Flipped Classroom and Learning Analytics in Higher Education: Effective Development, Integration, and Learner Support

Inauguraldissertation
zur Erlangung des akademischen Grades eines Doktors
der Wirtschaftswissenschaften des Fachbereichs
Wirtschaftswissenschaften der Universität Osnabrück

vorgelegt von
Alena Rodda

Osnabrück, Oktober 2023

Dekan:	Prof. Dr. Frank Teuteberg
Referenten:	Prof. Dr.-Ing. Bodo Rieger
	Jun.-Prof. Dr. Sofia Schöbel
Tag der Disputation:	30.10.2023

Preface

This cumulative dissertation was completed during my work as a research assistant at the Department of Management Support and Information Systems at the University of Osnabrück. I would like to seize this opportunity to express my gratitude to the people who helped and supported me throughout.

First and foremost, I would like to thank my doctoral supervisor, Prof. Dr.-Ing. Bodo Rieger, who significantly contributed to the success of this work through constructive discussions and feedback and who supported me throughout all phases of this dissertation. I am truly grateful for his constant availability, his advocacy for his team, his commitment to our growth, and his willingness to support our future endeavors. Furthermore, I would like to thank Jun.-Prof. Dr. Sofia Schöbel for her feedback, supervision, and mentoring.

I would also like to express my gratitude to my colleagues, who have always been there for me over the past years and have become good friends. A special thanks goes to Philip, who has consistently encouraged me, with whom I could discuss and talk about anything, and without whom this dissertation in its current form might not even exist. I would also like to thank Carla, Kirsten, Albin, Friedemann, Jutta, Alexandre and Christian.

In addition, I would like to thank my family and friends. In particular, I want to thank my parents Barbara and Horst, who have supported me throughout my life and always believed in me. They are not only the best parents I could have wished for but also the most wonderful grandparents. I also thank my sisters Marisa and Vanessa for their constant help and encouragement over the past years.

Finally, I want to express my gratitude to my husband Trent, who left his home country and moved to Germany so that I could complete this dissertation and pursue my future career path. Without his love and support, I would not be where I am today.

I dedicate this dissertation to my son Henry. You are the greatest and most precious gift in my life. I wish for you to always have faith in yourself and to know that you can achieve all your dreams in life.

Osnabrück, June 2023 *Alena Rodda*

Contents

Notes on the Structure of the Document

This cumulative dissertation is divided into two parts. The first part, Part A, comprises the theoretical and practical foundation of the research project as well as the explanation of the underlying research design. In addition, the individual research contributions are placed in an overall context. Part A is a separate document with its own indexes and a reference list.

Part B contains the research contributions in the order in which they are presented in the main paper. The formatting of the individual contributions is based on the specifications of the respective publication organs. The references in Part B refer to the bibliography of the respective article.

Part A – Introductory Overview

List of Figures

List of Tables

List of Abbreviations

AMCIS	Americas' Conference in Information Systems
BI	Business Intelligence
BPMN	Business Process Model and Notation
CCIS	Communications in Computer and Information Science
CM	Change Management
CSEDU	International Conference on Computer Supported Education
DSR	Design Science Research
E[x]	Expected Value
EMISAJ	Enterprise Modelling and Information Systems Architectures Journal
FC	Flipped Classroom
GPA	Grade Point Average
H_0	Null Hypothesis
HEI	Higher Education Institution
HICSS	Hawaii International Conference on System Sciences
I3E	Conference of e-Business, e-Services, and e-Society
ICDEc	International Conference on Digital Economy
IS	Information Systems
IT	Information Technology
LA	Learning Analytics
LAD	Learning Analytics Dashboard
LAS	Learning Analytics System
LMS	Learning Management System
M	Milestone
OECD	Organization for Economic Cooperation and Development
OT	Online Teaching

RQ	Research Question
SRL	Self-regulated Learning
SUS	System Usability Score
TML	Technology-mediated Learning
TTF	Task Technology Fit
VHB	Verband der Hochschullehrer für Betriebswirtschaftslehre
VisAWI-S	Short Visual Aesthetics of Websites Inventory
WEF	World Economic Forum
WI	Internationale Tagung Wirtschaftsinformatik
WKWI	Wissenschaftliche Kommission Wirtschaftsinformatik
α	Significance Level
$\hat{\sigma}$	Standard Deviation
$\bar{x}$	Median

1 Introduction

1.1 Motivation

Ever since digitization transforms society, universities evolve their teaching methods and the skills they impart. Today, universities are enriching their courses with digital content, offering hybrid teaching formats or online teaching (OT) (Veletsianos et al. 2021). The impacts of these changes were further amplified in response to the Covid-19 pandemic (Adedoyin and Soykan 2020), resulting in a substantial increase in the number of students worldwide enrolled in online courses by 2021, as universities swiftly transitioned to online teaching (Pokhrel and Chhetri 2021). Even after the pandemic subsides, many courses will continue in online or hybrid formats (Veletsianos et al. 2021; Zhao and Watterston 2021). These formats offer a variety of opportunities for students and lecturers to interact and collaborate in order to develop a wide range of academic and transferable skills (Gamage et al. 2023). The task of memorizing knowledge is of decreasing relevance, as knowledge is readily available today. Rather, metacognitive skills are becoming increasingly important (Fadel et al. 2015; WEF 2020) and thus have been incorporated as a vital component in the Organization for Economic Cooperation and Development (OECD) Learning Framework 2030 (OECD 2019). According to the World Economic Forum (WEF), the top skills employers "see as rising in prominence in the lead up to 2025 include groups such as critical thinking and analysis as well as problem-solving, and skills in self-management such as active learning […]" (WEF 2020, p. 5). Therefore, WEF urges higher education institutions (HEIs) to equip students with the necessary skills as a future workforce (WEF 2020), leading to new challenges for HEIs to adapt teaching formats and curricula despite financial and organizational constraints.

In the context of this dissertation, therefore, two research areas will be addressed: Firstly, this dissertation studies the Flipped Classroom (FC) approach, which is a hybrid teaching methodology that emphasizes on the acquisition of skills such as problem-solving and group work through the outsourcing of pure knowledge transfer and the focus on an interactive in-class phase (Bergmann and Sams 2012; Bishop and Verleger 2013). Secondly, this dissertation investigates Learning Analytics (LA), which involves the collection, evaluation, and processing of learning data to provide valuable insights for both students and teachers[1] to support self-reflection and independent learning (Long and Siemens 2011).

