only effective but also adaptable to the dynamic needs of learners and educators in a BL environment. The interventions were conceived based on qualitative data analysis derived from participant observations during the winter semester of 2021/22. Employing a variant of grounded theory methodology, the study identified significant cases of abnormalities in students' learning experiences and outcomes. This approach was instrumental in grounding the interventions in the real-life experiences and challenges of students, ensuring their relevance and impact.

The study identified several performance gaps in the 'learning experience' and 'learning outcomes' of students, which became the focus for intervention development. These gaps included delayed or lack of response, lack of time, supervision, content overload, lack of breaks, excessive overtime, and a fast pace. In addressing these gaps, the study proposed targeted interventions, such as increasing asynchronous learning opportunities, creating 'In-a-Nutshell' slides, developing a nationwide student quiz, and implementing short tutorials to enhance understanding. The ADDIE model was a vital tool in this process, ensuring a comprehensive development and evaluation of the interventions. The performance gaps were meticulously calculated, assigning percentage values to each gap based on factors like lack of knowledge, skill, or resources. This quantitative assessment was fundamental in highlighting the most impactful areas for intervention, guiding strategic decisions in the instructional design process.

Additionally, the study incorporated current literature on ML, social learning, and SoML to further refine the interventions. These approaches offered a profound basis for improving macro-units in higher education, with SoML being chosen as an innovative teaching method that combined improvements from both ML and social learning. The use of micro-content to share, discuss, and develop knowledge in Communities of Practice (CoPs), the primacy and recency effects, and the incorporation of gamification and situated learning were all leveraged to enhance the learning experience and outcomes. The interventions were strategically implemented and iteratively evaluated, with protocols from the participant observation in the summer semester of 2022 analysed to identify improvements in students' learning experiences and outcomes. This evaluation highlighted the reductions in performance gaps and the effectiveness of the interventions in improving the learning experience and outcomes.

Despite these successes, the study acknowledged limitations concerning the overall approach, research bias, generalisability, and evaluation scope, which will be addressed in detail in 9.2. The ADDIE model had to be adapted to build upon an existing curriculum, and the interventions were broadened to encompass ML and social learning. To mitigate research bias, a Subject Matter Expert (SME) was involved in the design process, and further research was suggested to confirm the universal applicability of the interventions.

In conclusion, Chapter 7 of the study exemplifies a thorough and methodical approach to instructional design in the BL context. By identifying and addressing specific performance gaps related to students' learning experience and outcomes, and by utilising the ADDIE model in conjunction with constructivist learning theories, ML, social learning, and SoML, the study demonstrates a comprehensive and effective strategy for enhancing BL in higher education. The results underscore the potential of carefully designed instructional interventions to improve student engagement, understanding, and academic success in a BL environment.

9.1.4 Comparative Evaluation

Chapter 8 presents a thorough and nuanced examination of the impact of SoML interventions on BL in higher education. This chapter, distinct from the earlier discussions on instructional design and instrument development, focuses on evaluating the effectiveness of SoML interventions in enhancing students' learning experiences and outcomes. The chapter addresses the central research question: "How valuable is it for higher education to support blended learning with social micro-learning interventions?".

The study employed a Multivariate Analysis of Variance (MANOVA) to analyse the data collected from student surveys conducted at the end of two semesters. This approach allowed for a detailed examination of the multifaceted impact of SoML interventions, dissecting their influence on learning outcomes and experiences. The participant pool included students from seven locations in Germany, with 191 students in the winter semester of 2021/22 and 660 in the summer semester of 2022.

A key finding of the study was the confirmation of the hypothesis that teaching with SoML interventions leads to increased student competency acquisition compared to teaching without interventions. This suggests that SoML interventions significantly contribute to enhancing students' competencies, aligning with the core goals of higher education. Furthermore, an improvement in students' overall grades was observed during the semester when SoML interventions were implemented, although this correlation could not be conclusively proven due to the anonymity of the survey. Regarding the learning experience, the study found that SoML

interventions could increase student interaction and focus, essential elements for an effective learning environment. However, the hypothesis that SoML interventions improve students' joy was not verified, leaving this question inconclusive. Similarly, no definitive conclusions could be drawn about the impact of SoML interventions on students' motivation, participation, and effort, highlighting the complexity of assessing the affective and engagement-related impacts of instructional interventions.

The study also examined whether there was a trade-off between enhancing students' learning experiences and outcomes. The hypothesis that an increase in learning experience correlates with an increase in learning outcomes was verified, indicating no trade-off, and affirming the positive relationship between these two aspects. This finding supports the innovation of higher education toward ML and collaborative learning approaches, such as SoML. Despite the significant findings, the study faced limitations concerning generalisability (see Section 9.2), given it was conducted at a single university, and the challenges of measuring subjective variables like motivation and effort. Moreover, while improvements in learning experiences and outcomes were observed, the exact causal relationships between the interventions and these improvements could not be fully established.

In conclusion, Chapter 8 demonstrates that SoML interventions positively influence certain aspects of the learning experience and outcomes in BL, such as student interaction, focus, and competency acquisition. However, the complexity of measuring affective aspects and the need for further research to fully understand and harness the potential of SoML interventions in enhancing BL in higher education are also highlighted. The findings of this chapter contribute to the ongoing discourse on innovative teaching and learning practices, providing valuable insights for educators and policymakers in higher education.

9.2 Limitations

The overall thesis in this comprehensive study on BL environments and SoML interventions, while offering substantial insights, are not exempt from a range of limitations. These limitations are essential to understand for a complete and nuanced interpretation of the study's outcomes and theoretical contributions.

A significant challenge throughout the study was the intertwining of research activities with the researcher's regular work duties. Conducting research within one's workplace can blur the lines between professional responsibilities and academic inquiry, potentially affecting the objectivity and neutrality of the research process. This dual role may lead to conflicts of interest or biases, consciously or unconsciously influencing the research direction, data interpretation, and even

the selection of literature. Maintaining a clear distinction between these roles is crucial for the integrity and credibility of research, but this is often easier said than done, especially in workplace-based research.

The study also faced practical challenges, including technical difficulties during online sessions and issues with mistranslations. In a research study that heavily relies on online interactions and potentially involves participants from diverse linguistic backgrounds, technical glitches can significantly disrupt data collection processes. Similarly, mistranslations can lead to misinterpretations or loss of critical nuances in communication, affecting the quality and accuracy of data collection and analysis. These factors are particularly pertinent in a study exploring BL, where digital communication is a key component. To mitigate some of these limitations, involving a Subject Matter Expert (SME) was a strategic and beneficial move. The SME's involvement in testing the survey and participating in the design process helped enhance the validity of the research findings. The SME's external perspective and expertise provided a check against potential biases and oversights, contributing to the study's overall rigor.

In the realm of educational research, particularly in the context of BL environments and the integration of SoML interventions, the comprehensive study presented in this thesis offers substantial insights. However, it is imperative to acknowledge a spectrum of limitations that permeate through various chapters of the study, as well as the overarching methodology and literature review, to fully comprehend the nuances and applicability of the research findings.

9.2.1 Exploring Current Practice

While providing insightful observations and interpretations in the context of BL and SoML interventions, this study encountered several limitations that merit comprehensive discussion for a nuanced understanding of the chapter's contributions and constraints.

A significant limitation in this chapter revolved around the process of participant selection, primarily through purposive sampling. This method, while advantageous for targeting a specific subset of the population relevant to the research, inherently carries the risk of bias. The researcher's preconceptions, whether stemming from professional experience, theoretical predispositions, or subjective viewpoints, might have inadvertently influenced the selection of participants. This bias, be it overt or subtle, could have significantly steered the study's trajectory, potentially skewing the outcomes and interpretations. The subjective nature of participant selection in qualitative research, particularly in studies involving purposive sampling, remains a persistent challenge, raising questions about the representativeness and generalisability of the findings.

Another critical limitation was the longitudinal scope of the study, which was confined to the span of a single semester. This temporal boundary placed significant constraints on the ability to observe, analyse, and measure the long-term effects and sustainability of the SoML interventions. Educational interventions, particularly those involving innovative teaching and learning methodologies, often manifest their impacts over extended periods. The changes in student behavior, the development of competencies, and the evolution of learning outcomes in response to SoML interventions are dynamic processes that unfold over time. The restricted timeframe of a single semester may not have been sufficient to capture these gradual shifts in student engagement, adaptation to the BL environment, and the deeper, more enduring educational impacts. Longitudinal studies, extending over multiple semesters or academic years, are vital to fully comprehend the sustained influence of such interventions.

This temporal limitation also impeded the possibility of observing the cyclical nature of educational interventions, where initial impacts might evolve, diminish, or even reverse over longer periods. Educational research that seeks to understand the lasting effects of interventions like SoML in BL contexts must contend with the challenges of capturing these longitudinal dynamics, which often require prolonged observation, repeated measurements, and sustained engagement with the subject matter.

9.2.2 Instrument Development

Chapter 6 of the study, which is pivotal in shaping the methodological framework for assessing the impact of SoML interventions in BL environments, faced several limitations that are integral to understanding the chapter's scope and the implications of its findings.

One of the most significant limitations in this chapter was the reliance on a relatively small sample size, particularly the focus on 25 on-campus students for the development of the research instrument. While this approach was practical and justified for the exploratory nature of the study, it inevitably raises concerns about the generalisability of the findings. The sample, being limited in size and potentially homogenous in terms of demographic and academic characteristics, might not adequately represent the broader student population involved in BL environments. This constraint is particularly relevant when considering the diverse nature of educational settings where SoML interventions could be applied. The transferability of the research outcomes to different contexts, student groups, or educational institutions may thus be limited, necessitating caution in extrapolating the findings to wider populations.

The study's scope in instrument development, while comprehensive within its defined parameters, also presented limitations. The instrument was designed based on data gathered

from a specific subset of students, which may not encompass the wide range of experiences, perceptions, and interactions typical of diverse BL environments. This specificity could influence the instrument's sensitivity and applicability in capturing the nuances of SoML interventions across varied educational contexts. Another limitation relates to the construct validity of the instrument. The development of the instrument was based on the qualitative findings and relevant literature, which, while rigorous, might not have captured all dimensions of the SoML experience. The constructs and variables chosen for inclusion in the instrument were derived from a specific theoretical and conceptual understanding of BL and SoML. This approach, though grounded in scholarly research, may overlook certain aspects or manifestations of SoML interventions that do not align neatly with the predefined constructs. Consequently, the instrument might not fully reflect the multifaceted and evolving nature of SoML practices in BL.

Moreover, the adaptability of the instrument in different BL settings poses another challenge. The instrument, tailored to the particularities of the student sample and the specific context of the study, may require significant modifications to be applicable in other educational scenarios. This adaptation process not only involves logistical considerations but also the re-validation of the instrument in each new context to ensure its reliability and relevance.

9.2.3 Instructional Design

While integral to the understanding of the development and implementation of SoML interventions in BL environments, Chapter 7 encounters a spectrum of limitations that significantly influence the interpretation and generalisation of its findings.

A primary limitation in this chapter stems from the researcher’s dual roles as both an observer and an analyst. This duality presents a unique set of challenges, particularly in maintaining objectivity throughout the research process. The involvement in dual capacities could lead to unintentional biases, as the researcher’s observations and interpretations are inevitably influenced by their personal experiences, beliefs, and theoretical orientations. This might have inadvertently shaped the data analysis and interpretation process, leading to subjective biases. The challenge lies in the difficulty of disentangling the researcher’s subjective insights from the objective analysis required for a scientific study.

Another significant limitation concerns the specific nature of the interventions developed and implemented. These interventions were tailored to meet the needs and characteristics of the study’s population, making them highly context specific. While this bespoke approach is advantageous in addressing the immediate needs of the target population, it potentially limits

the broader applicability and generalisation of the findings. Educational interventions, to be widely applicable, must be adaptable to diverse educational settings and student demographics. The unique design and implementation of the interventions in this study may not seamlessly translate to other contexts or populations, thus restricting the extrapolation of the study's conclusions to different BL environments.

The study also faced limitations concerning the directionality of its hypotheses. The hypotheses formulated lacked clear directionality, which is crucial in establishing causal relationships. This absence hindered the ability to definitively assess the cause-and-effect dynamics between the SoML interventions and the observed educational outcomes. Understanding the causality is essential in educational research to determine whether specific interventions directly lead to observed changes in learning outcomes or experiences. Without this directionality, the study's ability to make strong causal inferences is significantly diminished. Closely related to the lack of hypothesis directionality is the challenge in assessing the causal relationships between interventions and outcomes. The ability to claim that specific changes in educational outcomes were directly attributable to the SoML interventions is limited by the study's methodological constraints. The interplay of various external and internal factors in educational settings further complicates the establishment of clear causal links.

These limitations are critical in understanding the scope and applicability of the study's findings. The biases potentially introduced by the researcher's dual roles, the limited generalisability of context-specific interventions, and the challenges in establishing causality all play a pivotal role in shaping the conclusions drawn from the study. Future research in this area may benefit from addressing these limitations by involving multiple researchers to mitigate individual biases, designing interventions with broader applicability, and employing methodologies that more clearly define and test causal relationships.

9.2.4 Comparative Evaluation

Chapter 8, which plays a crucial role in assessing the effectiveness of SoML interventions in BL environments, encounters several limitations that are vital for a comprehensive understanding of the study's outcomes and their implications.

A significant limitation in this chapter was the absence of explicit testing for biases related to gender and class size. Both these factors are known to exert a considerable influence on learning experiences and outcomes. Gender differences can affect students' engagement, interaction patterns, and responses to various teaching methodologies in BL environments. Similarly, class size has the potential to impact the effectiveness of SoML interventions, with varying class

dynamics potentially influencing student participation, interaction, and overall learning outcomes. The study's methodology did not methodically scrutinise these aspects, which could have provided deeper insights into how these demographic and logistical factors interact with SoML interventions. The omission of this analysis presents a gap in fully understanding the nuanced ways in which different student groups experience and benefit from SoML interventions.

Another notable limitation was the reliance on self-assessment data for evaluating the impact of the interventions. While self-assessment is a valuable tool for capturing students' perceptions and experiences, it is inherently subjective and often prone to biases. Respondents may have conscious or unconscious biases that influence how they perceive and report their experiences and learning outcomes. This subjectivity can complicate the interpretation of findings, as it may not accurately reflect the actual impact of the interventions. The potential for social desirability bias, where respondents might answer in ways they believe are expected or favourable, further adds to the complexity of relying on self-assessment data.

The use of self-assessment data in educational research requires careful interpretation. While it provides insights into students' self-perceived learning experiences and outcomes, correlating these perceptions with objective measures of learning can be challenging. The subjective nature of self-assessment means that students' responses may not always align with tangible improvements in skills or knowledge acquisition. This discrepancy can lead to difficulties in drawing definitive conclusions about the effectiveness of the interventions based on self-reported data alone.

These limitations in Chapter 8 highlight the need for a multifaceted approach to evaluating educational interventions. Incorporating a more diverse range of data collection methods, including objective measures of learning outcomes and consideration of demographic factors such as gender and class size, would enhance the robustness of the study's findings. Additionally, triangulating self-assessment data with other sources of information could provide a more comprehensive understanding of the impact of SoML interventions.