[1] In this dissertation, the terms "teacher" and "instructor" are used interchangeably.

FC is a teaching methodology that combines the advantages of face-to-face and online teaching. Therefore, knowledge transfer, which used to take place in the form of in-person lectures, and the application of knowledge through exercises that students usually worked on at home, are being reversed (Bishop and Verleger 2013). The transfer of knowledge now occurs as a self-learning (pre-class) phase asynchronously at home, usually with the help of instructional videos, reading materials or online activities, and is preceded by an in-class phase (Lage et al. 2000; O'Flaherty and Phillips 2015). The in-class phase, which takes place synchronously and on-site, is then used to jointly apply the previously learned knowledge in the context of, e.g. group work, discussions, or application in software (Giannakos et al. 2014). Studies attribute mostly positive effects to FC, e.g. with regard to an increase in interaction and learning success (Bishop and Verleger 2013; Giannakos et al. 2014; Loviscach 2019; Sandhu et al. 2021). The design of FC courses, on the other hand, is time-consuming and costly, with individual instructors often being the ones to create them (Karabulut-Ilgu et al. 2018). There is only limited research on systematic approaches for the development and integration of FCs into university operations, with most studies focusing on case studies (Lundin et al. 2018; Song et al. 2017). Another difficulty of FCs is that the preparatory work of students during the pre-class phase is decisive for successful participation during the in-class phase (Lai and Hwang 2016). Students are expected to study independently and motivate themselves. However, many students, especially at the beginning of their studies, lack the skills for self-regulated learning (Kim et al. 2014; Lai and Hwang 2016). Teachers also face disadvantages during the pre-class phase that are analogous to those of online-only courses. For example, they lack the ability to monitor students' performance, strengths, and weaknesses, and cannot rely on visual cues for feedback (Joshi et al. 2022). Although the in-class phases can compensate for parts of these issues, ineffective in-class sessions due to unprepared participants (Mason et al. 2013) or the relocation of the sessions online due to the Covid-19 pandemic can further aggravate the problem.

To enhance students' self-regulated learning skills and to motivate them to work independently on the self-learning parts, LA can be used to provide continuous feedback, insights in one's performance, an overview of remaining content to be covered, and comparisons of the individual with the rest of the group (Heikkinen et al. 2023; Long and Siemens 2011; Nguyen et al. 2021). By using LA data, teachers can gain valuable insight into student performance, enabling them to transparently track progress and identify difficult areas and at-risk students early (Gašević et al. 2015). On the one hand, LA data can be used as a foundation for discussion with students in the subsequent in-class phase, and on the other hand, teachers can provide additional explanations or adapt the materials of the preparation phase. LA dashboards (LADs)

are commonly used to present this data visually (Bodily et al. 2018). Studies show much potentials in the field of LA (Daniel 2015; Jovanović et al. 2017), but its implementation is, also in Germany, clearly behind (Nouri et al. 2019). Current research also lacks information regarding the desires and concerns of students (Ifenthaler 2017), whose acceptance as primary data providers and, in many cases, as the primary users of LA, is crucial (Ferguson 2012).

1.2 Aim

Consequently, this dissertation addresses the challenges that universities face in terms of creating and implementing FC courses and their improvement with the help of LA. The overall aim of this dissertation can be stated as: Providing solutions to systematically develop and integrate Flipped Classrooms into higher education operations, and support students and lecturers with the help of Learning Analytics. The dissertation includes 11 individual contributions that address various aspects related to the development and integration of FCs and the application of LA. The research is guided by two main research questions (RQ), which are as follows:

RQ1: How can Flipped Classroom courses be systematically developed and integrated into higher education operations?

The first research question focuses on the challenges of developing and implementing FC courses, and a process model is proposed as a viable solution. To evaluate this model, it was used to redesign and implement a "Business Intelligence" (BI) module in the study program Business Informatics at the University of Osnabrück.[2] Furthermore, possibilities for the long-term integration of FCs by including relevant stakeholders and employing change management (CM) are presented. In this context, the previously designed process model was enriched with CM tasks. Additionally, a more general and model-independent CM guideline for FC integration at universities was created.

RQ2: How can the use of Learning Analytics contribute to the improvement of Flipped Classroom courses?

The second research question aims to identify the challenges students and teachers face in FCs and the opportunities for LA to improve these courses, including online-only formats. The focus is primarily on the perspective of the students, with the development and evaluation of a

[2] This dissertation studied empirical evidence along the course of the third-party funded project "FlipOS", where an existing BI module at the University of Osnabrück was transformed into an FC. The project allowed for the application and evaluation of a process model as well as for student surveys and the prototypical development of an LAD.

prototypical LAD using the BI module as an example. Looking forward, the research also considers the teachers' views on LA, examining the opportunities and threats of LA as well as an outlook on the design of LADs for teachers.

1.3 Structure

The remainder of this dissertation is structured as follows: Chapter 2 provides a brief introduction to the fundamentals of the FC approach and LA. Chapter 3 highlights the research design of this dissertation, beginning with an overview of the individual contributions. Furthermore, it presents the research agenda, an overarching research framework, and a concise illustration of the methods employed. The results of the contributions are summarized in Chapter 4. They are not presented in chronological order; instead, the structure of the Chapter is based on the two research questions. According to the character of the cumulative dissertation and to avoid redundancies, there is no detailed description of the applied methods, theories, and results of the contributions in Part A. The focus is placed on answering the main research questions and their sub-questions. The key findings as well as the theoretical and practical implications, limitations, and further research possibilities are outlined in Chapter 5. Chapter 6 serves as the conclusion of Part A. Detailed descriptions of the individual contributions can be found in the full contributions in Part B of this dissertation.

2 Theoretical Foundations

In the following Chapter, the basic principles of the FC approach are explained in Section 2.1, which also provides an overview of two models, namely Technology Mediated Learning (TML) and the phases of self-regulated learning (SRL). Subsequently, the relevant foundations of LA are discussed in Section 2.2.

2.1 Flipped Classroom

The FC approach has gained popularity in schools and universities since it was first mentioned in publications by (Baker 2000) and Lage et al. (2000). The approach can be associated with the overarching concept of blended learning, which describes "the thoughtful integration of classroom face-to-face learning experiences with online learning" (Garrison and Kanuka 2004, p. 96). The FC approach aims to switch the traditional classroom-based knowledge delivery with the application of knowledge, which typically takes place at home (Bishop and Verleger 2013). In literature and practice, other terms such as inverted classroom, reverse instruction, or backward classroom are used to refer to the same teaching concept (Bishop and Verleger 2013; Giannakos et al. 2014). In this dissertation, the term FC is used as a representative for all these terms.

The FC concept consists of two alternating phases, referred to as the pre-class phase and the in-class phase. During the pre-class phase, students independently acquire knowledge using prepared materials such as instructional videos, screencasts, podcasts, or reading materials (Bishop and Verleger 2013; DeLozier and Rhodes 2017). Additionally, self-assessment tests can be provided to students to evaluate and reinforce their knowledge (Velegol et al. 2015). The materials are commonly provided through a learning management systems (LMS) (O'Flaherty and Phillips 2015). The in-class phase is designed to complement the pre-class phase and aims to apply and deepen students' acquired knowledge (Giannakos et al. 2014). This alignment can be contextualized within Bloom's (1956) taxonomy of learning objectives, which was further developed by Anderson et al. (2001) and Krathwohl (2002). Typically, lower levels of the learning taxonomy, such as remembering and understanding, are addressed in the pre-class phase. During the in-class phase, various activating teaching methods are used to focus on higher learning objectives, such as applying, analyzing, evaluating, and creating (Halili and Zainuddin 2015; Lambach et al. 2017). At the beginning of the in-class phase, a brief review is usually conducted, allowing students to ask questions and helping instructors ensure that participants have a sufficient understanding of the course content (Zappe and Leicht). Subsequently, various activating teaching methods can be employed. Examples include the

think-pair-share method (Kothiyal et al. 2013), problem-based learning (Chis et al. 2018), discussions, presentations, and quizzes (Bishop and Verleger 2013; Giannakos et al. 2014). During the in-class phase, the role of teachers changes from lecturers to guides or coaches, who support students in solving (application-related) problems (McLean and Attardi 2023). Depending on the size of the groups, in-class phases can either take place in several parallel small sessions, which can lead to a greater personnel load, or can be carried out using certain participant-activating methods designed for large groups, in which case the range of possible methods is limited (Lambach et al. 2017).

Several systematic literature reviews on the use and effects of the FCs in specific disciplines at universities (Betihavas et al. 2016; Chen Hsieh et al. 2017; Karabulut-Ilgu et al. 2018; Tan et al. 2017), as well as comprehensive reviews, already exist (Al-Samarraie et al. 2020; Bishop and Verleger 2013; DeLozier and Rhodes 2017; O'Flaherty and Phillips 2015). These reviews attribute predominantly positive effects to the FC approach. Many studies have found that students' performance, usually measured by exam scores or final grades, has improved compared to traditional teaching methods (Evseeva and Solozhenko 2015; Giannakos et al. 2014; Kerr 2015; Koo et al. 2016; Rahman et al. 2014; Wong et al. 2014; Wright et al. 2017). Furthermore, an increase in motivation (Chen Hsieh et al. 2017; Chien and Hsieh 2018; Evseeva and Solozhenko 2015; Ritzhaupt and Sommer 2018; Wright et al. 2017) and higher engagement of students (Esson 2016; McLaughlin et al. 2014; Mutch et al. 2017) have been observed. A positive impact of the FC approach has also been noted in terms of problem-solving skills and communication abilities (McCredden et al. 2017; Velegol et al. 2015), self-efficacy and self-directed learning (Enfield 2013; Esson 2016; Hao and Lee 2016), and collaborative learning among students (Mutch et al. 2017). In contrast, there are a few studies where the FC approach showed no effects (Cabı 2018; Gillette et al. 2018; Zuber 2016). Research identifying the adverse effects of the FC approach is rare, but some studies mention a negative impact on performance (Missildine et al. 2013) and student satisfaction (Moffett and Mill 2014).

In the following, two models are presented, which are subsequently used in Section 3.3 to develop the research framework of this dissertation. The first model is Bower's (2019) representation of the TML theory. TML describes the use of technology as a means to facilitate and enhance learning (Gupta and Bostrom 2009). The FC approach is directly related to TML in that it relies on technology as a central component for mediating knowledge during the pre-class phase. Figure 1 illustrates significant aspects of TML according to Bower (2019). The author combined various theories from literature, such as Engeström's (1987) activity theory

and Bandura's (1986, 1991) framework of social-cognitive theory and self-efficacy. Technology is the key element and functions as a mediator between teachers and students to achieve a desired (learning) outcome. To enhance learning, it is important to consider the affordances of technology and to employ them effectively. Beliefs, knowledge, and practices of teachers and students mutually influence each other and the broader environment in which learning takes place. Teachers develop and implement course content, continuously adapting it to student feedback, while students process the information and interact with the technology (Bower 2019).

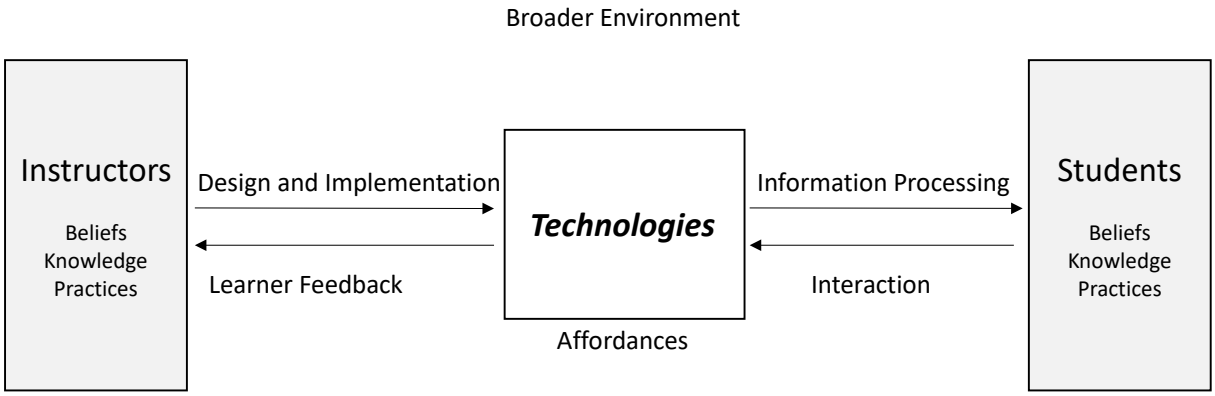


Figure 1. TML Theory Adapted from Bower (2019)