9.3 Implications

This thesis emphasises the necessity of adopting a student-centred approach in designing BL courses. This involves managing the workload effectively and tailoring teaching methods to meet students' needs and preferences, aligning with the theoretical discourse on student-centred learning. Such an approach has implications for instructional design and curriculum development in higher education. Moreover, the dissertation underlines the importance of

fostering meaningful interaction and engagement between lecturers and students in online courses. The research suggests that simply incorporating interactive tools may not be sufficient. Instead, deliberate efforts are required to enhance interaction, which can inform the design and implementation of online learning platforms, discussion forums, and collaborative activities. This creates a more interactive and engaging learning environment.

9.3.1 Theoretical Implications

The study makes significant theoretical contributions, particularly in the realm of BL in higher education, offering a nuanced understanding of instructional design and student engagement. It highlights the necessity of a student-centred approach in the design and implementation of BL courses. This approach, which emphasises effective workload management and adaptation of teaching methods to suit student preferences and needs, aligns with the broader theoretical discourse on student-centred learning. The findings have profound implications for instructional design and curriculum development, advocating for pedagogies that prioritise student engagement and adaptability.

Furthermore, the study underlines the critical role of meaningful interaction between lecturers and students, especially in online components of BL courses. It posits that the mere incorporation of interactive tools is not sufficient; rather, deliberate, and strategic efforts are essential to foster genuine interaction. This insight is pivotal for the design and implementation of online learning platforms, discussion forums, and collaborative activities, guiding educators towards creating more interactive and engaging learning environments. Another key theoretical implication from the study is the importance of integrating reflective practices within BL. The identified correlation between reflective opportunities, support for learning groups, and enhanced student interaction underscores the necessity for strategies that promote self-reflection, peer-to-peer interactions, and group discussions. These strategies are instrumental in facilitating deeper understanding and knowledge construction, shaping instructional practices, and curriculum design.

In terms of pedagogical innovation and improvement, the dissertation offers insights into areas for enhancing the overall student learning experience and outcomes. Addressing challenges such as workload management, adaptive teaching styles, and fostering increased interaction can lead to the development of new instructional models, strategies, and technologies in BL. The study also serves as a foundational platform for future research in BL, setting the stage for more extensive investigations, experimental studies, and exploration of specific interventions and instructional approaches.

The research aligns with and contributes to existing literature and theories on BL. It echoes the effective use of tools and technologies in enhancing the learning environment, as noted by Kirschner and De Bruyckere (2017) and others. It resonates with the literature on student-centred learning (Meacham, 2016), the importance of collaboration between students and lecturers (Churches, 2008), and the need for practical, relevant information (Chicca & Shellenbarger, 2018). Additionally, the study underscores the significance of individualised, engaging, and technologically advanced learning experiences, along with the role of flexibility in learning, drawing upon the theories of social constructivism and situated learning (Walker & Baets, 2008; Vaughan, 2007; Kresch & Evans, 2015).

9.3.2 Practical Implications

On a practical level, the study's findings have significant implications for the design and delivery of BL courses in higher education. The emphasis on a student-centred approach necessitates a re-evaluation of current teaching practices and curriculum structures. Educational institutions and instructors are encouraged to consider strategies that not only manage student workload effectively but also tailor teaching methods to individual learning styles and needs.

The importance of fostering meaningful interactions in online learning environments calls for a rethinking of how online platforms and tools are utilised. Educational technologists and course designers are prompted to focus on creating spaces that encourage genuine interaction, moving beyond mere tool implementation to fostering an environment conducive to collaborative learning and engagement. The study's focus on reflective practices implies a shift towards pedagogies that incorporate reflective activities, peer-to-peer learning, and group discussions. This has implications for course design, suggesting the integration of activities that facilitate deeper learning and understanding through reflection and interaction. These strategies can be particularly effective in enhancing student engagement and promoting critical thinking skills. The insights into pedagogical innovation and the development of new instructional models and technologies offer valuable guidance for educators and instructional designers. The study highlights areas for improvement and innovation in BL, providing a roadmap for developing more effective and engaging learning experiences.

In sum, the study offers significant theoretical and practical implications, providing a comprehensive framework for enhancing BL in higher education. It contributes to the existing body of knowledge in the field and sets a direction for future research and practice, emphasising the importance of student-centred approaches, meaningful interactions, reflective practices, and pedagogical innovation in BL environments.

9.3.3 Key Take Aways

In synthesising the key findings of this dissertation, several critical takeaways emerge, offering a comprehensive overview of the outcomes, theoretical insights, and practical implications of the study in the realm of BL and educational technology within higher education. The study reaffirms the enduring relevance of constructivist and social learning theories in contemporary educational contexts, especially within the framework of digital age learning. It underscores how technology-enhanced environments, facilitated by ICT, can promote active, collaborative, and student-centred learning experiences. This theoretical contribution is significant as it not only validates existing pedagogical theories but also extends their applicability to modern, technology-mediated educational settings.

Practically, one of the most significant findings is the positive impact of SoML interventions on students' competency acquisition and learning success. This insight is crucial for educators and curriculum designers, pointing towards the effectiveness of SoML in enhancing the quality of learning outcomes in BL environments. Additionally, the research sheds light on how SoML interventions can increase student interaction and focus, which are essential elements of an effective learning environment. However, the study leaves room for further exploration regarding the impact of SoML on aspects such as student joy and motivation, indicating a complex and multifaceted relationship between instructional interventions and student engagement.

The study also offers concrete strategies for effective BL implementation. These include managing workload, adapting teaching styles based on student feedback, and utilising interaction tools more effectively to foster a more engaging and responsive BL environment. Such strategies are vital for creating learning experiences that are not only academically rigorous but also attuned to the needs and preferences of students in a digital learning landscape. The dissertation's contributions extend beyond immediate findings, offering a foundation for future research and practice. The theoretical insights provided enrich the academic discourse on the role of technology in education, particularly in relation to constructivist and social learning theories. The practical applications derived from the study offer a roadmap for educators in higher education to enhance their teaching practices using evidence-based recommendations. Additionally, the areas where findings remain inconclusive, particularly regarding the affective and engagement-related impacts of SoML interventions, highlight the need for ongoing research. This suggests a fertile ground for future studies to explore the nuanced impacts of instructional interventions in BL settings.

Based on the critical takeaways elaborated above, this dissertation culminates in a comprehensive framework model for the practical application of SoML interventions in BL environments. This model, grounded in the extensive research and findings presented in the dissertation, offers educators and institutions actionable strategies and tools for enhancing learning experiences. The framework begins with the assessment of current practices, leveraging an approach akin to the ADDIE analysis (Appendix K). Educators are encouraged to evaluate their teaching methodologies and integrate SoML activities, such as 'Increase Retention' and 'Repeat Content', ensuring alignment with course objectives (Appendices N to X). The effectiveness of these interventions is measured using specific tools and protocols developed during the research (Appendix X).

For educators, the framework provides strategies for effective workload management to avoid content overload, adapting teaching styles based on student feedback, and incorporating interactive tools like Mentimeter (Appendices H, N, O, T, and X). Curriculum designers are guided to balance SoML with traditional pedagogical approaches (Appendices K and M), ensuring a harmonious integration of technology-enhanced learning. Professional development workshops based on the ADDIE model and the practical application of SoML interventions (Appendices K, N to X) are recommended. These workshops aim to equip educators with the skills and knowledge necessary for effective implementation of SoML in their teaching.

The model also emphasises the adoption of collaborative learning models to foster interaction and collective problem-solving, drawing insights from the dissertation's findings (Appendix X). Policy recommendations for educational institutions are provided, focusing on the integration of SoML interventions, including aspects such as resource allocation, teacher training, and curriculum development (Appendices K, M, and T). Finally, an Engagement and Motivation Toolkit is proposed. This toolkit addresses more nuanced aspects of student engagement and motivation, utilising insights from areas of research that remained inconclusive (Appendix X). It includes techniques for increasing student participation and maintaining focus, thereby addressing key challenges in BL environments.

This framework model offers a structured and evidence-based approach for enhancing BL experiences through the strategic integration of SoML interventions. It presents a holistic strategy for educators and institutions, aiming to improve both the effectiveness of teaching and the quality of student learning outcomes.

9.4 Recommendations for Future Practice

Future research should aim to conduct longitudinal studies spanning multiple semesters or academic years. This would provide a more comprehensive understanding of the long-term effectiveness of SoML interventions in BL. Longitudinal studies can offer insights into the sustainability of learning improvements, the evolution of student engagement strategies, and the adaptability of instructional designs over time. It's further recommended that future studies explicitly incorporate gender and class size as variables in their research design. Analysing how different genders interact with and benefit from BL and SoML can uncover important insights for creating more inclusive and effective learning environments. Additionally, examining the impact of class size on the effectiveness of SoML interventions can help in optimising BL strategies for different educational settings, ensuring that they are adaptable and scalable.

Utilising artificial intelligence (AI) algorithms to analyse extensive datasets can lead to the creation of personalised learning experiences. These experiences are tailored to individual students' needs, abilities, and learning styles, as highlighted by Kizilcec, Piech, and Schneider (2013). German higher education institutions can benefit from integrating AI-powered adaptive learning platforms that dynamically adjust instruction based on students' progress, thereby optimising learning outcomes, as suggested by VanLehn (2011). Implementing intelligent tutoring systems in German universities can simulate one-on-one interactions, offering immediate feedback, guidance, and tracking of student progress. This method enhances concept comprehension and mirrors the benefits of personalised instruction, aligning with the findings of Roll, Aleven, McLaren, and Koedinger (2011).

AI's capabilities in natural language processing can significantly improve communication between students and educational resources. By integrating chatbots and virtual assistants, German universities can enhance accessibility and reduce reliance on human instructors, a strategy supported by Mostafa and Al-Mallah (2014). Data analytics and predictive modelling, pivotal components of AI, facilitate the early identification of academic struggles and provide valuable insights for optimising educational strategies, as noted by Romero and Ventura (2010). This aspect is crucial for developing effective educational strategies in German higher education. The automation of grading processes using AI algorithms allows for faster and more consistent feedback, supporting student progress and alleviating the workload on instructors, as evidenced by Chen, Chen and Huang (2016). This approach can be particularly beneficial in large-scale educational settings typical in German universities. Finally, combining AI with augmented reality (AR) and virtual reality (VR) technologies can create immersive and

interactive learning environments. Such environments, which simulate real-world scenarios, laboratory experiments, and historical events, foster enhanced understanding and engagement. This application is especially relevant for technical and scientific disciplines prevalent in German higher education, as highlighted by Sánchez, Salinas, and Pomares (2018).

In conclusion, these recommendations provide a roadmap for German higher education institutions to effectively incorporate AI technologies in teaching and learning practices. The integration of AI not only enhances the quality of education but also equips students with the necessary skills and knowledge to thrive in an increasingly digital world. This strategic approach to integrating AI in education has the potential to revolutionise learning experiences and outcomes in the German higher education landscape.

9.5 Conclusions

The research conducted in this study offers a comprehensive and multi-faceted exploration of SoML interventions within the context of BL in higher education. The conclusions drawn from this research are grounded in an extensive literature review, a methodological framework employing mixed methods, and a detailed analysis of the implementation and impact of SoML interventions.

The extensive literature review conducted as part of this research not only identified SoML as a niche area within the study but also established a theoretical foundation by exploring the characteristics of Generation Z students and the implementation of Information and ICT in education. Additionally, it examined historical developments in teaching and learning, including significant learning theories and changes in educational methods.

The methodological framework guided the overall research design, employing participant observation as a tool to provide initial insights into the impact of workload, teaching style, interaction rates, and opportunities on students' learning experiences and outcomes in BL higher education. The potential of SoML interventions in enhancing learning experience and outcomes was highlighted, indicating the need for further research to validate and expand upon these initial observations. The development of a quantitative instrument, employing an exploratory sequential design, facilitated a comprehensive understanding of the challenges associated with BL in higher education. This mixed-methods approach integrated qualitative and quantitative data collection and analysis in a sequential manner. The instructional design, based on the ADDIE model, aimed to redesign learning by considering the evolving nature of the curriculum. The SoML interventions, developed based on constructivist learning theories,

the ADDIE method, and literature reviews, targeted identified performance gaps to enhance the overall learning experiences and outcomes for students in BL higher education.

Overall, the study successfully addressed the principal research question and sub-questions, confirming the positive impact of SoML interventions on students' acquisition of competencies and learning success. However, it did not establish a significant improvement in students' joy or motivation. The limitations of the study, including the small sample size and reliance on self-assessment data, highlight the need for further research to establish a causal relationship between the interventions and the observed improvements.

9.5.1 Exploring Current Practice

The study has contributed significant insights into how various factors such as workload, teaching style, interaction rate, and the use of interaction tools in online teaching influence student learning experiences in BL higher education. The research highlighted that an excessive workload throughout the course, coupled with a lack of adaptation in teaching style to students' suggestions, can detrimentally impact the learning experience. This preliminary finding offers a valuable perspective on potential areas for improvement in BL, specifically in terms of workload management and teaching style flexibility.

Furthermore, the study unearthed a potential correlation between the decrease in students' learning experience and the lack of lecturer-student interaction during the online course, even with the presence of didactically implemented interaction tools. This finding suggests that an increase in interaction rate could lead to an improvement in student learning experiences. Additionally, the research identified a possible connection between the provision of space for reflection by the teaching form used and enhanced support of learning groups by the lecturer, as well as increased student interaction with each other during the course and in self-learning, which could collectively elevate the learning experience.

The study also delved into the relationship between student learning outcomes and factors such as teaching style, workload, interaction rate, and interaction opportunities. Preliminary results indicate that learning outcomes tend to be lower when the workload is high and the teaching style is not adapted according to student feedback. This insight sheds light on potential areas for improvement, emphasising the need to reduce workload and adapt teaching styles. The study also suggests a link between declining learning outcomes and inadequate lecturer-student interaction, hinting at the importance of fostering more engaging and interactive teaching environments.

These findings align with the broader conversations and debates in the field of successful BL implementation, particularly in enhancing the learning environment through the effective, efficient, and enjoyable use of available tools and technologies (Kirschner & De Bruyckere, 2017; Alammary, Sheard & Carbone, 2014; Vaughan, 2007; Rovai & Jordan, 2004; Graves & Twigg, 2006). They also build on research emphasising the need for student-centred learning (Meacham, 2016), collaboration between students and lecturers (Churches, 2008), and the provision of practical and relevant information (Chicca & Shellenbarger, 2018).

The findings suggest that greater flexibility in learning, such as the option to learn from home, is increasingly important, resonating with the perspectives of Kresch & Evans (2015) and Vaughan (2007). This study contributes to the understanding of optimal BL courses as thoughtful integrations of different teaching methods (Alammary, Sheard & Carbone, 2014) and aligns with theories of social constructivism and situated learning (Walker & Baets, 2008), emphasising knowledge construction in a social context. The effective implementation of interaction tools that support student contact and interaction (Aram & Noble, 1999; Walker & Baets, 2008) can facilitate this collaborative learning process.

9.5.2 Instrumental Development

The study made significant advancements in understanding and assessing the challenges associated with the introduction of BL in higher education from a student's perspective, through a specifically tailored instrument. This development was part of a mixed-methods approach employing an exploratory sequential design.

The qualitative phase of the research aimed to establish a conceptual framework. This framework utilised both deductive and inductive codes, with the former derived from existing literature and the latter from qualitative data analysis. Deductive codes included concepts like ‘learning experience,’ encompassing sub-codes such as ‘interaction’ and ‘flexibility,’ and ‘learning outcomes,’ which included sub-codes like ‘learning success,’ ‘competencies’, and ‘future skills’. The inductive codes were derived from participant observations and covered various factors, including ‘participation’, ‘interaction’, ‘communication’, ‘teaching style’, ‘course content’, ‘media usage’, ‘focus’, and ‘pacing’. The quantitative phase involved constructing a Likert Scale questionnaire to measure variables related to the ‘learning experience’. This included aspects such as ‘joy’, ‘motivation’, ‘effort’, ‘participation’, ‘interaction’, and ‘focus’. Additionally, items were developed for ‘learning outcomes’ pertaining to ‘learning success’, ‘competencies’, and ‘future skills’. Notably, supplementary items were added to the questionnaire after implementing the interventions.

This instrument's development and subsequent implementation were crucial in evaluating the instructional design interventions and their impact on the learning experience and outcomes. The tailored nature of the questionnaire allowed for a nuanced understanding of the specific context of BL in higher education. The study's methodological approach, combining qualitative and quantitative data collection and analysis, provided a comprehensive overview of the students' learning experiences and outcomes. This instrument serves as a valuable method for assessing specific cases in BL and contributes to the broader discourse on evaluating and enhancing learning experiences in higher education.

9.5.3 Instructional Design

The study delves into the design and implementation of Social Micro-Learning (SoML) interventions in blended learning (BL) higher education. The interventions were developed based on constructivist learning theories and refined using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) method to ensure their value and sustainability. This approach to instructional design underscored the importance of developing interventions that are not only effective but also adaptable and enduring.

The interventions were specifically tailored based on qualitative data analysis from participant observations conducted during the winter semester of 2021/22. Employing a variant of grounded theory, significant cases of abnormalities in students' learning experiences and outcomes were identified, highlighting performance gaps. These gaps included issues such as delayed or lack of response, lack of supervision, content overload, lack of breaks, excessive overtime, fast pace, and lack of interaction, all impacting the learning experience. Similarly, deficits in learning outcomes were traced to factors like late response, lack of revision, and lack of time.

To address these identified performance gaps, a series of interventions were crafted. These included increasing asynchronous learning opportunities and repeating key aspects in online sessions or exercises to address the lack of revision. Teaching aids like 'In-a-Nutshell' slides and word clouds were developed to aid learning and comprehension. Curriculum adjustments were made to alleviate content overload by moving some content from online lectures to on-site exercises and supplementing with additional self-study materials and homework. A nationwide student quiz and short tutorials were introduced to support learning about statistics.

The complex issue of 'lack of interaction' was tackled by focusing on related performance gaps such as lack of breaks, time constraints, and response delays. Planned breaks were introduced to facilitate increased interaction. The learning tool was switched to Blackboard Collaborate to

address the ‘lack of monitoring’ gap. To mitigate the issue of ‘too much overtime,’ the new learning platform was set to automatically terminate sessions after a five-minute overtime limit.

These SoML interventions represented a comprehensive effort to improve the learning experience and outcomes in BL contexts. They underscored the dynamic nature of instructional design in higher education, where interventions must be continually assessed and refined to meet evolving educational needs and challenges.

9.5.4 Comparative Evaluation

This comprehensive study embarked on a detailed exploration of the efficacy and impact of SoML interventions within the framework of BL in higher education. The essence of this investigation revolved around a pivotal query: "How valuable is it for higher education to support blended learning with social micro-learning interventions?" This question, central to the advancement of contemporary educational practices, was meticulously dissected through a quantitative lens, employing robust statistical methods, primarily a Multivariate Analysis of Variance (MANOVA), to scrutinise and interpret the multifaceted data.

The study's design was comprehensive and multi-layered, focusing on a diverse array of variables to holistically assess the SoML interventions' impact. A key dimension of this exploration was the assessment of students' acquisition of competencies and learning success, two critical indicators of educational efficacy. The findings were strikingly clear in this regard: SoML interventions significantly enhanced students’ competency acquisition and overall learning success. This positive outcome resonates with the core principles of constructivist learning theories and the Bologna reform, emphasising the pivotal role of skill acquisition in fostering lifelong learning and equipping students with essential skills for life.

However, the study’s scope extended beyond these facets, delving into the nuanced realms of students' learning experiences. Here, the results painted a more complex and variegated picture. While it was evident that SoML interventions contributed positively to enhancing student interaction and focus, the interventions' impact on other affective domains, such as students' joy and motivation, remained ambiguous. The hypothesis positing an improvement in students' joy through SoML interventions was not substantiated, leaving a gap in understanding the full spectrum of these interventions’ emotional and motivational impacts.

Another intriguing aspect of the study was the exploration of a potential trade-off between enhancing students’ learning experiences and their learning outcomes. Contrary to what might be expected, the study revealed a synergistic relationship rather than a dichotomous trade-off.

Enhancing the learning experience through SoML interventions was found to positively correlate with improved learning outcomes, suggesting a mutually reinforcing dynamic.

Despite these insightful findings, the study was not without its limitations. The relatively small sample size and the reliance on self-assessment data introduced elements of uncertainty and potential bias. Furthermore, the specificity of the interventions to the studied population raised questions about the generalisability of the findings to other contexts. A notable gap in the study was the lack of clear directionality in the hypotheses, which precluded a definitive assessment of the causal relationships between the interventions and the observed improvements. This gap underscores the need for further research, particularly in elucidating the causal mechanisms underlying the efficacy of SoML interventions.

For practitioners in the realm of higher education, these findings offer valuable guidance. The implementation of SoML interventions appears promising in increasing student interaction and focus, and in enhancing competency acquisition and learning success. However, educators should approach these interventions with a nuanced understanding, recognising the mixed results regarding their impact on students' emotional and motivational states. The need for adaptability and continual reassessment of educational strategies is paramount in the ever-evolving landscape of higher education.

In summary, this thesis contributes a significant chapter to the ongoing narrative of educational innovation in higher education. It underscores the potential of SoML interventions in enhancing certain key aspects of the learning process, while also highlighting areas ripe for further exploration. As the educational community continues to navigate the complexities of blending traditional and digital learning modalities, studies such as this offer crucial insights and guideposts for the journey ahead. The conducted research encourages educators to consider implementing SoML interventions to enhance student interaction, focus, and the acquisition of competencies and learning success in BL higher education. The findings and recommendations of this study offer valuable insights and directions for future research and practical applications in the domain of higher education BL.

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Appendices

Appendix A

Anonymity, Data Protection, and the Voluntary Nature of Participation.

Dear students of the course Empirical Research and Statistics,
As part of my doctorate, I am concerned with improving the blended learning concept at the Macromedia University of Applied Sciences, specifically with the linking of online lectures and face-to-face exercises. Your assessment forms the basis for the study and future teaching design.

I would therefore ask you to take 15 minutes to answer the questions. As a reward for your efforts, I will raffle 3 x 50 € vouchers for a provider of your choice (Netflix, Amazon, Adobe etc.) among all participants. Simply send me an informal email with the 5-digit number code at the end of the survey, it starts with a 5XXXX.
Thank you in advance for your participation,
Nanette Willberg

Important note: The response is voluntary, anonymous and completely independent of Macromedia University. No information will be forwarded or published.

Appendix B

Preliminary Observation Guide after Merkens (1992).

Microsystem BL scenarios (individual level):
General setting
- Date - Category - Duration
Class organization
- Fully online - Fully on campus - Attendance - Homework
Teaching contents
- Units - Curricular changes - Holidays
Type of instruction
- Levels of competencies - Learning objectives - Teaching style - Usage of teaching media - Work materials available
Student behaviour
- Student characteristics
- Gender
- Participation
- Student communication inside of class
- Student communication outside of class
- Self-learning phase
Outcomes
- Grades
- Learning success
- Competencies
- Future skills
- Trade-Off
Problem list for the institutional level
Working characteristics of lecturers: - Open for innovations - Easily reachable

Appendix C

Observational Protocol Template based on Saunders et al. (2009) and Robson (2002).

Observation Protocol | Empirical Research & Statistics Unit __ | Date: _____

Lecturer: _____ / Student Cohort: _____			
Session: _____	B.A.	Session type: _____	Macromedia University
Date: _____	Time: _____	Empirical Research & Statistics	Total number: _____

Time	Observation (what I see)	Interpretation (what I guess)

Notes

Observation Protocol

Appendix D

Category System of the Online Sessions in the Winter Semester of 2021/ 22.[2]

General setting																	
Date			07.10.2021	14.10.2021	21.10.2021	28.10.2021	04.11.2021	11.11.2021	18.11.2021	25.11.2021	02.12.2021	09.12.2021	16.12.2022	23.12.2021	13.01.2022	20.01.2022	08.02.2022
Category	all	none	Expert Session 1	Expert Session 2	Expert Session 3	Expert Session 4	No lecture	Expert Session 5	Expert Session 6	Expert Session 7	Expert Session 8	Expert Session 9	Expert Session	No lecture	Expert Session 11	Expert Session 12	Exam
Duration: 90 min			97	91	98	96		93	91	91	93	111	89		98	95	
Starts early			no	yes	yes	no		no	no	no	no	no	no		no	no	
Overstay			yes	no	yes	yes		yes	yes	yes	yes	yes	no		yes	yes	
Classroom organization																	
Fully online	x																
Fully on campus		x															
Hybrid		x															
Attendance																	
Amount			123	107	75	68		49	55	48	53	42	41		48	38	
Beginning			81	59 (technical issues)	42	48		38	39	37	39	22	33		38	22	
End			73	89	46	39		23	31	27	41	22	28		28	23	
Active onsite		x															
Active online			5/ 1 from exercise	4/ 1 from exercise	1/ 0 from exercise	2/ 0 from exercise		0/ 0 from exercise	1/ 0 from exercise	2/ 1 from exercise	3/ 0 from exercise	1/ 0 from exercise	1/ 0 from exercise		1/ 0 from exercise (not course relevant)	1/ 0 from exercise	
Homework given/ not		x															
Homework done/ not		x															
Teaching contents																	
Unit(s)			1 Einführung: Relevanz und Grundlagen empirischer Sozialforschung und Statistik	2 Die Methode der quantitativen Befragung I: Ziele, Operationalisierung, Gütekriterien & Pretest	3 Die Methode der quantitativen Befragung II: Stichprobenziehung und Feldzeit	4 Die Methode der quantitativen Inhaltsanalyse I: Ziele, Operationalisierung, Gütekriterien & Pretest		5 Die Methode der quantitativen Inhaltsanalyse II: Stichprobenziehung und Feldzeit	6 Die Methode der quantitativen Beobachtung: Beobachtung zwischen Befragung und Inhaltsanalyse ... und darüber hinaus	7 Experimentelle vs. nicht-experimentelle Designs: Erkenntnisunterschiede, Vorteile & Nachteile	8 Deskriptive Statistik: Realität mit Zahlen beschreiben	9 Induktive Statistik I: Analysieren von Unterschieden (Chi-Quadrat-Test und t-Test)	10 Induktive Statistik II: Analysieren von Unterschieden (Varianzanalyse)		11 Induktive Statistik III: Analysieren von Zusammenhängen (Korrelation, Einfache Regression)	12 Induktive Statistik IV: Analysieren von Zusammenhängen (Multiple Regression)	13 Exam
Curricular changes			no	no	no	no		no	no	no	yes	no	no		no	no	
Holiday			no	no	no	no		yes	no	no	no	no	no		yes	no	
Didactics/ Type of instruction																	
Levels of competences			1; 6	1; 2; 3	1; 2; 5	1; 2; 3		1; 2; 5	1; 2; 3	1; 2; 3	1; 4; 3	1; 4; 3	1; 4; 3		1; 4; 3	1; 4; 3	
Learning objectives			L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L8: Hypothesen zu Fragestellungen der Medienforschung und geeignete Forschungsdesigns inklusive Erhebungs- und Auswertungsmethoden entwerfen	L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L5: Eignung, Vor- und Nachteile der Erhebungsmethoden Befragung, Beobachtung, Inhaltsanalyse in der empirischen Sozialforschung diskutieren	L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L7: Beurteilen, ob die Schlussfolgerungen einer empirischen Studie aufgrund vorliegender Daten plausibel sind	L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L5: Eignung, Vor- und Nachteile der Erhebungsmethoden Befragung, Beobachtung, Inhaltsanalyse in der empirischen Sozialforschung diskutieren		L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L7: Beurteilen, ob die Schlussfolgerungen einer empirischen Studie aufgrund vorliegender Daten plausibel sind	L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L5: Eignung, Vor- und Nachteile der Erhebungsmethoden Befragung, Beobachtung, Inhaltsanalyse in der empirischen Sozialforschung diskutieren	L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L5: Eignung, Vor- und Nachteile der Erhebungsmethoden Befragung, Beobachtung, Inhaltsanalyse in der empirischen Sozialforschung diskutieren	L2: Die Grundlagen der deskriptiven und induktiven Statistik wie Grundbegriffe, Skalenniveaus, empirische Verteilungen, Mittelmaße, Streuungsmaße, Wahrscheinlichkeit und Testverfahren bezeichnen L3: Eigenschaften von Funktionen analysieren L6: Deskriptive und induktive statistische Auswertungen in der empirischen Wirtschafts- und Sozialwissenschaft anwenden	L2: Die Grundlagen der deskriptiven und induktiven Statistik wie Grundbegriffe, Skalenniveaus, empirische Verteilungen, Mittelmaße, Streuungsmaße, Wahrscheinlichkeit und Testverfahren bezeichnen L3: Eigenschaften von Funktionen analysieren L6: Deskriptive und induktive statistische Auswertungen in der empirischen Wirtschafts- und Sozialwissenschaft anwenden	L2: Die Grundlagen der deskriptiven und induktiven Statistik wie Grundbegriffe, Skalenniveaus, empirische Verteilungen, Mittelmaße, Streuungsmaße, Wahrscheinlichkeit und Testverfahren bezeichnen L3: Eigenschaften von Funktionen analysieren L6: Deskriptive und induktive statistische Auswertungen in der		L2: Die Grundlagen der deskriptiven und induktiven Statistik wie Grundbegriffe, Skalenniveaus, empirische Verteilungen, Mittelmaße, Streuungsmaße, Wahrscheinlichkeit und Testverfahren bezeichnen L3: Eigenschaften von Funktionen analysieren L6: Deskriptive und induktive statistische Auswertungen in der empirischen Wirtschafts- und Sozialwissenschaft anwenden	L2: Die Grundlagen der deskriptiven und induktiven Statistik wie Grundbegriffe, Skalenniveaus, empirische Verteilungen, Mittelmaße, Streuungsmaße, Wahrscheinlichkeit und Testverfahren bezeichnen L3: Eigenschaften von Funktionen analysieren L6: Deskriptive und induktive statistische Auswertungen in der empirischen Wirtschafts- und Sozialwissenschaft anwenden	

2 For reasons of space, only a section of the entire category system is shown. On request, the author offers an external folder with all additional files.