The second model used as a foundation for the research framework is Zimmermann's (2003) presentation of the three phases of SRL. The SRL theory depicts how students actively participate in learning processes, for example, by setting goals, monitoring their progress, and adjusting their learning behaviors to achieve learning objectives (Bandura 1991; Zimmerman 1989). According to Yen et al. (2018), "SRL is one aspect of metacognition, whereby students are aware of their cognitive processes and knowledge and monitor and regulate their learning" (p. 580). Research shows that the use of SRL strategies such as time management, goal setting, and self-monitoring are positively related to student learning outcomes in both traditional and online courses (Broadbent and Poon 2015). Zimmerman and Campillo (2003) propose a conceptualization of SRL consisting of three phases. While the phases can be seen as a cyclical process, they do not necessarily repeat themselves in a rigid or sequential manner. The first phase, known as the forethought phase, involves learners setting goals, developing strategies, and activating prior knowledge. The second phase, called the performance phase, includes learners' participation in learning activities and the continuous monitoring of their progress. Finally, the self-reflection phase follows, in which learners evaluate their understanding and performance, identify areas for improvement, and adjust their learning behavior if necessary (Zimmerman and Campillo 2003). Figure 2 shows an overview of the three phases. In a recent

study by Öztürk and Çakıroğlu (2021), the authors linked the phases to the FC approach. The pre-class phase was assigned to the forethought and the performance phase, while the in-class phase was mainly assigned to the performance phase. The self-reflection phase could also be partly assigned to the in-class phase if students receive feedback about their performance during the in-class phase (Öztürk and Çakıroğlu 2021). Depending on the design of the FC, there may be deviations in this regard.

Figure 2. SRL Phases Adapted from Zimmerman and Campillo (2003)

2.2 Learning Analytics

LA is defined as "the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (Long and Siemens 2011, p. 32). It has been influenced by developments in the fields of Educational Data Mining and Academic Analytics. While LA shares common ground with these disciplines, it is differentiated through its distinct focus. LA concentrates on the domain of education and its primary objective is to enhance (online) teaching and learning at course and departmental levels (Ferguson 2012; Long and Siemens 2011). Educational Data Mining primarily addresses technical challenges concerning the extraction and analysis of large-scale learning data (Baker and Inventado 2014; Ferguson 2012). Academic Analytics, in contrast, take a broader perspective and consider political and economic challenges, to improve learning at a national level (Ferguson 2012).

The database of LA often relies on LMS, although other systems, such as examination systems, video conferencing platforms, library systems, or external data from social media can also be utilized (Greller and Drachsler 2012; Ifenthaler and Schumacher 2016). The extracted student data can be categorized into different types. In this dissertation, the categorization proposed by Ifenthaler and Schumacher (2016) is employed, which includes socio-demographic data, previous academic data, and learning activity data. Socio-demographic data contains information about the students themselves, such as their age, place of residence, or gender. Previous academic data refers to the student's past academic performance, such as high school

grade point average (GPA) or grades from previously taken courses. Learning activity data contains information about the student's performance and progress in the course under investigation, which may involve interactions with the LMS or results from midterm and self-assessments (Ifenthaler and Schumacher 2016; Nguyen et al. 2021). The data can be analyzed using various data mining methods to provide descriptive insights into the current learning status or predict performance (Nguyen et al. 2021), at both the course level and department level (Long and Siemens 2011).

The analyses are predominantly delivered to users, commonly students and teachers, through LADs, as these can be designed intuitively and interactively, making it easier for users to understand the visualized data (Ifenthaler 2017; Klerkx et al. 2017; Yigitbasioglu and Velcu 2012). In a systematic review of LADs, Vieira et al. (2018) noticed that most dashboards were used in a blended learning environment and typically included students' interaction with a given tool, their performance in the class, survey responses, and contributions to discussions as data sources. The most common objectives of LADs were to promote reflection, improve instructional materials, identify collaboration between students, and discover learning paths (Vieira et al. 2018). Ferguson (2012) emphasized the importance of clarity in the design of LADs to ensure that users without prior knowledge can understand and interpret the information.

As mentioned before, LA offer various potentials for both students and teachers. With the help of LA, teachers can, for example, gain insights into learning behaviors, the use of learning materials, as well as the progress and challenges of students (Daniel 2015; Jovanović et al. 2017; Nguyen et al. 2021). Based on LA, teachers can adapt instructional materials or formats, offer additional explanations or face-to-face sessions, or provide early and individualized support to students who are at risk of failing the course (Gašević et al. 2015; Ifenthaler 2017). Among other advantages, students benefit from LA by gaining an overview of their performance and progress, also in comparison to fellow peers, and can adjust their learning behaviors accordingly (Ellis 2013; Long and Siemens 2011). LA can therefore help students to improve their SRL skills (Heikkinen et al. 2023), as self-reflection through self-monitoring and self-observation is particularly important for SRL (Zimmerman and Campillo 2003).

The field of LA also poses several challenges that HEIs face when implementing LA systems (LAS). Firstly, the development and deployment of LAS require significant time and financial resources (Tsai et al. 2019). Secondly, there are multiple issues concerning data collection and integration. Institutional data systems, such as LMS, student management systems, and examination systems, are often not designed for data analysis purposes and lack interoperability

(Daniel 2015; Klasen and Ifenthaler 2019; Nouri et al. 2019). Moreover, the shortage of qualified IT personnel at HEIs hinders the development and implementation of LA. Additionally, ethical concerns have been raised, particularly regarding potential violations of student privacy (Ifenthaler and Schumacher 2016; Sclater 2017). Universities need to consider a range of issues that include consent, data privacy and security, data retention duration, and data accessibility (Daniel 2015; Ferguson 2012). Lastly, the long-term benefits of LA compared to costs remain unclear (Tsai et al. 2019).

3 Research Design

In the following Chapter, the individual contributions, the research agenda, and the methods used are described. Section 3.1 provides a tabular overview of the contributions included in this dissertation. The contributions are numbered according to topic with a #-identifier. Section 3.2 then outlines the research agenda and framework as follows: To approach the two research questions presented in Chapter 1, a research agenda was developed that divides them into four sub-questions. The individual contributions are assigned to the sub-questions. An overarching framework based on models from relevant literature illustrates the thematic relationships. Finally, Section 3.3 describes the methods utilized in this dissertation to address the research questions.