Appendix E

Observational Protocol of Unit 1 on 07.10.21.[3]

Observation Protocol | Unit 1 | 07.10.2021

Prof. Dr. Mothes / Students: (ES)_Mothes_B-STG-ALL-EFS-21WS			
Online Lecture	B.A.	Expert Session	Macromedia University
07.10.2021	14-15:30	Empirical Research and Statistics	123/ 191 attending
nationwide			

Time	Observation (what I see)	Interpretation (what I guess)
14:00	81 students nationwide entered the session. Prof. Mothes starts the session in time.	
14:03	120 students have attended in total by now. The intro by the professor is over and the recording starts.	
14:04	The presentation starts. Its an intro into the semester and topic.	
	All students are muted and have the camera turned off. Questions shall be posted into the chat, as well as answered after class. Students interact with thumbs up and a first question in the chat.	They are not allowed to speak up due to data protection.
14:13	Currently, 123 students are attending. The professor is explaining the necessity of the course. Besides the students, Prof. Mothes, the researcher and another lecturer are participating. One more question is asked. Also the other lecturer introduces himself in the chat. One student is not actively participating.	The professor is very motivating .She is mentioning several times the importance of attending and explaining the course in detail.
14:20		
14:33	The presentation of the content and relevance continues, including reference to learning goals and catch up to last semester.	
14:48	118 are still attending. No new questions so far.	
15 05	116 are still attending. No breaks are taken.	
15:27	112 are still attending. No question answered so far.	
15:30	105 are still attending. Course is still going.	
15:35	73 still attending. Course ended. Question: Learning goal achieved? Wishes for future? Recording ended. Two more questions in the chat.	
15:37	Questions are being answered by the lecturer.	
	No answeres from students. 2-3 Reactions with thumbs up and clapping.	

Notes
The students were invited one week ahead via an e-mail invitation incl. calendar entry. 15 people, inc.
12 students and three lecturers (inlc. the researcher) accepted.
Screenshots of attendees were taken in the first 15 minutes. 17 more attendees are not visible.

Observation Protocol

3 For reasons of space, only the first of 12 protocols is shown. On request, the author offers an external folder with all additional files.

Appendix F

Category System of the On-Site Exercises in the Winter Semester of 2021/ 22.[4]

General setting																		
Date			17.03.2022	24.03.2022	31.03.2022	07.04.2022	14.04.2022	21.04.2022	28.04.2022	05.05.2022	12.05.2022	19.05.2022	No lecture	02.06.2022	09.06.2022	No lecture	23.06.2022	01.07.2022
Category	all	none	Expert Session 1	Expert Session 2	Expert Session 3	Expert Session 4	Expert Session 5	Expert Session 6	Expert Session 7	Expert Session 8	Expert Session 9	Expert Session 10		Expert Session 11	Expert Session 12		Expert Session 13	Exam
Duration: 90 min			85	91	98	96		93	91	91	93	91						
Starts early			no	yes	yes	no		no	no	no	no	no						
Overstay			no	no	yes	yes		yes	yes	yes	yes	yes						
Classroom organization																		
Fully online	x																	
Fully on campus		x																
Hybrid		x																
Attendance																		
Amount			21 (11 online; 6 very active, 4 active, 1 little active)	16 (1 online; 6 very active, 4 active)	no exercise (Munich)	no exercise	15 (5 very active, 2 active, 1 little active)	17 (1 online due to broken leg; 2 new, have to redo exam)	no exercise	18 (5 very active, 1 active)	18 (4 online: 3 leave 20 min early; 3 very active, 5 active)	14 (3 active, 3 little active)	12 (2 online, 3 very active, 3 active, 2 little active)	13 (7 online; 6 generally active)	16 (3 online; 2 very active, 4 active, 1 little active)	no exercise		
Beginning			18	59 (technical issues)	42	48		38	39	37	39							
End			21	89	46	39		23	31	27	41							
Active onsite		x																
Active online			5/ 1 from exercise	4/ 1 from exercise	1/ 0 from exercise	2/ 0 from exercise		0/ 0 from exercise	1/ 0 from exercise	2/ 1 from exercise	3/ 0 from exercise							
Homework given/ not		x																
Homework done/ not		x																
Teaching contents																		
Unit(s)			1 Einführung: Relevanz und Grundlagen empirischer Sozialforschung und Statistik	2 Die Methode der quantitativen Befragung I: Ziele, Operationalisierung, Gütekriterien & Pretest	3 Die Methode der quantitativen Befragung II: Stichprobenziehung und Feldzeit	4 Die Methode der quantitativen Befragung III: Stichprobenziehung und Feldzeit	5 Die Methode der quantitativen Inhaltsanalyse I: Ziele, Operationalisierung, Gütekriterien & Pretest	6 Die Methode der quantitativen Inhaltsanalyse II: Stichprobenziehung und Feldzeit	7 Die Methode der quantitativen Beobachtung: Beobachtung zwischen Befragung und Inhaltsanalyse … und darüber hinaus	8 Experimentelle vs. nicht-experimentelle Designs: Erkenntnisunterschiede, Vorteile & Nachteile	9 Deskriptive Statistik: Realität mit Zahlen beschreiben	10 Induktive Statistik I: Analysieren von Unterschieden (Chi-Quadrat-Test und t-Test)		11 Induktive Statistik II: Analysieren von Unterschieden (Varianzanalyse)	12 Induktive Statistik III: Analysieren von Zusammenhängen (Korrelation, Einfache Regression)		13 Induktive Statistik IV: Analysieren von Zusammenhängen (Multiple Regression)	14 Exam
Curricular changes			no	no	no	no		no	no	no	yes	no	no		no	no		
Holiday			no	no	no	no		yes	no	no	no	no	no		yes	no		
Didactics/ Type of instruction																		
Levels of competences			1; 6	1; 2; 3	1; 2; 5	1; 2; 3		1; 2; 5	1; 2; 3	1; 2; 3	1; 4; 3	1; 4; 3	1; 4; 3		1; 4; 3	1; 4; 3		
Learning objectives			L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L8: Hypothesen zu Fragestellungen der Medienforschung und geeignete Forschungsdesigns inklusive Erhebungs- und Auswertungsmethoden entwerfen	L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L5: Eignung, Vor- und Nachteile der Erhebungsmethoden Befragung, Beobachtung, Inhaltsanalyse in der empirischen Sozialforschung diskutieren	L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L7: Beurteilen, ob die Schlussfolgerungen einer empirischen Studie aufgrund vorliegender Daten plausibel sind	L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L7: Beurteilen, ob die Schlussfolgerungen einer empirischen Studie aufgrund vorliegender Daten plausibel sind	und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L5: Eignung, Vor- und Nachteile der Erhebungsmethoden Befragung, Beobachtung, Inhaltsanalyse in der empirischen Sozialforschung	L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L7: Beurteilen, ob die Schlussfolgerungen einer empirischen Studie aufgrund vorliegender Daten plausibel sind	L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L5: Eignung, Vor- und Nachteile der Erhebungsmethoden Befragung, Beobachtung, Inhaltsanalyse in der empirischen Sozialforschung diskutieren	L1: Ziele, Aufbau und Ablaufschritte eines Forschungsprozesses sowie mögliche Forschungsmethoden benennen L4: Qualitätskriterien einer empirischen Untersuchung und ihre Bedeutung für die Aussagekraft von Forschungsergebnissen erklären L5: Eignung, Vor- und Nachteile der Erhebungsmethoden Befragung, Beobachtung, Inhaltsanalyse in der empirischen Sozialforschung diskutieren	L2: Die Grundlagen der deskriptiven und induktiven Statistik wie Grundbegriffe, Skalenniveaus, empirische Verteilungen, Mittelmaße, Streuungsmaße, Wahrscheinlichkeit und Testverfahren bezeichnen L3: Eigenschaften von Funktionen analysieren L6: Deskriptive und induktive statistische Auswertungen in der empirischen Wirtschafts- und Sozialwissenschaft anwenden	L2: Die Grundlagen der deskriptiven und induktiven Statistik wie Grundbegriffe, Skalenniveaus, empirische Verteilungen, Mittelmaße, Streuungsmaße, Wahrscheinlichkeit und Testverfahren bezeichnen L3: Eigenschaften von Funktionen analysieren L6: Deskriptive und induktive statistische Auswertungen in der empirischen Wirtschafts- und Sozialwissenschaft anwenden		L2: Die Grundlagen der deskriptiven und induktiven Statistik wie Grundbegriffe, Skalenniveaus, empirische Verteilungen, Mittelmaße, Streuungsmaße, Wahrscheinlichkeit und Testverfahren bezeichnen L3: Eigenschaften von Funktionen analysieren L6: Deskriptive und induktive statistische Auswertungen in der empirischen Wirtschafts- und Sozialwissenschaft anwenden	L2: Die Grundlagen der deskriptiven und induktiven Statistik wie Grundbegriffe, Skalenniveaus, empirische Verteilungen, Mittelmaße, Streuungsmaße, Wahrscheinlichkeit und Testverfahren bezeichnen L3: Eigenschaften von Funktionen analysieren L6: Deskriptive und induktive statistische Auswertungen in der empirischen Wirtschafts- und Sozialwissenschaft anwenden		L2: Die Grundlagen der deskriptiven und induktiven Statistik wie Grundbegriffe, Skalenniveaus, empirische Verteilungen, Mittelmaße, Streuungsmaße, Wahrscheinlichkeit und Testverfahren bezeichnen L3: Eigenschaften von Funktionen analysieren L6: Deskriptive und induktive statistische Auswertungen in der empirischen Wirtschafts- und Sozialwissenschaft anwenden	

4 For reasons of space, only a section of the entire category system is shown. On request, the author offers an external folder with all additional files.

Appendix G

Observational Protocol of the First On-Site Exercise on 12.10.21.[5]

Observation Protocol | Exercise 1 | 12.10.2021

Alexander Roth / Students: (ES)_Mothes_B-STG-ALL-EFS-21WS			
Hybrid Session	B.A.	Exercise	Macromedia Univ.
12.10.2021	12:15-14:00	Emirical Reseach and Statistics	21/ 22 attending
campus-wide			

Time	Observation (what I see)	Interpretation (what I guess)
12:14	The exercise takes place hybird. This means that half of the course is on campus, while the other one participates online.	
12:15	The session is installed by the lecturer.	
	9 students are in class. 11 are online.	
12:18	Students on campus are asked if they are tested or vaccinated.	
	12 students are online.	
12:20	Introduction by the lecturer.	
12:25	Introduction by students. They are scared, as they don't know what will happen in the course. They don't have many touchpoints. They want to know how to use data and hope it is useful for their Bachelor thesis.	
12:36	Lecturer asks question on lecture online: Difference between qualitative and quantitative research. No answers.	In the beginning, students were shy to say something wrong.
12:43	First exercise starts.	
12:48	Student asks question regarding scientific writing catch up.	Related to last week's online lecture.
12:52	Exercise is discussed. Thora and Lara P.: answers a & d, others see it the same.	Team work for 7 minutes. 4 Teams.
12:58	Question: who is active on IG and TikTok? Who on Facebook? Half/ half and FB only 3.	
13:01	Discussion in class. Question: to b? Answer online Bonk Veronika. 5 answers in class.	Interaction and participation in class much higher compared to online.
13:11	Second exercise starts.	
13:14	No breaks taken so far. Students get more tired and less focused in class. 2 students are on their phone. One answer online, 3 in class.	
13:20	Lecturer actively asks online students to participate more.	
13:28	Question to take a break. Not interested. Incentive to end class earlier. Answers mainly from class. Lecturer actively asks online group to answer.	High activity in class overall. Lecturer is impressed.
13:54	Class ends. Last question, students are packing: Learning goals achieved? Most active students thumbs up, others no answer.	

5 For reasons of space, only the first of 12 protocols is shown. On request, the author offers an external folder with all additional files.

Appendix H

Summary of Descriptive Codes: Protocols from Unit 1-12.

the student participation over the semester shows a continuous decrease. The number of students typically peaks around 15 minutes after the beginning of each session but steadily declines throughout the session. The student count at the beginning of the semester was 123, and it gradually decreased to 107, 75, 68, and so on. Towards the end of the semester, the student count dropped to 38. At the beginning of the sessions, there was an average of 81 students present. In some instances, technical issues may have caused a slight decrease in participation, as indicated by the count of 59 students. As the semester progressed, the number of students at the beginning of the session decreased further to 42, 38, 22 and so on. By the end of each session, the student count varied. It ranged from 73 to 28, showing fluctuations in student retention throughout the duration of the class. Overall, the data suggests a continuous decline in student participation over the semester. The initial number of students gradually decreased, with some fluctuations throughout each session. The reasons for the decrease in participation may vary and could include factors such as technical difficulties, time constraints, or disengagement with the course material.	Participation
The professor has maintained a consistent teaching style throughout the entire session, despite students' requests for a change. This implies a lack of adaptability and openness to innovation in education on the part of the professor. By not adjusting her teaching style in response to the students' feedback or requests, the professor appears resistant to adapting her methods to better meet the needs and preferences of the students. This lack of adaptability may hinder the learning experience and engagement of the students, as their input and suggestions are not being considered. The professor's reluctance to change her teaching style suggests a certain level of rigidity or adherence to traditional teaching methods. This may indicate a resistance to incorporating new approaches, technologies, or pedagogical innovations that could enhance the learning experience and make it more engaging and effective for the students. Overall, the statement implies that the professor's teaching style remains unchanged throughout the session, despite students expressing a desire for a different approach. This suggests a lack of adaptability and openness to innovation in education on the part of the professor.	Teaching Style
The course began with an introduction to the relevance and basics of empirical social research and statistics. The professor explained the importance of understanding research methodologies and statistical analysis in the social sciences. In the following sessions, the focus was on the method of quantitative survey. The professor	Course Content Curriculum

discussed the objectives, operationalization, and criteria for quality in survey research, as well as the pretesting process. Students learned about the significance of sampling and field time in quantitative surveys. The course then moved on to the method of quantitative content analysis. The professor explained the objectives, operationalization, and criteria for quality in content analysis. Students also gained insights into the process of sampling and the importance of field time in content analysis. The professor emphasized the role of content analysis as a research method that goes beyond surveys and observations. The next topic covered was the method of quantitative observation. The professor discussed the role of observation in social research, highlighting its position between surveys and content analysis. Students explored the various applications of quantitative observation and its contribution to understanding social phenomena. A significant portion of the course was dedicated to discussing experimental and non-experimental designs. The professor compared these designs, emphasizing the differences in knowledge generation and the advantages and disadvantages of each approach. Students gained insights into the importance of selecting appropriate research designs based on their research questions. The course also included sessions on descriptive statistics, where the professor explained how to describe real-world phenomena using numerical data. Students learned about fundamental concepts such as scales of measurement, empirical distributions, central tendencies, and measures of variability. The remaining sessions focused on inductive statistics. The professor guided students through the process of analysing differences and relationships using statistical tests. They covered topics such as the chi-square test, t-test, analysis of variance, correlation, and simple and multiple regression analysis. Finally, the course concluded with an exam that assessed students' understanding of the course material. The exam covered all the topics discussed throughout the semester, including the various research methods, statistical techniques, and their applications in empirical social research. Overall, the course provided a comprehensive overview of the fundamentals of empirical social research and statistics, equipping students with the necessary knowledge and skills to conduct their own research and analyse social phenomena using quantitative methods.	
Throughout the sessions, there was limited interaction between the students and the professor, as well as among the students themselves. The professor initiated communication through welcome emails and personal introductions, but there were minimal immediate responses from the students. Students raised concerns about the lecture pace, the need for breaks, and difficulties in understanding the material. Administrative matters, such as exam-related inquiries, were also addressed. The professor provided	Interaction Communication

feedback through email and acknowledged decreasing student participation. The overloaded slides and the desire for increased student engagement were also mentioned by the professor. As the semester progressed, the interaction between the professor and the students seemed to decrease gradually. Initially, the students actively engaged in the online class by expressing their appreciation through likes, claps, and asking questions in the chat. However, as time went on, this interaction became less frequent. The professor tried to maintain communication by occasionally talking to the students when the recording was off, but this was a one-sided conversation as the students could only respond via chat. During the personal introduction at the beginning of the semester, the professor asked if there were any questions, but received no response from the students. One student raised a concern about some students being unable to participate. In response, the professor presented a solution, suggesting a break, and asked if anyone agreed. Fourteen students raised their hands to indicate their support for the break. Slowing down the pace of the class was also suggested as a possible solution. The professor expressed her hope that the students had watched the video she prepared after the last class, which was supposed to be part two of a topic. She encouraged students to reach out via email or utilize exercise sessions to get their questions answered. During the exercise session, verbal feedback was given, indicating that the slides were still overloaded and too full of information. At the beginning of another class, the lecturer mentioned that fewer students were attending. She asked if there were any questions but received none at that time. Towards the end of the session, a new question was asked, prompting the professor to hurry up with the lecture. The lecturer repeatedly addressed the issue of fewer student participants, mentioning it for the third time. She even questioned if it was her fault for the lack of engagement. One student responded to this query, presumably offering an explanation or reassurance. The professor mentioned that she had uploaded the necessary content on Moodle, an online learning platform. She expressed her hope that more students would actively participate in the current session. As the class approached its conclusion, the lecturer mentioned her intention to finish the remaining content for the recording, even though it would require going over the allotted time.	
To ensure data protection, all students were required to have their microphones muted and cameras turned off during the sessions. This measure aimed to protect their privacy and maintain confidentiality. Instead of speaking up, students were encouraged to utilize the chat function to post their questions and engage with the content. By using the chat, students had the opportunity to interact by expressing their thoughts and posing queries. They could provide feedback or show their agreement using emojis such as thumbs up.	Data Protection Media Usage

The chat function allowed for a written exchange between the students and the professor, fostering a dynamic learning environment. In compliance with data protection regulations, the professor addressed the questions raised in the chat after the class had concluded. This approach ensured that sensitive information or personal discussions were not publicly shared during the live session, preserving the privacy of the students. By adhering to these guidelines, the session maintained a secure and confidential environment while still allowing for active student participation. Students had the ability to engage with the content and seek clarification, all within the boundaries of data protection regulations.	

Summary of Interpretative Codes: Protocols from Unit 1-12

Throughout the course, it became evident that the pace set by the professor was too fast for the students to keep up. This concern was expressed by a student in the chat, who received support from nine others who liked the comment. The student specifically requested the professor to slow down and also mentioned the need for breaks during the class. However, despite the student's request, the professor did not adjust the pace of the lecture or provide any breaks. This lack of response left the students struggling to follow the content being presented. The fast-speaking style of the professor made it challenging for students to comprehend and absorb the information being conveyed. In the chat, another student voiced their difficulty in keeping up, emphasizing the need for breaks. This sentiment was echoed by multiple observers who noted that the professor's fast pace made it hard for students to stay concentrated and attentive during the lengthy 90-minute sessions. The observer noted that the professor consistently spoke at a rapid pace, making it difficult for students to fully grasp the material. Despite the wealth of knowledge possessed by the professor, there was a failure to adapt to the students' needs. As a result, many students felt lost and struggled to follow the lectures. Towards the end of the sessions, the professor increased the speed of delivery to cover all the remaining content. This rushed approach resulted in overloaded slides, making it nearly impossible for students to both read and listen effectively. In summary, the high pace set by the professor, coupled with the absence of breaks, created significant challenges for the students. Their concerns were voiced in the chat, and observers also noted the difficulties faced by the students in keeping up with the fast-paced lectures. Despite the professor's extensive knowledge, there was a	**Pace too High** **Lack of Breaks**

lack of adjustment to accommodate the students' needs, leaving them feeling overwhelmed and unable to fully engage with the course material.	
Throughout the semester, it became evident that the course workload was overwhelming for the students. The sessions consistently ran out of time, requiring the professor to upload a second part for students to watch at home. The slides used in the lectures were overloaded with information, exacerbating the challenge of keeping up with the content. Students expressed their concerns about the excessive workload and information overload. One protocol from October 21st noted that there was too much information being presented, and the professor spoke at a fast pace. The need for breaks was emphasized, highlighting the students' struggle to absorb the material without sufficient pauses. Verbal feedback from exercise sessions reiterated the issue, indicating that the slides were too full and contained an excessive amount of detail. The observer also noticed the overwhelming amount of content and lack of breaks in the lectures. They remarked that the professor had a wealth of knowledge but failed to adapt to the students' needs. As a result, the students often felt lost and had difficulty following along. The chat feature provided an opportunity for students to voice their opinions, and a message with two likes highlighted the difficulty many faced in staying concentrated and attentive for the lengthy 90-minute sessions. Many students preferred to watch the lecture afterwards, as it allowed them to pause and take better notes. The lack of breaks and the fast pace made it challenging for students to maintain focus. As the semester progressed, the workload remained high, and the students' focus continued to decrease. The lectures covered an extensive amount of material without sufficient time for revision. Technical terms were explained in detail, contributing to the overall overload of information. Additionally, observers noted that the slides were overloaded, making it difficult to both read and listen effectively. In summary, the course placed an excessive workload on the students, with sessions often running out of time and requiring additional materials to be uploaded for independent viewing. The slides were overloaded with information, and the pace of the lectures was too fast for effective comprehension. The lack of breaks further hindered the students' ability to stay focused. Observers and students alike expressed concerns about the excessive workload, information overload, and the diminishing focus throughout the semester.	**Too much Content** **Overload** **Lack of Focus**

Throughout the semester, there was limited interaction between the students and the professor, as well as among the students themselves. The professor made efforts to initiate communication by sending welcome emails and introducing themselves at the beginning of each session, but the students did not respond immediately. During the lectures, only four messages from students were received, mainly focusing on technical issues, the pace of the lectures, the need for breaks, and difficulties in understanding the material. One student specifically mentioned that the lecture was too fast for them to follow and suggested a slower pace for future sessions. They also expressed the challenge of staying engaged for the entire 90-minute duration without a break. Another student raised a question regarding a specific concept, but unfortunately, there were no responses from the professor or other students. In terms of administrative matters, one message addressed the issue of lecture recordings, while another raised concerns about the workload and the class exceeding the allotted time. Interestingly, there were no messages directly related to the content of the lectures, likely due to time constraints. One chat message, which received two likes, highlighted the preference of many students to watch the lecture recordings afterwards. This allowed them to pause the lecture and take better notes. Additionally, the message emphasized the difficulty of maintaining concentration and attentiveness throughout the full 90 minutes without a break. Concerning the upcoming exam, three messages were posted in the chat. The first asked if a specific program was required, the second inquired about the exam date, and the third questioned the availability of exam examples. The first question received an immediate response, while the others were addressed towards the end of the session. Outside of the lecture recordings, the professor engaged in one-sided communication through email, responding to student queries. Furthermore, the professor expressed their hope that students had watched a video prepared as part two of a previous class and encouraged them to seek answers to their questions via email or exercise sessions. Verbal feedback from a previous exercise session indicated that the slides used in the lectures were still overloaded with information. The professor made multiple references to the decreasing number of students participating in the sessions and even questioned whether it was their fault. One student responded to this query, presumably offering an explanation or reassurance. The professor also mentioned uploading necessary content on Moodle, an online learning platform,	**Interaction Feedback**

and expressed a desire for increased student participation in the current session. Additionally, the professor mentioned their intention to complete the class for the recording, even if it meant exceeding the scheduled time. In summary, the interaction between the students and the professor, as well as among the students themselves, was limited throughout the sessions. The professor made efforts to communicate through welcome emails and personal introductions, but there were minimal immediate responses from the students. Students raised concerns about the lecture pace, the need for breaks, and difficulties in understanding the material. Administrative matters, such as exam-related inquiries, were also addressed. The professor provided feedback through email and acknowledged the decreasing student participation. The issue of overloaded slides and the desire for increased student engagement were also highlighted by the professor.	

Appendix I

Analytical Codes for All Code Concepts.

Attendance

The attendance of students was applied to any text segment containing the words ‘participate’ or ‘participation’, ‘join’, ‘attend’, ‘active’, ‘be present’, ‘take part’, ‘engage’, and similar terms.

Teaching Style

The teaching style was applied to any text segment containing the words ‘applying’ ‘lecturing’, ‘didactically’, ‘approaching’, ‘pedagogically’, ‘instructionally’, ‘teaching’, ‘methodically’, ‘educational’, ‘classroom technique’, ‘learning strategy’, ‘instructional style’, and similar terms.

Usage of media

The usage of the media of the lecturers was applied to any text segment containing the words ‘multimedia’, ‘using’, ‘incorporating’, ‘integrating’. ‘technological’, ‘audio visually’, digital’, ‘interactively’, ‘application’, ‘utilisation’, and similar terms.

Work materials

The application work materials of the lecturers were applied to any text segment containing the words ‘instructions’, ‘teaching resources’, ‘learning tools’, ‘course materials’, ‘handouts’, ‘supplementing’, ‘training materials’, and similar terms.

Student Characteristics

The characteristics of the students were applied to any text segment containing the words ‘act’, ‘active’, ‘engagement’, ‘engage, ‘participate’, ‘participation’, involvement’, ‘involve’, ‘behave’, ‘behaviour’, ‘attitude’, and similar terms.

Gender

No Analytical Code Report was created for the code concept ‘Gender’.

Participation

The participation of the students was applied to any text segment containing the words ‘active’, ‘participate’, ‘involve’, ‘involvement’, ‘engage’, ‘engagement’, ‘contribute’, ‘contribution’, ‘participation’, ‘collaboration’, ‘collaborate’, ‘interact’, ‘interaction’, ‘presence’, and similar terms.

Instructor Characteristics

The characteristics of the lecturers were applied to any text segment containing the words ‘teacher’, ‘teaching’, ‘educating’, ‘instructing’, ‘skills’, ‘characteristics’, ‘pedagogical traits’, ‘qualities’, ‘educator’, and similar terms.

Communication Inside of Class: Interaction with Professor (Example in Thesis)

The communication inside the class with the professor was applied to any text segment containing the words ‘interact’ or ‘interaction’, ‘ask’ or ‘asked’, ‘question’, ‘answer’, ‘response’, ‘reaction’ or ‘react’, ‘suggest’, ‘raise hands’ or ‘hands up’, ‘feedback’ and similar terms.

Communication Inside of Class: Interaction with Students

The communication inside the class with the professor was applied to any text segment containing the words ‘communicate’, ‘chat’, ‘react’, ‘peer communication’, ‘student-student interaction’, ‘classroom collaboration’, ‘collaborate’, ‘discuss’, ‘group discussion’, ‘collaborative learning’, ‘interactions among students’, ‘student-student communication’, ‘dialogue’, and similar terms.

Communication Outside of Class: Interaction with Professor

The communication inside the class with the professor was applied to any text segment containing the words ‘emailing’, ‘communication’, ‘communicating’, ‘consulting’, ‘communicating’, ‘guiding’, ‘guidance’, ‘interact’, ‘interaction’, ‘discussion’, ‘teacher-student interaction’, ‘instructor availability’, and similar terms.

Communication Outside of Class: Interaction with Students

The communication inside the class with the professor was applied to any text segment containing the words ‘group projects’, ‘collaboration’, ‘study group’, ‘interaction’, ‘teamwork’, ‘peer communication’, ‘student-student interaction’, ‘collaborative work’, ‘interaction with classmates’, ‘collaborative learning’, and similar terms.

Self-learning Phase

The communication inside the class with the professor was applied to any text segment containing the words ‘independently’, ‘studying alone’, ‘independent study’, ‘individual learning’, ‘autonomous learning’, ‘self-directed learning, ‘personal study time’, ‘independently’, ‘independent’, ‘individually’, ‘individual’, ‘exploring’, ‘conducting’, ‘homework’, ‘repeating’, and similar terms.

Learning success

The communication inside the class with the professor was applied to any text segment containing the words ‘achieve’, ‘know’, ‘knowing’, ‘knowledge acquisition’, ‘learning, ‘learning progress’, ‘achieving’, ‘achievement’, and similar terms.

Competencies

The communication inside the class with the professor was applied to any text segment containing the words ‘skilled’, ‘developing’, ‘development’, ‘proficiency’, ‘competence acquisition’, ‘capability building’, ‘aptitude development’, ‘expertise enhancement’, ‘mastering’, ‘acquiring’, ‘competent’, and similar terms.

Future Skills

The communication inside the class with the professor was applied to any text segment containing the words ‘employability’, ‘transfer’, ‘transferable’, future-ready’, ‘future workforce competencies’, ‘emerging skills’, ‘interdisciplinary’, ‘forward-looking capabilities’, next-generation skills’, future-oriented proficiencies’, ‘skills for tomorrow’, and similar terms.

Appendix K

Analysis Summary of the ADDIE Process.

1. Assessment of Performance

The actual performance was measured by the researcher through a participant observation (see study 1). Through the analysis of the data using a variant of grounded theory by Schatzman and Strauss (1973) and given literature, the extent of the performance gap was determined, and the primary causes identified. This was possible, as the researcher herself is a practicing lecturer and has therefore expert knowledge of the teaching process. Lastly, the performance discrepancy can be traced back to the lack of knowledge and skill of the performing lecturers and not a lack of resources or motivation. Performance gaps caused by a lack of knowledge and skill indicate the resources to perform the desired task are evident and the individual is willing to perform the desired task; however, the intellectual skill or psychomotor skill to perform as desired is not evident. Thus, instruction may be the best response.

2. Statement of Purpose

The aim of the didactic interventions is to provide valuable methods to improve the current instructional design in blended learning at Macromedia University of Applied Sciences and thereby increase the learning experience and learning outcomes of students in higher education in the long term.

3. List of Instructional Objectives

Due to the existing curriculum, the overall learning objectives are already predefined (see 4.2.1.1 & 4.2.1.2). Nevertheless, based on them and student's needs compiled from literature and empirical data, the objectives for the interventions The instructional objectives for the interventions are designed to address the students' needs and align with their learning preferences. The literature and empirical data suggest that students require student-centred learning and collaboration, along with practical, relevant, and engaging information. They also value the use of advanced technology, visual-based learning, and effective utilization of tools and technologies.

The overarching goal of the interventions is to transform students into active learners who can communicate their needs and interests to their teachers, leading to increased success. The objectives aim to improve students' competencies and develop future skills such as self-learning and self-management.

The specific instructional objectives include:

- L1: State the aims, structure, and steps of a research process, as well as possible research methods (competence level 1).
- L2: Name the basics of descriptive and inductive statistics, including basic concepts, scale levels, empirical distributions, mean measures, measures of dispersion, probability, and test procedures (competence level 1).
- L3: Analyse properties of functions (competence level 4).
- L4: Explain the quality criteria of an empirical investigation and their importance for the validity of research results (competence level 2).

- L5: Discuss the suitability, advantages, and disadvantages of survey methods such as interview, observation, and content analysis in empirical social research (competence level 3).
- L6: Apply descriptive and inductive statistical analysis in empirical economic and social research (competence level 3).
- L7: Evaluate the plausibility of conclusions in an empirical study based on available data (competence level 5).
- L8: Design hypotheses on media research issues and develop appropriate research designs, including survey and evaluation methods (competence level 6).