3.1 Overview of Research Contributions

Table 1 shows an overview of the individual contributions included in this cumulative dissertation. All 11 contributions were published in a double-blind peer review process at internationally renowned conferences, or in the case of **contribution 2,** in a journal. To assess the quality of the publications, the contributions are rated based on the two rankings relevant to business informatics in Germany:

- VHB JOURQUAL3 (German Academic Association for Business Research (Verband der Hochschullehrer für Betriebswirtschaftslehre e.V. (VHB) 2015))
- WKWI Guidance List (Scientific Commission Information Systems (Wissenschaftliche Kommission Wirtschaftsinformatik (WKWI) (Heinzl 2008))

These rankings are based on the assessment of experts and assign a score from A (highest score) to D (lowest score) to selected conferences and journals. The rankings associated with the individual contributions and an explanation of the co-author's input to each contribution can be found in Table 1.

Table 1. Overview of Research Contributions

#	Bibliographic Information	Ranking	
		VHB	**WKWI**
1	Vogelsang, K., **Droit, A.**, and Liere-Netheler, K. 2019. "Designing a Flipped Classroom Course – a Process Model," in Proceedings of the Internationale Tagung Wirtschaftsinformatik, pp. 345-359. *[1]	*WI (conference)* C	A
2	Vogelsang, K., **Droit, A.**, and Liere-Netheler, K. 2019. "Designing a Flipped Classroom Course – A Process Model," Enterprise Modelling and Information Systems Architectures (14:4), pp. 1-23. *[2]	*EMISAJ (journal)* C	-
3	Blömer, L., Voigt, C., **Droit, A.**, and Hoppe, U. 2020. "Agile Development of a Flipped Classroom Course," in Responsible Design, Implementation and Use of Information and Communication Technology: 19th IFIP WG 6.11 Conference on e-Business, e-Services, and e-Society, pp. 581-592. *[3]	*I3E (conference)* C	B
4	Blömer, L., **Droit, A**., and Vogelsang, K. 2020. "May the Change Be with You: The Need for New Roles to Support Flipped Classroom Development," in Responsible Design, Implementation and Use of Information and Communication Technology: 19th IFIP WG 6.11 Conference on e-Business, e-Services, and e-Society, pp. 532-544. *[4]	*I3E (conference)* C	B
5	Blömer, L., **Droit, A.**, and Hoppe, U. 2020. "Enabling Stakeholders to Change: Development of a Change Management Guideline for Flipped Classroom Implementations," in Proceedings of the 12th International Conference on Computer Supported Education, pp. 227-237. *[5]	*CSEDU (conference)* -	-
6	Kötter, J., Blömer, L., Voigt, C., **Droit, A.**, and Hoppe, U. 2021. "Through the Lens of Different Stakeholders: Development and Application of a Change Management Guideline for Flipped Classroom Implementations," in Computer Supported Education. CSEDU 2020. Communications in Computer and Information Science (Vol. 1473). Cham: Springer, pp. 216-244. *[6]	*CCIS (book series)* -	-
7	**Rodda, A.** 2022. "Understanding Opportunities and Threats of Learning Analytics in Higher Education – A Students' Perspective," in Proceedings of the 21st IFIP WG 6.11 Conference on e-Business, e-Services and e-Society, pp. 111-122.	*I3E (conference)* C	B
8	**Droit, A.**, and Rieger, B. 2020. "Learning Analytics in the Flipped Classroom – Learning Dashboards from the Students' Perspective," in Proceedings of the 53rd Hawaii International Conference on System Sciences, pp. 100-107. *[7]	*HICSS (conference)* C	B
9	**Rodda, A.** 2023 "Student-centered Design and Evaluation of a Learning Analytics Dashboard," in Proceedings of the 8th International Conference on Digital Economy, pp. 67-80.	*ICDEc (conference)* C	-
10	**Rodda, A.** and Stahmann, P. 2023. "Towards a Student-Centered Learning Analytics Dashboard: Design, Development and Evaluation," in Proceedings of the Americas' Conference in Information Systems. *[8]	*AMCIS (conference)* D	C
11	**Rodda, A.** 2023. "How can Learning Analytics Enhance Online Teaching? A Teacher's Perspective," in Proceedings of the 8th International Conference on Digital Economy, pp. 97-110.	*ICDEc (conference)* C	-

Comments

*[1] Mrs. Vogelsang had the idea for the contribution and took on the coordination. The literature review, as well as the analysis and description of the three phases, were equally undertaken by all authors. The author of this dissertation wrote the introduction, Mrs. Vogelsang the methodology, and Mrs. Liere-Netheler the conclusion.

*[2] This contribution is an extension of Contribution 1. Additionally, the presentation of the process model was done using Business Process Model Notation, which was equally carried out by all authors. Mrs. Vogelsang and Mrs. Liere-Netheler wrote an extended discussion and conclusion. The author of this dissertation independently transformed a BI module into an FC using the model and evaluated the approach.

*[3] The author of this dissertation contributed to shaping the idea and shared her practical experience in the iterative development of FCs with the other authors. The idea for the contribution originated from Mrs. Blömer. Mrs. Blömer and Mrs. Voigt conducted the research, as well as the development and application of the agile FC model. Prof. Dr. Uwe Hoppe accompanied and critically reflected on the research process.

*[4] The idea for the contribution came from Mrs. Blömer and Mrs. Vogelsang, and the author of this dissertation assisted in shaping the idea. The introduction and methodology were written by the co-authors. The author of this dissertation wrote the foundational part on FCs and conducted the literature review together with the co-authors. The descriptions of the phases in Section 4, as well as portions of the discussion and conclusion, were contributed by the author of this dissertation.

*[5] The idea for the contribution came from Mrs. Blömer. The alignment and research questions were developed together with the author of this dissertation. Mrs. Blömer described the methodology and conducted a significant part of the literature review, with this author's assistance. Subsequently, based on the research results, the author of this dissertation independently developed the CM Guideline and wrote the corresponding section. Additionally, the author of this dissertation, together with Mrs. Blömer, wrote the implications and limitations. The author of this dissertation drafted the conclusion and introduction in consultation with Mrs. Blömer. Prof. Dr. Uwe Hoppe accompanied and critically reflected on the research process.