By targeting these objectives, the training program aims to provide a student-centred and collaborative learning environment that offers practical and relevant information. It also focuses on using advanced technology and visual-based learning approaches to enhance the effectiveness, efficiency, and enjoyment of the learning process. Ultimately, the program seeks to improve students' competencies and equip them with valuable future skills, such as self-learning and self-management.

4. Learner Analysis

The learner analysis provides insights into the characteristics of the student group that participated in the surveys conducted during the winter semester of 2021/22 and the summer semester of 2022. The analysis includes information about the participants' demographics, experience level, attitude, and skills that may impact the training delivery system. Here is a summary of the learner analysis based on the provided data:

- **Learner Group Identification**
  - Participants: The surveys included a total of 191 students in the winter semester of 2021/22 and 660 students in the summer semester of 2022.
  - Locations: The students were from seven different locations in Germany.
- **General Characteristics**
  - Age: The age range of the participants is from 18 to 27 years old, with the majority falling between 19 and 21 years old. The most common age group is 20 years old (39.1%).
  - Gender: The majority of participants identified as female (71.8%), followed by male participants (23.6%). One participant identified as diverse.
- **Experience Level**
  - Semester: The analysis indicates that the majority of participants (85.1%) were in the second semester of their bachelor's degree. There were participants from various semesters, ranging from the second to the seventh.
- **Attitudes and Skills**
  - Digital Media Usage: The learner group, which belongs to Generation Z, is surrounded by digital media daily. They spend significant time using multimedia platforms such as smartphones, tablets, and social media applications.
  - Loneliness: Despite being constantly connected through digital media, the learner group experiences high levels of loneliness. Approximately 79% of Generation Z students feel lonely, which can lead to mental health problems.

    - Competence: Lack of knowledge about how to use media properly is identified as a contributing factor to the increase in mental health problems. Building media competence among this learner group may be essential.
- **Comparison of Quantitative Data**
    - A total of 173 students participated across the two surveys, with 86 of them answering all the questions. This comparison allowed for conclusions to be drawn about the value of interventions.

Based on the learner analysis, it can be inferred that the target group of this dissertation is Generation Z students, aged between 18 and 27, studying at various locations in Germany. They have significant exposure to digital media but also experience feelings of loneliness. Understanding their attitudes, skills, and challenges related to media usage and competence will be crucial for designing effective training interventions.

5. Resources Required

The training program requires various resources to support effective instruction and learning. These resources can be categorized into content resources, technology resources, instructional facilities, and human resources.

- **Content Resources**
    - Curriculum: A structured plan outlining the topics, learning objectives, and sequencing of the interventions.
    - PowerPoint slides: Visual presentations to support instructional delivery and provide key information.
    - Scripts: Written materials that guide the instructors in delivering the content effectively.
    - Exam: Assessment materials to evaluate students' understanding and knowledge retention.
- **Technology Resources**
    - Moodle: A digital learning environment that serves as a platform for course management, content delivery, and student engagement.
    - MS Teams: Communication and collaboration tool that enables real-time interaction and virtual meetings.
    - Blackboard Ultra: A learning management system that facilitates content delivery, assessments, and student engagement.
    - Blackboard Collaborate: Web conferencing tool for synchronous online sessions and virtual classrooms.
    - Additional tools for learning: Various software applications, online resources, and multimedia materials used to enhance learning experiences.
- **Instructional Facilities**
    - Digital learning environment: Online platforms and systems that provide access to digital content, discussion forums, and collaborative activities.
    - Rooms on campus: Physical spaces equipped with technology and resources for face-to-face instruction and group work.
- **Human Resources**

- Professor: The main instructor and academic expert responsible for overseeing the training program.
- Lecturers: Additional subject matter experts who assist in delivering specific topics and supporting student learning.

These resources work together to create an effective training program, where content resources provide the necessary information and structure, technology resources facilitate digital learning and communication, instructional facilities provide physical and digital learning spaces, and human resources ensure effective instruction and guidance throughout the program.

6. Possible Delivery Systems

The training program utilizes various delivery systems, each with a specific length of time allocated for instruction. These delivery systems include fully online, fully on campus, and a specific intervention called SoML (Simulation-oriented Micro-Learning).

- In Scenario A, the training is delivered fully online, allowing students to access the course materials and participate in learning activities remotely. The duration of this online session is 90 minutes, providing an adequate timeframe for instruction, engagement, and interaction within the virtual environment.
- Scenario E involves the training being conducted fully on campus, where students attend face-to-face sessions. The duration of this on-campus session is 105 minutes, providing additional time for in-person discussions, group activities, and practical exercises.
- The SoML intervention, a specific component of the training program, is designed to be concise and focused. It typically takes less than 10 minutes to complete. The intervention utilizes simulation-oriented micro-learning units, which are brief but impactful learning experiences that can range from a few seconds to three minutes in length. While the preferred timeframe for a micro-learning unit is within this range, it is also acceptable for it to extend up to 10 minutes, as stated by industry research.

By utilizing a combination of fully online and fully on-campus delivery systems, along with the targeted SoML intervention, the training program offers flexibility in terms of delivery modes and timeframes. This allows for effective instruction and engagement while accommodating different learning preferences and logistical considerations.

7. Project Management Plan

- **Project Overview**
  The project aims to design and deliver comprehensive interventions to enhance students' learning experience and outcomes. The interventions will cater to a diverse group of learners comprising 660 students from seven locations in Germany during the summer semester of 2022. The project will utilize a combination of online and on-campus delivery systems, with a focus on student-centred learning, collaboration, and the use of technology to enhance engagement and learning outcomes.
- **Project Objectives**
  - Develop and implement a training program that addresses the specific learning needs of the target student group.

- Enhance students' understanding and application of research methods, statistical analysis, and empirical investigation.
- Foster student-centred learning, collaboration among students and with the instructors, and the effective use of technology in the learning process.
- Improve students' competencies in critical thinking, problem-solving, and data analysis.
- Promote the development of future skills such as self-learning and self-management among the students.

- **Project Scope**

The project will encompass the following key components:

- Curriculum development: Designing a structured curriculum that includes learning objectives, content resources (PowerPoint slides, scripts, exams), and assessment criteria.
- Delivery systems: Implementing fully online and fully on-campus sessions to accommodate different learning preferences and logistical considerations.
- Technology resources: Utilizing Moodle, MS Teams, Blackboard Ultra, and Blackboard Collaborate, along with additional tools for learning, to facilitate content delivery, communication, collaboration, and engagement.
- Instructional facilities: Leveraging digital learning environments and physical rooms on campus to support the delivery of training sessions and student activities.
- Human resources: Assigning a professor and lecturers to deliver the interventions, provide guidance and support, and ensure effective instruction.

- **Project Timeline**
  - Curriculum development: Weeks 1-4
  - Online session preparation: Weeks 5-6
  - On-campus session preparation: Weeks 7-8
  - Interventions delivery: Weeks 9-24
  - Assessment and evaluation: Weeks 25-26
- **Project Team**
  - Course Coordinator: Responsible for overall project coordination, planning, and monitoring.
  - Curriculum Development Team: Comprises the subject matter expert (SME), the instructional designer (researcher), and the dean who collaborate to develop the training curriculum.
  - Technology Support Team: Provides technical expertise and support for the implementation and management of the online platforms and tools.
  - Instructor Team: Consists of the professor and lecturers who deliver the interventions and provide guidance to the students.
  - Evaluation Team: Conducts assessments and evaluates the effectiveness of the training program based on student feedback and learning outcomes.
- **Project Risks**
  - Technical issues or limitations with the online platforms and tools.

    - Challenges in coordinating and scheduling on-campus sessions across multiple locations.
    - Resistance to change or limited student engagement in the online learning environment.
    - Time constraints and workload management for the project team members.
- **Project Communication**
    - Regular meetings and updates among the project team members to discuss progress, address challenges, and make necessary adjustments.
    - Ongoing communication with students through Moodle, Blackboard, and other communication channels to provide instructions, support, and clarify any queries.
- **Project Evaluation**
    - Continuous assessment of the training program's effectiveness through student feedback, performance in exams, and achievement of learning objectives.
    - Periodic evaluation of the delivery systems, content resources, and technology tools to ensure they align with the project objectives and meet the students' needs.

By following this Project Management Plan, the interventions will be successfully implemented, providing students with a comprehensive and engaging learning experience that enhances their competencies in research methods and statistical analysis.

Appendix L

Goal Inventories Summary of the ADDIE Process after Branch (2009).

1. Purpose Statement

The didactic interventions aim to provide valuable methods to improve the current instructional design in blended learning at Macromedia University of Applied Sciences and thereby increase the learning experience and learning outcomes of students in higher education in the long term.

2. Instructional Goals

(1) Describe to the students the interventions and their function, and the role of the researcher.
(2) Explain to them the changes in the curriculum, lesson design, and applied digital learning tools.
(3) Prepare a lesson plan together with the researcher that seamlessly integrates the interventions.
(4) Teach the course 'Empirical Research and Statistics' using the implemented interventions.
(5) Evaluate the quality of the new lesson design through the researcher's participant observation.

3. Essential Tasks

(1) Conduct a comprehensive review and analysis of the current instructional design in blended learning at Macromedia University of Applied Sciences.
(2) Identify areas for improvement and determine the specific interventions required to enhance the learning experience and outcomes of students.
(3) Develop a clear understanding of the function and purpose of the interventions and their role in the instructional design.
(4) Collaborate with the researcher to understand the changes in the curriculum, lesson design, and digital learning tools that will be implemented.
(5) Familiarize oneself with the new interventions and their integration into the lesson plan.
(6) Work closely with the researcher to create a lesson plan that seamlessly incorporates the interventions, ensuring alignment with learning objectives and desired outcomes.
(7) Acquire a thorough understanding of the course "Empirical Research and Statistics" to be taught using the implemented interventions.
(8) Prepare and organize the necessary resources, materials, and technology tools required for effective delivery of the course.
(9) Implement the new interventions during the course, ensuring proper communication and guidance to the students.
(10) Facilitate active learning and engagement among the students, making use of the interventions to enhance their understanding and application of empirical research and statistics.
(11) Collaborate with the researcher in conducting participant observation to evaluate the quality of the new lesson design and gather valuable feedback.

(12) Reflect on the observations and feedback received, making necessary adjustments and improvements to the instructional design and interventions as needed.

4. Prerequisite Tasks

(1) Thoroughly familiarize oneself with the current instructional design, curriculum, lesson plans, and digital learning tools in use at Macromedia University of Applied Sciences.

(2) Conduct a needs analysis or assessment to identify the specific challenges and areas for improvement in the current instructional design and learning experience.

(3) Review relevant literature and research on instructional design, blended learning, and effective teaching strategies to gain a comprehensive understanding of best practices and approaches.

(4) Familiarize oneself with the goals and objectives of the course "Empirical Research and Statistics" and the desired learning outcomes for the students.

(5) Gather data and feedback from previous students or stakeholders regarding their experiences with the current instructional design and areas they feel need improvement.

(6) Collaborate with instructional designers or educational technologists to gain insights into the existing digital learning tools and technologies used at the university.

(7) Identify any institutional policies, guidelines, or constraints that may impact the implementation of new interventions and ensure compliance with relevant regulations.

(8) Assess the availability and accessibility of necessary resources, materials, and technology tools to support the implementation of the interventions.

(9) Engage in professional development or training opportunities to enhance knowledge and skills in instructional design, pedagogy, and the use of technology in education.

(10) Establish effective communication and collaboration channels with the researcher, instructional support staff, and other stakeholders involved in the project.

(11) Seek support and approval from relevant authorities or decision-makers within the university to implement the proposed interventions and make necessary changes to the curriculum or lesson plans.

Appendix M

Design Brief of the ADDIE Process after Branch (2009).

1. Task Inventory

Purpose Statement: The purpose of the didactic interventions is to improve the current instructional design in blended learning at Macromedia University of Applied Sciences, aiming to enhance the learning experience and outcomes of students in higher education in the long term.

Instructional Goals:

(1) Describe the interventions and their function, along with the role of the researcher, to the students.
(2) Explain the changes in the curriculum, lesson design, and digital learning tools to the students.
(3) Collaborate with the researcher to develop a lesson plan that seamlessly integrates the interventions.
(4) Teach the course "Empirical Research and Statistics" using the implemented interventions.
(5) Evaluate the quality of the new lesson design through participant observation by the researcher.

Primary Performance Tasks:

- Task 1: Deliver a presentation to students, describing the interventions and the researcher's role.
- Task 2: Conduct a detailed explanation of the changes in the curriculum, lesson design, and digital learning tools.
- Task 3: Collaboratively develop a lesson plan with the researcher, ensuring the effective integration of the interventions.
- Task 4: Teach the "Empirical Research and Statistics" course using the implemented interventions.
- Task 5: Participate in participant observation conducted by the researcher to evaluate the quality of the new lesson design.

Prerequisite Knowledge and Skills:

- Familiarity with the current instructional design and challenges in blended learning at Macromedia University.
- Understanding of instructional goals and desired learning outcomes for the course "Empirical Research and Statistics".
- Knowledge of relevant pedagogical approaches, instructional strategies, and digital learning tools.
- Proficiency in teaching methods and techniques for higher education settings.

2. Performance Objectives

- Objective 1: After the presentation, students will be able to accurately describe the interventions and understand the researcher's role.
- Objective 2: Students will be able to explain the changes in the curriculum, lesson design, and digital learning tools, demonstrating a clear understanding.

- Objective 3: Students, in collaboration with the researcher, will develop a lesson plan that effectively integrates the interventions.
- Objective 4: By the end of the course, students will demonstrate competence in applying the implemented interventions while teaching “Empirical Research and Statistics”.
- Objective 5: Through participant observation, the researcher will evaluate the quality of the new lesson design based on predefined criteria.

3. Test Items

- Test Item 1: Provide a written summary of the interventions discussed in the presentation.
- Test Item 2: Write a reflective essay explaining the impact of the changes in the curriculum, lesson design, and digital learning tools.
- Test Item 3: Present the developed lesson plan, highlighting the seamless integration of the interventions.
- Test Item 4: Conduct a simulated teaching session, demonstrating the effective use of the implemented interventions.
- Test Item 5: Evaluate and provide constructive feedback on the new lesson design based on the researcher’s observation.

4. Testing Strategy

- Pre-test: Assess students’ knowledge and understanding of the current instructional design and challenges in blended learning.
- Formative Assessment: Monitor students’ progress throughout the intervention implementation and course teaching.
- Summative Assessment: Evaluate students’ performance in the final tests and the researcher’s evaluation of the new lesson design.

5. Cost–Benefit Calculation

- Costs: Time and resources invested in developing and implementing the interventions, conducting participant observation, and evaluating the new lesson design.
- Benefits: Improved instructional design, enhanced learning experience, and increased learning outcomes for students in higher education in the long term, potentially leading to better student engagement and success.

Appendix N

Intervention 1: Increase Retention (at the beginning of the exercise).

The 'Increase Retention' intervention was designed to reinforce content from the online lecture by incorporating it into the exercise sessions. The objective was to provide students with an opportunity to recall key terms and concepts through collaborative activities. To maximize the effectiveness of this intervention, several strategies were employed.

Firstly, the exercise was strategically positioned at the beginning of the on-site session to leverage the primary and recency effects. By placing the exercise early on, students were more likely to remember the information presented. Additionally, the exercise timeframe was carefully managed based on the principles of cognitive load theory, ensuring that students could focus their attention on the task at hand.

Through the collaborative exercise, students were able to engage in recalling and repeating knowledge together, facilitating situated learning at the foundational level of Bloom's Taxonomy. This approach encouraged active participation and deeper understanding of the content.

To support the intervention, specific media were selected for each stage of the exercise. At the beginning, PowerPoint slides were used to provide an overview and set the context. The main content was delivered using the interactive presentation tool Mentimeter, which allowed for engaging and dynamic presentations. The whiteboard was utilized for practice, feedback, and closure, providing a versatile platform for interactive learning experiences.

The exercise sessions were designed to have a smooth transition from one learning episode to the next. Following the introductory exercise, the next phase involved reviewing the student quiz, which served as the central content for each on-site exercise. This ensured continuity and progression in the learning process, reinforcing the material covered and allowing students to assess their understanding.

In summary, the 'Increase Retention' intervention incorporated content repetition from the online lecture into the exercise sessions. By strategically positioning the exercise at the beginning of the on-site session and employing effective instructional media, students were able to recall and reinforce key concepts collaboratively. The integration of situated learning and a smooth transition between learning episodes facilitated a comprehensive and engaging learning experience.

For the learning episode, see Table 46 on page 218.

Intervention 2: Repeat Content (at the end of the online session).

To enhance students' comprehension of the course's complex content, a strategy of content repetition was employed at the conclusion of each online session. This repetition served to reinforce key concepts and provide a solid foundation for the upcoming exam. By condensing the content into succinct 'In a Nutshell' slides, students were presented with bite-sized summaries that encapsulated the essential information. The creation of these 'In a Nutshell' slides was a collaborative effort between the SME and the researcher. This ensured that the slides accurately captured the core content and aligned with the learning objectives of the

course. Importantly, these slides also formed the basis for both a nationwide student quiz and the end-of-semester exam.

Adhering to the principles of constructive alignment, the exam exclusively covered the content presented in the 'In a Nutshell' slides. This approach ensured alignment between the intended learning outcomes, the instructional methods employed, and the assessment of students' knowledge and understanding. Furthermore, by integrating moments for questions and discussion within the repetition of content, students were provided with opportunities to clarify any uncertainties and engage in meaningful dialogue. This active engagement fostered a deeper understanding of the subject matter and facilitated the exchange of ideas among students and the instructor.

In summary, the implementation of content repetition through 'In a Nutshell' slides served as a valuable tool in reinforcing the course material, preparing students for the exam, and creating an environment conducive to interactive learning. By focusing on these concise summaries and providing avenues for questions and discussions, students were equipped with the necessary foundation to succeed in their assessments and develop a robust understanding of the course content.

Learning Episode of the Intervention at the End of the Online Session: 'Repeat Content'

Event	**Instructional Strategy**	**Lecturer or Student**	**Media**
Motivation	Based on the primary and recency effect and situated learning, the content was repeated at the end of every online session is aimed at remembering key aspects from the lecture using constructive alignment and social interaction in an ML activity.	Student: Forms concluding thoughts about the content of the course.	PowerPoint slides
Objective	Be familiar with the content and the exam.	Lecturer: Informs the students that they will be expected to remember the content of the 'In A Nutshell' slides for answering the student quiz and the final exam.	
Prerequisite	Define the exact task (max. 1) and time frame (max. 3 minutes).	Student: Contributes to the online session by following the lecturer's instructions.	

Content	Introduction: This summary is intended to provide you with the most important aspects of the course relevant to the examination. Please ask questions if you are unclear.	Lecturer: Presents the task and timeframe.	Mentimeter
	Concept	Student: Asks questions and discusses them to better understand the content from the previous online session.	
	Theory	Lecturer: Answers questions and directs student's attention to content that is specifically relevant.	
	Practice	Student: Recalls knowledge and skills already possessed about the topic.	
Guided Practice	Question what you learn in the course and during self-study time and consolidate the concept behind it.	Lecturer: Provides valuable insights into key terms, relevance to the exam and explains related concepts.	Whiteboard
Independent Practice	Repeat what you have learned and do the student quiz during self-study time.	Student: Saves slides to repeat them for answering the quiz during self-study time.	
Feedback	Provide opportunities for the students to come back to the teachers if they have any questions.	Teacher or Student: a. Suggests alternatives to reach out during self-study time or formal learning time. b. Provides contact possibilities.	

Assessment	Inform the student about her or his performance relative to the objective criteria.	Teacher: Provides additional explanations about previous quizzes and what students got correct and the things that were commonly mistaken. Provides insights about previous exams and difficulties students had.	
Closure	Summarize and reinforce the following ideas: • What were the key questions and insecurities? • What should be emphasized? • What is important for the next session?	Student: Takes notes, saves the slides and reviews both in preparation for the quiz and following learning episode.	

Intervention 3: Repeat Content (in the self-study time and exercise).

To address the challenges of both lack of revision and content overload, a strategy of repeating content was implemented during the self-study time and exercise sessions. This approach aimed to provide students with opportunities to review and reinforce their understanding of the course material.

To reduce content and ensure a manageable workload, a collaborative process involving the SME and the researcher was undertaken. By consulting the curriculum and considering the expertise of the SME, content was selectively shifted from synchronous frontal sessions to asynchronous self-learning phases. However, it was recognized that students in lower semesters may struggle with self-directed learning, so it was crucial to emphasize motivation, reward, and attention to support their engagement. Gamification elements were identified as suitable tools to enhance motivation and facilitate a stronger connection between the lecture, self-learning phase, and exercise components.

The reduction and displacement of content to the asynchronous self-study time allowed for increased retention through repetition opportunities. By incorporating gamification elements, such as quizzes or interactive activities, students were encouraged to actively engage with the material while learning at home. These gamified learning experiences provided a basis for reinforcing key concepts and enhancing long-term retention. The goal of this approach was twofold: to reduce content overload and increase retention of the course material. By focusing on content reduction during the expert session, students were presented with a more manageable

amount of information, as determined through consultation with the SME and alignment with the curriculum.

In summary, the incorporation of content repetition in the self-study time and exercise sessions, along with the integration of gamification elements, aimed to address the challenges of lack of revision and content overload. By strategically reducing and displacing content, students had the opportunity to engage in self-directed learning and reinforce their understanding. The gamification aspects provided motivation and rewards, fostering active participation, and enhancing the linkages between different components of the course. Through these efforts, the goal of reducing content and increasing retention was achieved while maintaining a balanced and effective learning experience.

Learning episode of the intervention during the exercise and self-study time: 'Repeat Content'

Event	**Instructional Strategy**	**Lecturer or Student**	**Media**
Motivation	Based on the forgetting curve content was repeated during the self-study time and every on-site exercise session to apply the knowledge gained from the previous lectures using collaboration, social learning, constructive alignment, and gamification aspects in an ML activity.	Student: Forms initial understanding about the content of the course.	PowerPoint slides
Objective	Be familiar with the content and implementation of the quiz.	Lecturer: Informs the students that they will be expected to apply the content from the last online session.	
Prerequisite	Define the exact task (max. 1) and time frame (max. 3 minutes).	Student: Contributes by conducting the quiz during self-study time and to the exercise by following the lecturer's instructions.	
Content	Introduction: This quiz aims to make you apply constructively aligned knowledge from the last online session.	Lecturer: Presents the task and timeframe.	Mentimeter

	Concept	Student: Applies knowledge that has already been remembered and understood.	
	Theory	Lecturer: Directs student's attention to content that is specifically relevant.	
	Practice	Student: Applies knowledge and understanding possessed about the topic in an gamified formal learning environment.	
Guided Practice	Scrutinize the questions and answers of the quiz and discuss the concepts behind them.	Lecturer: Discusses a variety of content related to the quiz questions, students' answers, and related concepts.	Whiteboard
Independent Practice	Apply the appropriate knowledge and skills.	Student: Proposes appropriate answers and objections based on her or his knowledge.	
Feedback	Provide opportunities for the students to correct their answers.	Teacher or Student: a. Suggests alternatives to achieve the same results. b. Provides "what if" questions.	
Assessment	Inform the student about her or his performance relative to the objective criteria.	Teacher: Provides additional explanations about what most students got correct and the things that were commonly mistaken.	
Closure	Summarize and reinforce the following ideas:	Student: Takes notes and reviews them in preparation for the	

	• What was the common knowledge applied? • What was missing? • What is important for this session and future self-study time?	next learning episode.	

Intervention 4: Increase Interaction (and scheduled breaks in the online session).

To optimize the learning experience and outcomes, several measures were implemented during the expert sessions. The pace of the sessions was adjusted by reducing the amount of content covered, allowing for more time to delve into topics in greater depth. This decision was made in consultation with the SME and aligned with the curriculum requirements. To ensure an effective learning environment, planned breaks were incorporated at regular intervals, typically occurring after 20-30 minutes. These breaks served as opportunities to address any questions that arose during the session, enabling timely clarification and fostering interactive discussions.

Furthermore, emphasis was placed on fostering timely and meaningful interaction between the professor and students within the session. The professor actively engaged with students, addressing their queries promptly and providing relevant explanations. Additionally, avenues for students to ask questions were made available via email and during exercise sessions, ensuring that their concerns were addressed comprehensively. To support these efforts, a new learning platform was introduced, featuring integrated assessment tools. This platform facilitated the seamless integration of assessments into the learning process, allowing for continuous evaluation of students' understanding and progress. Moreover, to ensure efficient time management, the learning platform was designed to automatically terminate sessions that exceeded the allotted time by five minutes.

By implementing these measures, the aim was to create an engaging and interactive learning environment that fostered deep understanding and active participation. The reduced pace, scheduled breaks, timely interaction, and the integration of assessment tools through the new learning platform contributed to an enhanced learning experience for students, promoting effective knowledge acquisition and skill development.

Learning episode of the intervention during the online session: 'Increase Interaction'

Event	**Instructional Strategy**	**Lecturer or Student**	**Media**
Motivation	Based on the forgetting curve and situated learning, the online session is subdivided into three parts to	Student: Refocuses and forms thoughts about the content of the course.	PowerPoint slides

	increase the focus and provide room for questions using collaborative aspects in an ML activity.		
Objective	Be familiar with the content, the course instruction, and its implementation.	Lecturer: Informs the students that they will be expected to write questions into the chat during the online session.	
Prerequisite	Define the exact task (max. 1) and time frame (max. 3 minutes).	Student: Contributes to the online session by following the lecturer's instructions.	
Content	Introduction: This intervention aims to make you refocus and ask questions about the current online session and related topics.	Lecturer: Presents the task and timeframe.	Mentimeter
	Concept	Student: Shares questions and concerns about content, exam, and other related topics.	
	Theory	Lecturer: Motivates students to ask questions and to take active breaks.	
	Practice	Student: Ask specific questions about the topic and take breaks.	
Guided Practice	Collaborate in the formal learning environment to share concerns and understanding of the topic.	Lecturer: Discusses a variety of content related to the questions and related concepts.	Whiteboard
Independent Practice	Take active break and reflect on possible questions to ask in the chat during the online session.	Student: Proposes appropriate questions and feedback.	

Feedback	Provide opportunities for the students to ask further questions outside the session.	Teacher or Student: a. Suggests alternatives to answer questions and increase knowledge. b. Provides learning alternatives such as scrips or short videos (ten-minute-tutorials).	
Assessment	Inform the student about her or his performance as part of the community of practice.	Teacher: Provides additional explanations about the content in question.	
Closure	Summarize and reinforce the following ideas: • What were the questions? • What was still unclear and should be forwarded to the exercise or self-learning phase? • What is important for the next session?	Student: Takes notes, watches tutorials, and reflects on possible further questions in preparation for the next learning episode.	

Appendix O

Preparatory Meeting Protocol from 08.03.2022.

Meeting Protocol

Date: 08.03.2022
Time: 12:00 to 13:00
Location: MS Teams

Attendees:
Subject Matter Expert/Professor: Prof. Mothes
Researcher/Instructional Designer: Nanette Willberg

Agenda:

1. Introduction and Welcome
2. Presentation of Final Intervention Implementation
3. Discussion on Implementation Process
4. Clarification of Roles and Responsibilities
5. Planning Next Steps
6. Setting a Follow-up Meeting Date and Time
7. Adjournment

Meeting Proceedings:

Introduction and Welcome:
The meeting is called to order by Prof. Mothes.
Prof. Mothes welcomes Nanette Willberg and expresses appreciation for her work on the instructional design project.

Presentation of Final Intervention Implementation:
Nanette Willberg presents the finalized implementation plan for the interventions.
She shares the details of the instructional strategies, digital learning tools, and curriculum changes to be incorporated.
Prof. Mothes attentively listens and reviews the proposed interventions.

Discussion on Implementation Process:
Prof. Mothes engages in a discussion with Nanette Willberg to gain a comprehensive understanding of the implementation process.
They discuss the timeline, sequence of activities, and any potential challenges or considerations.
Clarification is sought regarding the technical aspects of integrating the interventions into the existing course structure.

Clarification of Roles and Responsibilities:

Prof. Mothes and Nanette Willberg discuss their respective roles and responsibilities in the implementation phase.
They ensure clear delineation of tasks, ensuring that each team member understands their assigned responsibilities.
Any overlapping areas or dependencies are identified and addressed.

Planning Next Steps:
Prof. Mothes and Nanette Willberg discuss the immediate next steps following the preparatory meeting.
They determine the actions required to initiate the implementation, such as resource procurement or communication with other stakeholders.
Key milestones and deadlines are established to track progress.

Setting a Follow-up Meeting Date and Time:
Prof. Mothes and Nanette Willberg agree to schedule a follow-up meeting to monitor the implementation progress and address any emerging issues.
They mutually decide on a suitable date and time for the next meeting.

Adjournment:
Prof. Mothes expresses gratitude to Nanette Willberg for her efforts in developing the instructional interventions.
The meeting is adjourned, and the action items and decisions are documented for future reference.

End of Meeting Protocol

Appendix P

Preparatory Meeting Protocol from 09.03.2022.

Meeting Protocol

Date: 09.03.2022
Time: 15:00 to 16:00
Location: MS Teams

Attendees:
Course Coordinator: Prof. Mothes
Researcher/Instructional Designer: Nanette Willberg
Lecturers (12 out of 16)

Agenda:

1. Introduction and Welcome
2. Recap of Interventions and Implementation Plan
3. Addressing Absent Lecturers
4. Presentation of Additional Video Explanation
5. Discussion and Q&A Session
6. Planning Next Steps
7. Setting a Follow-up Meeting Date and Time
8. Adjournment

Meeting Proceedings:

Introduction and Welcome:
The meeting is called to order by Prof. Mothes.
Prof. Mothes welcomes the lecturers and Nanette Willberg to the meeting.

Recap of Interventions and Implementation Plan:
Nanette Willberg provides a brief recap of the instructional interventions and their implementation plan.
She highlights the main strategies, tools, and curriculum changes to be incorporated in the course.
Lecturers are encouraged to ask questions and seek clarifications.

Addressing Absent Lecturers:
Prof. Mothes acknowledges the absence of four lecturers and notes the importance of their involvement in the implementation process.
The lecturers present are informed about the need to share the information with their absent colleagues and ensure their understanding of the interventions.