*[6] This contribution is an extension of Contribution 5 and the CM Guideline developed by the author of this dissertation therein. Mr. Kötter evaluated and modified the guideline with the support of Mrs. Voigt. Mrs. Blömer assisted the other co-authors with the methodology. Prof. Dr. Hoppe accompanied and critically reflected on the research process.

*[7] The contribution was developed and written by the author of this dissertation. Prof. Dr.-Ing Bodo Rieger accompanied and critically reflected on the research process.

*[8] The contribution was developed and written by the author of this dissertation. Mr. Stahmann was involved in the statistical analysis of the questionnaire and critically reflected the research process.

Legend
VHB = Journal Quality Index 3 (VHB 2015)
WKWI = Guidance List 2008 (Heinzl et al. 2008)

3.2 Research Agenda and Framework

This dissertation is based on two research questions, which, due to their complexity, are divided into four sub-questions (a-d) for a comprehensive exploration and analysis. Table 2 shows an overview of the research questions and sub-questions as well as a mapping to the contributions (#) presented in Section 3.1. The two question blocks (RQ1 and RQ2) are structured along the lines of the phases of the Design Science Research (DSR) process as proposed by Peffers (2007), which are explained in more detail in Section 3.3. Thus, in sub-questions 1a and 2a, the identification of problems concerning FCs (analogous to LA) and the motivation for the research is addressed. Afterward, sub-questions 1b and 2b focus on the definition and objectives of possible solutions, which are then demonstrated and evaluated in the context of sub-questions 1c and 2c based on the chosen BI module. Finally, sub-questions 1d and 2d present an outlook, for the first research block with regard to the long-term integration of FC courses into university operations, and the second research block concerning the views of teachers on LA in the context of a change of perspective.

Table 2. Overview of Research Agenda and Corresponding Contributions

Research Plan				**#**
How can hybrid teaching formats, using the example of the FC, be systematically developed, integrated into higher education operations, and supported through the application of LA?				
RQ1	How can FC courses be systematically developed and integrated into higher education operations?	a	What challenges arise in the development and implementation of FC courses?	1 3 4 5
		b	How can a process model for the systematic development of FC courses be designed?	1 2
		c	How can the concrete implementation of an FC course using a process model look like, using the example of a BI module?	2 3
		d	How can the long-term integration of FC courses in higher education be supported using CM methods?	4 5 6
RQ2	How can the use of LA contribute to the improvement of FC courses?	a	What new challenges arise for students and teachers in FC courses?	7 11
		b	How can LA support students in FC courses?	7
		c	How can a student-centered LAD look like, using the example of a BI module?	8 9 10
		d	How can LA support teachers in FC courses?	11

The research questions presented in Table 2, can be summarized in a research framework based on the models of Bower (2019), and Zimmerman and Campillo (2003), as presented in Section

2.1. Figure 3 illustrates the main component of this dissertation, namely the FC, consisting of a pre-class phase and a subsequent in-class phase. The main stakeholders, instructors and students, are located on either side of the model. An LAS is depicted at the bottom of the figure. Arrows indicate the relationships between the elements. Dotted boxes represent the overarching research questions and circles show the corresponding contributions.

Instructors design and implement FC courses (**contributions 1-3**). Based on feedback from students, which they receive during the in-class activities or due to evaluations based on LA, they adapt the courses, e.g. regarding the content or media used. On the student's side, the three phases of self-regulating learning according to Zimmerman and Campillo (2003) are presented. In the forethought phase, students process the information from the pre-class phase by working on the material independently. The subsequent performance phase takes place during the in-class activities, in which learners actively participate and interact with their peers and teachers. This is followed by a self-reflection phase, where students review their performance based on experiences during in-class activities and the support of an LAD (**contributions 8-10**). The possibilities that LA offers in general for supporting FCs are addressed for students in **contribution 7** and instructors in **contribution 11**. The analyses within the context of LA rely on the data extracted from the university's systems, such as LMS or examination systems. The university environment is represented as a box above the core elements of the figure, highlighting the framework conditions that enable the development and implementation of FCs and their integration into university operations in the long term, with **contributions 4-6** addressing CM topics.

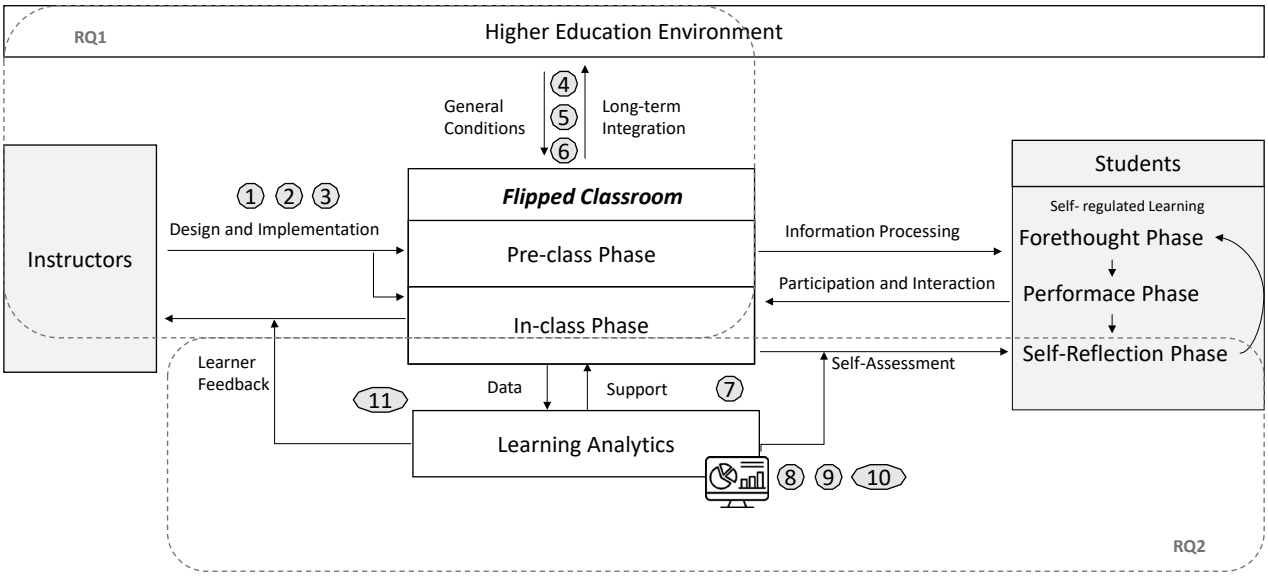


Figure 3. Research Framework

3.3 Spectrum of Applied Methods

Information Systems (IS) is a comparably young and multidisciplinary field at the intersection of computer science, management, engineering, and psychology (Recker 2021). The primary objective of IS research is to comprehend and enhance how individuals generate value through information (Nunamaker and Briggs 2011). IS is characterized as a sociotechnical field, as researchers distinguish between technical components and tasks, such as systems or platforms, and social components, such as individuals, groups, and organizations. The research examines both components and their interactions (Recker 2021). In this dissertation, the focus is on considering students, teachers, and universities, i.e., social components, along with the digital parts of FC courses and LA systems as technical components. The development of the technical components together with the interaction of students and teachers with them, as well as the associated organizational framework, are examined within the contributions using a variety of methods. In general, the discipline of IS can be divided into two epistemological paradigms with their associated theories and methods: Constructivist research based on the design science approach and behavioral research (Hevner et al. 2004; Österle et al. 2011). The focus of the constructivist approach is on the development and evaluation of new artifacts, such as instantiations, constructs, models, and methods, to solve real problems (Hevner et al. 2004). In contrast, the aim of behaviorist research is "to develop and justify theories (i.e., principles and laws) that explain or predict organizational and human phenomena surrounding the analysis, design, implementation, management, and use of information systems" (Hevner et al. 2004, p. 76) In the context of this dissertation, both paradigms are applied in combination: Constructivist research is utilized to create a process model, an FC course, and an LAD. Behaviorist research is applied to investigate, among other aspects, stakeholder views and requirements.

The overarching framework of this dissertation, however, is oriented toward the DSR process according to Peffers et al. (2007). Peffers defines six steps to create and evaluate innovative artifacts in IS research (cf. Figure 4). The first step is to identify and motivate the problem. To achieve this, researchers should describe the state of the art and the importance of the problem. Next, the objectives of the solution are identified. This includes defining requirements that an artifact would be expected to have to solve the problem. In the third step, the artifact is designed and developed, for instance, a construct, model, method, or instantiation (Hevner et al. 2004). In the fourth and fifth steps, the artifact is demonstrated and evaluated. Often, there are multiple evaluation cycles in DSR projects. Suitable evaluation methods for artifacts include surveys, experiments, expert interviews, or focus groups (Sonnenberg and vom Brocke 2012). The sixth step addresses the communication of results, for example through publications at conferences

or in journals. Though the process is structured in a nominally sequential order, researchers using DSR can begin at any of the first four steps and iterate the process backward as necessary (Peffers et al. 2007).

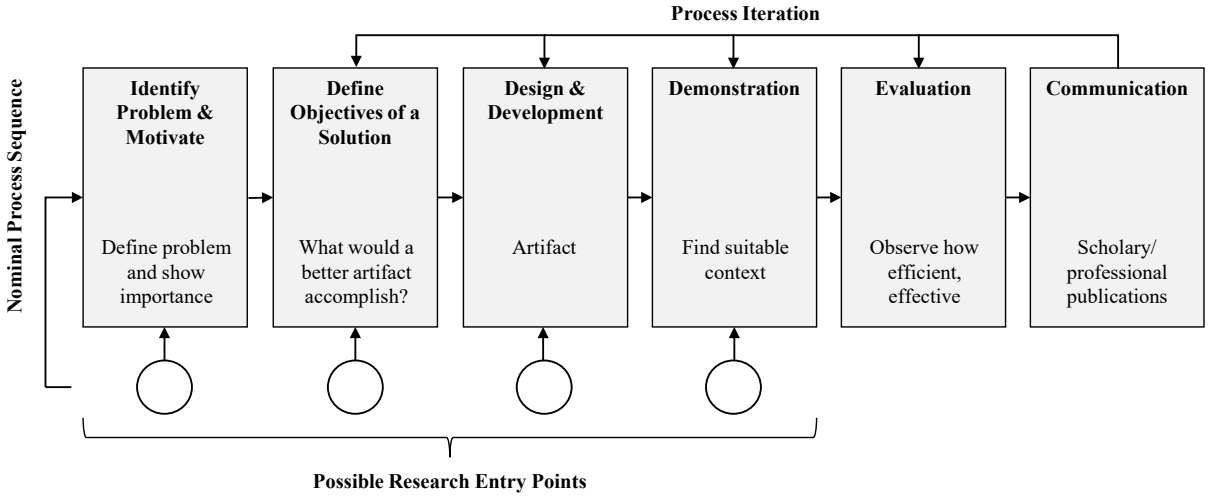


Figure 4. DSR Methodology Process Adapted from Peffers et al. (2007)

Depending on the research paradigm, there are several qualitative and quantitative methods that IS researchers can draw on (Wilde and Hess 2007). Qualitative methods are particularly suited for exploratory research by drawing new insights from the collection and analysis of non-numerical data (Recker 2021; Schultze and Avital 2011). Quantitative methods, on the contrary, are based on numerical data sets, such as the results of surveys, e.g. to uncover empirical correlations with the help of statistical methods (Recker 2021). To answer the research questions of this dissertation, different qualitative and quantitative research methods were combined in a mixed-methods approach (Venkatesh et al. 2013). Table 3 presents a list of the methods used, along with the corresponding contributions and references. It is worth noting that all methods, except for surveys, fall under the term qualitative research, while surveys used in this dissertation can be classified as quantitative research. Detailed information on the methodological approach can be found within each contribution.

Table 3. Research Methods

Research Methods	Contributions											References
	1	2	3	4	5	6	7	8	9	10	11	
Systematic Literature Review	■	■	■	■	■	■						(Schryen 2015; vom Brocke et al. 2009; Webster and Watson 2002)
Process Modelling	■	■		■								(Briggs 2007; Fettke 2014)
Survey		■				■		■	■	■		(Recker 2021; Reips 2002)
Case Study		■	■			■						(Bonoma 1985; Kaplan and Duchon 1988; Recker 2021)
Qualitative Content Analysis							■	■			■	(Mayring 2014)
Prototyping									■	■		(Hevner et al. 2004)
Focus Group										■		(Stewart et al. 2007; Tremblay et al. 2010)
Expert Interviews											■	(Bell et al. 2022; Myers and Newman 2007)

4 Summary of the Research Findings

4.1 Systematic Development and Integration of FCs at Universities

In this Section, the first research question regarding the systematic development and integration of FCs at universities is discussed. Each of the four sub-questions, labeled RQ1a-d, is addressed in its respective Subsection. In Subsection 4.1.1 current problems concerning the creation and integration of FCs are identified. Subsequently, in Subsections 4.1.2 to 4.1.4 possible solutions for the systematic development and long-term establishment of FCs at universities are explored.