Presentation of Additional Video Explanation:

Prof. Mothes shares a pre-recorded video explaining the need for and benefits of the interventions.
The video emphasizes the impact on student learning outcomes and the long-term improvement in instructional design.
Lecturers are encouraged to watch the video and share it with their absent colleagues via the MS Teams group created for sharing between lecturers.

Discussion and Q&A Session:
Lecturers engage in a discussion with Prof. Mothes and Nanette Willberg, asking questions and seeking further clarification on the interventions.
Concerns or challenges raised by the lecturers are addressed, and solutions or suggestions are provided.
The Q&A session aims to ensure that all lecturers have a clear understanding of the interventions and their implementation.

Planning Next Steps:
Prof. Mothes and Nanette Willberg discuss the immediate next steps following the preparatory meeting with the lecturers.
They identify the actions required from both the lecturers and the instructional designer to ensure a smooth implementation.
A timeline is established for completing necessary tasks and delivering required materials.

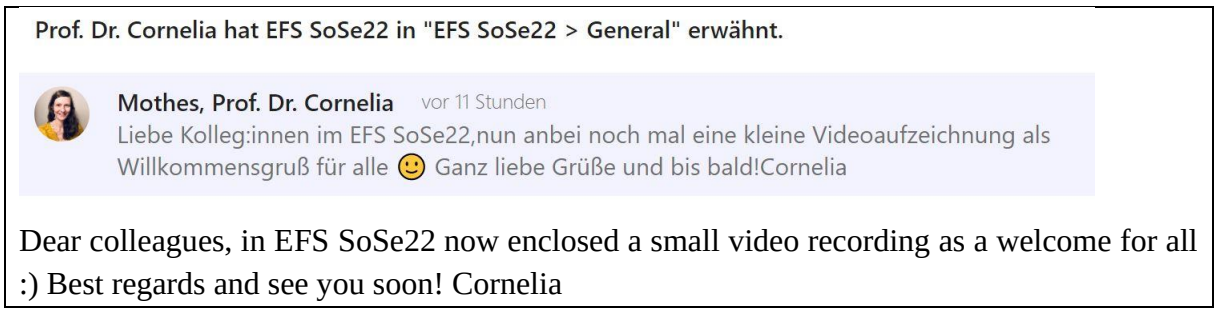
Setting a Follow-up Meeting Date and Time:
Prof. Mothes and Nanette Willberg agree to schedule a follow-up meeting to assess the progress of the implementation and address any further concerns or questions.
They collectively determine a suitable date and time for the next meeting, considering the availability of all relevant parties.

Adjournment:
Prof. Mothes expresses gratitude to the lecturers for their participation and their commitment to implementing the interventions.
The meeting is adjourned, and the necessary actions and decisions are documented for reference.

End of Meeting Protocol

Appendix S

Screenshot and Translation of MS Teams Post "Video for Lecturers"



Dear colleagues, in EFS SoSe22 now enclosed a small video recording as a welcome for all :) Best regards and see you soon! Cornelia

Appendix T

Preparatory Meeting Protocol from 17.03.2022.

Meeting Protocol

Date: 17.03.2022
Time: During the first online lecture
Location: Virtual, cross-campus introductory event

Attendees:
Students
Professor Mothes
Researcher/Instructional Designer: Nanette Willberg

Agenda:

1. Introduction and Welcome
2. Introduction of Nanette Willberg as Subject Didactician
3. Division of Students into Groups
4. Course Offerings and Schedule
5. Overview of the Instructional Design Interventions
6. Q&A Session
7. Conclusion

Meeting Proceedings:
Introduction and Welcome:
The meeting is called to order by Professor Mothes during the first online lecture of the course.
Professor Mothes welcomes the students and introduces the purpose of the meeting.

Introduction of Nanette Willberg as Subject Didactician:
Professor Mothes introduces Nanette Willberg, the researcher and instructional designer, as the subject didactician for the course.
Ms. Willberg briefly explains her role and the purpose of her involvement in improving the instructional design.

Division of Students into Groups:
Professor Mothes informs the students that the 660 enrolled students will be divided into two groups for effective facilitation and interaction.
The groups are determined based on logistical considerations and class size.

Course Offerings and Schedule:
Professor Mothes provides an overview of the course offerings and schedule.
She informs the students that the course will be offered twice per unit, with separate time slots on Thursdays (12:45-14:15 and 15:00-16:30).
The students are instructed to choose their preferred time slot and attend accordingly.

Overview of the Instructional Design Interventions:
Ms. Willberg presents an overview of the instructional design interventions that will be implemented in the course.
She explains the purpose and benefits of these interventions in enhancing the learning experience and outcomes for the students.
Ms. Willberg highlights the importance of active engagement and participation in the learning process.

Q&A Session:
Students are given the opportunity to ask questions about the instructional design interventions, course schedule, or any other related concerns.
Professor Mothes and Ms. Willberg address the questions raised and provide clarifications as needed.

Conclusion:
Professor Mothes concludes the meeting by expressing appreciation for the students' attendance and their commitment to the course.
She encourages the students to actively engage in the upcoming sessions, utilize the instructional design interventions, and take ownership of their learning journey.

End of Meeting Protocol

Preparatory Meeting Protocol from 22.03.2022.

Meeting Protocol

Date: 22.03.2022
Time: 11:30-13:00
Location: Campus in Munich

Attendees:
Students
Professor Schmitt
Researcher/Instructional Designer: Nanette Willberg

Agenda:
1. Introduction and Welcome
2. Introduction of Nanette Willberg as Subject Didactician
3. Overview of the Instructional Design Interventions
4. First Exercise and Implementation of Interventions
5. Q&A Session
6. Conclusion

Meeting Proceedings:
Introduction and Welcome:
The meeting is called to order by Mr. Schmitt during the first exercise on campus in Munich.
Mr. Schmitt welcomes the students and sets the context for the session.

Introduction of Nanette Willberg as Subject Didactician:
Mr. Schmitt introduces Nanette Willberg, the researcher and instructional designer, as the subject didactician for the course.
Ms. Willberg briefly explains her role and the purpose of her involvement in improving the instructional design.

Overview of the Instructional Design Interventions:
Ms. Willberg provides a brief overview of the instructional design interventions that have been implemented in the course.
She highlights the purpose and benefits of these interventions in enhancing the learning experience and outcomes for the students.

First Exercise and Implementation of Interventions:
Mr. Schmitt explains the structure and objectives of the first exercise.
He integrates the introduced instructional design interventions into the exercise, demonstrating their practical application.
Ms. Willberg supports the implementation process and provides guidance as needed.

Q&A Session:
Students are given the opportunity to ask questions or seek clarification about the instructional design interventions or the exercise.
Professor Schmitt and Ms. Willberg address the questions raised and provide further explanations or examples.

Conclusion:
Mr. Schmitt concludes the meeting by expressing appreciation for the students' participation and engagement in the exercise.
He encourages the students to continue utilizing the instructional design interventions in their learning journey.
Ms. Willberg reiterates the importance of active involvement and encourages students to provide feedback on their experience with the interventions.

End of Meeting Protocol

Appendix W

Follow-Up Meetings Protocols from 04.04.2022, 11.05.2022, and 07.06.2022.

Meeting Protocol – Follow-Up Meeting 1

Date: 04.04.2022
Time: 10:00-11:00
Location: MS Teams (Video Call)

Attendees:
Professor Mothes
7 Lecturers
Researcher/Instructional Designer: Nanette Willberg

Agenda:

1. Introduction and Welcome
2. Review of Implemented Interventions
3. Feedback and Discussion
4. Next Steps and Action Plan
5. Conclusion

Meeting Proceedings:
Introduction and Welcome:
The meeting is called to order by Professor Mothes via the MS Teams video call.
Professor Mothes welcomes the attendees and sets the agenda for the follow-up meeting.

Review of Implemented Interventions:
Nanette Willberg provides an overview of the instructional design interventions that have been implemented in the course.
She highlights the key features, benefits, and observed outcomes of the interventions based on initial feedback and observations.

Feedback and Discussion:
Each lecturer shares their experiences and feedback on the implemented interventions.
The group engages in a constructive discussion about the effectiveness, challenges, and potential improvements of the interventions.
Nanette Willberg addresses any questions or concerns raised by the lecturers and provides further clarification or guidance.

Next Steps and Action Plan:
Professor Mothes and Nanette Willberg discuss the next steps to further enhance the instructional design interventions.
They collaboratively identify potential modifications or adjustments based on the feedback received.

Action items are assigned to specific individuals or teams to implement the agreed-upon changes.

Conclusion:
Professor Mothes expresses gratitude to the lecturers and Nanette Willberg for their participation and valuable input.
She emphasizes the importance of their collaboration in continuously improving the instructional design for the benefit of the students.
Nanette Willberg thanks the attendees for their engagement and assures them that their feedback will be taken into consideration during the refinement process.

End of Meeting Protocol

Meeting Protocol – Follow-Up Meeting 2

Date: 11.05.2022
Time: 14:00-15:00
Location: MS Teams (Video Call)

Attendees:
Professor Mothes
5 Lecturers
Researcher/Instructional Designer: Nanette Willberg

Agenda:
1. Introduction and Welcome
2. Review of Progress and Updates
3. Discussion on Challenges and Successes
4. Next Steps and Action Plan
5. Conclusion

Meeting Proceedings:
Introduction and Welcome:
The meeting is called to order by Professor Mothes via the MS Teams video call.
Professor Mothes welcomes the attendees and briefly recaps the purpose of the meeting.
Review of Progress and Updates:
Nanette Willberg provides an update on the progress made since the last meeting.
She highlights any modifications or improvements made to the instructional design interventions based on previous feedback.

Discussion on Challenges and Successes:
The lecturers share their experiences, challenges, and successes encountered while implementing the interventions.

They discuss any issues or concerns that arose during the instructional delivery and provide suggestions for improvement.
Nanette Willberg acknowledges the feedback and addresses any questions or concerns raised by the lecturers.

Next Steps and Action Plan:
Professor Mothes and Nanette Willberg discuss the next steps in refining the interventions.
They identify specific areas that require further attention and discuss strategies to overcome the challenges faced.
Action items are assigned to individuals or teams, along with agreed-upon deadlines for implementation.

Conclusion:
Professor Mothes expresses appreciation to the lecturers and Nanette Willberg for their continued dedication and collaboration.
She emphasizes the importance of their ongoing efforts in enhancing the instructional design for optimal student learning outcomes.
Nanette Willberg thanks the attendees for their valuable input and commits to incorporating their feedback into the instructional design improvements.

End of Meeting Protocol

Meeting Protocol – Follow-Up Meeting 3

Date: 07.06.2022
Time: 14:00-15:00
Location: MS Teams (Video Call)

Attendees:
Professor Mothes
4 Lecturers
Researcher/Instructional Designer: Nanette Willberg

Agenda:
1. Introduction and Welcome
2. Progress Update
3. Discussion on Further Improvements
4. Evaluation and Feedback
5. Next Steps and Action Plan
6. Conclusion

Meeting Proceedings:
Introduction and Welcome:
The meeting is called to order by Professor Mothes via the MS Teams video call.

Professor Mothes welcomes the attendees and provides an overview of the meeting agenda.

Progress Update:
Nanette Willberg presents an update on the progress made since the last follow-up meeting.
She shares any new modifications or enhancements to the instructional design interventions based on previous discussions.

Discussion on Further Improvements:
The lecturers engage in a discussion regarding further improvements that can be made to the interventions.
They share their insights, suggestions, and ideas for enhancing the instructional delivery and learning experience.

Evaluation and Feedback:
The group evaluates the effectiveness of the implemented interventions.
They provide feedback on the impact of the interventions on student engagement, learning outcomes, and overall satisfaction.

Next Steps and Action Plan:
Professor Mothes and Nanette Willberg outline the next steps in refining the interventions based on the feedback received.
They identify specific areas of focus and assign action items to individuals or teams for implementation.

Conclusion:
Professor Mothes expresses gratitude to the lecturers and Nanette Willberg for their continued commitment and collaboration.
She emphasizes the importance of their contributions in continuously improving the instructional design.
Nanette Willberg thanks the attendees for their active participation and valuable insights, ensuring that their feedback will be incorporated into the ongoing enhancements.

End of Meeting Protocol

Appendix X

Evaluation of the Interventions.

Evaluation

Based on the evaluation of the interventions, significant improvements were observed in students' learning experience and outcomes as a result of the instructional methods and the role of the lecturer. The following factors contributed to the improvements in the performance gaps related to the code concept 'learning experience':

- Timely Response: The lecturer's prompt and timely response to students' queries and concerns improved their learning experience.
- Monitoring: The monitoring of students' progress and performance allowed for timely intervention and support.
- Revision: The opportunity for students to review and revise the course content enhanced their understanding and retention.
- Retention: The interventions focused on strategies to help students retain the information and concepts more effectively.
- Interaction: The increased interaction between students and the lecturer facilitated active learning and engagement.
- Limited Overtime: The interventions aimed to prevent overwhelming students with excessive workload or extended study hours.
- Slower Speed: The pacing of the course was adjusted to ensure that students could grasp the content effectively.

However, despite these improvements, certain challenges and issues still persisted, including:

- Lack of Response: Some students experienced delays or inadequate responses to their queries or concerns.
- Lack of Time: Students felt time constraints in completing the course requirements and engaging in self-study.
- Content Overload: The volume of course content was overwhelming for some students, impacting their learning experience.
- Lack of Breaks: Insufficient breaks or opportunities for rest and rejuvenation were identified as a concern.
- Too High Speed: The pace of the course was perceived as too fast for some students, affecting their understanding and retention.

In terms of learning outcomes, additional improvements were observed and validated in connection to the code concept 'learning outcomes'. The following factors contributed to these improvements:

- Breaks: Scheduled breaks allowed students to recharge and process the information effectively.
- Timely Response: The lecturer's timely response to students' progress and assessments helped address their individual needs.

- Monitoring: Continual monitoring of students' performance enabled targeted support and guidance.
- Revision: Opportunities for revision and review supported students in consolidating their learning.
- Limited Overtime: Avoiding excessive overtime allowed students to manage their workload more effectively.

However, certain challenges persisted, including:

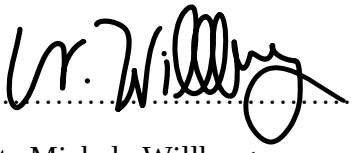
- Content Overload: Some students found the course content to be overwhelming, impacting their learning outcomes.
- Too Short Breaks: The duration of breaks was insufficient for students to fully rest and recharge.
- Lack of Time: Time constraints hindered students' ability to fully engage with the course materials and assessments.
- Too High Speed: The pace of the course was perceived as too rapid, leading to difficulties in achieving desired learning outcomes.

In terms of student behaviour, it was observed that there was less content in the online course, which was considered beneficial. However, students still exhibited a lack of initiative during self-study time, prompting the need for repeated reminders to complete the quiz. Additionally, the scheduled breaks, although provided, were not fully utilized for interactive activities, indicating a potential lack of engagement during those periods.

Overall, the evaluation highlights both the successes and areas for improvement in the implemented interventions, providing valuable insights for further refinement and enhancement of the instructional design and learning experience.

Author’s Declaration

I declare that the materials contained in this thesis are from my own work.

Signature: 

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