4.1.1 Challenges in the Development and Implementation of FCs

This Subsection addresses the potential challenges that arise in the development and implementation of FC courses (RQ1a), based on the research motivations of **contributions 1, 3, 4** and **5**. Even though the FC approach had gained popularity across various academic disciplines at universities, with studies highlighting its positive impacts (Giannakos et al. 2014; Loviscach 2019; Sandhu et al. 2021), many instructors struggle to effectively design and implement FCs (Senali et al. 2022). Two main reasons for this were identified in **contributions 1** and **5**: (1) A lack of structured models that enable teachers to efficiently plan their FCs considering the limited time and financial resources, and (2) the lack of stakeholder involvement and change management at universities that can hinder the long-term integration of FCs into their operations.

(1) Regarding the first challenge, FC research is dominated by case studies, while systematic overarching approaches to FC development are rare (Song et al. 2017), resulting in a "siloed" character of this research field (Lundin et al. 2018; O'Flaherty and Phillips 2015). Structured procedural models that guide instructors step-by-step can play a significant role in the planning, development, and implementation of FC courses. Well-developed planning in terms of content, materials, media usage, as well as personnel, and technical resources is essential for the successful creation of an FC (O'Flaherty and Phillips 2015). Especially at the beginning of the FC development, a high effort for teachers arises (Giannakos et al. 2014; Mason et al. 2013). In this regard, the biggest challenge teachers face is the lack of time (Lo and Hew 2017; Tucker 2012). For example, instructors often have to spend a great amount of time learning about technology, such as how to record, edit, and upload videos or how to create and deliver online self-study tests in an LMS (Lo and Hew 2017). In some cases, they receive no or only limited (technological) support from their institutions. Technical and didactic training, as well as consulting for teachers are urgently needed (McGrath et al. 2017). Teachers must also

determine before an FC implementation whether additional funds are needed for new technology or staff, which must then be covered by the departments themselves, the institution, or third parties (Giannakos et al. 2014). In addition to the technical effort that is particularly relevant to the pre-class phase of the FC, instructors must also engage in creating the associated in-class content. A variety of possible activities is available, such as student presentations, (group) discussions, problem-based learning, peer-learning, and pair-and-share methods (Bishop and Verleger 2013; DeLozier and Rhodes 2017; O'Flaherty and Phillips 2015). The selection and implementation of activating methods is a critical factor for the success of FCs (DeLozier and Rhodes 2017) but can present new challenges for teachers who have had little experience with active learning. Moreover, not all methods are suitable for the particular content or group size (Lehmann et al. 2015). Teachers, therefore, have to invest a significant amount of time in planning in-class activities (Giannakos et al. 2014). Since FCs are student-centered, the teacher's role changes to an observer, facilitator, and coach during the in-class phase, roles that seem unusual for teachers at first (Bergmann and Sams 2012). Teachers are also supposed to use the performance and feedback from the in-class phase to adapt the subsequent pre-class and in-class phases accordingly, e.g. by introducing additional explanations of topics that students found difficult. Thus, FC design will also take place during the semester, despite an already high workload for teachers. At this point, agile methods for the preparation of teaching can be useful. In the context of **contribution 3**, a systematic literature search was conducted in six databases to identify articles on the topic of agile development of FCs. This search led to a limited number of only five results, indicating a lack of research in this specific area (Blömer et al. 2020c).

(2) Regarding the second challenge, the design and implementation of FCs involves not only instructors but also other stakeholders, including students, university management, as well as the IT and didactics departments. Research shows that all stakeholder groups can show resistance to the implementation of FCs (Bishop and Verleger 2013). However, there is usually no overarching CM in HEIs to engage stakeholders in the process from the beginning to increase motivation, commitment, and satisfaction (Hutchings and Quinney 2015). More than 50% of organizational changes fail due to resistance from stakeholders (Bondarev et al. 2018). Stakeholders may oppose change due to a lack of knowledge or understanding, uncertain outcomes, fear of the unknown or innovation, and inadequate skills (Bondarev et al. 2018). A literature review by Flavell et al. (2019) shows that academic staff in particular have difficulty adopting new technologies. The low perceived value of technology (Debuse et al. 2008), fear of failure, poor confidence (Dusick and Yildirim 2000), and a shortage of resources and support

for new technologies (Adams Becker et al. 2017) are cited as problems. Adopting effective CM in universities is crucial but challenging because universities are organizations composed primarily of experts who work independently in teaching and research (Morisse 2016). Although studies have established the importance of CM in HEIs (Bondarev et al. 2018), the establishment of CM strategies and their integration into e-learning approaches, especially FCs, is rare (Flavell et al. 2019). A systematic literature review conducted as part of **contribution 4** found that in a large amount of existing FC research, CM approaches play an explicit role in only a fraction of the articles (Blömer et al. 2020b).

In summary, to answer research question 1a, teachers face multiple challenges in designing and implementing FCs. These include a lack of structured process models, a high workload, a lack of time resources, and a shortage of technical and media didactic training. The design and implementation of FCs involve not only teachers but also other stakeholders who may show resistance due to lack of knowledge, understanding, uncertain outcomes, fear of innovation, and insufficient skills. Therefore, **contributions 1-6** of this cumulative dissertation address possible solutions to these problems, which are presented in Subsections 4.1.2 to 4.1.4.

4.1.2 Design of a Process Model for the Systematic Development of FCs

This Subsection presents an answer to the question, of how a process model for the systematic development of FC courses can be designed (RQ1b). This process model, as well as a checklist for teachers, were created in **contributions 1** and **2**. The underlying idea was to link a standard procedure in project management with findings from current FC research. The foundation is laid by the four phases of project management: Initiation, planning, execution, and closing (Rose 2013). The first phase, the project initiation, includes the evaluation of the idea and a risk assessment, while the planning phase includes schedule, cost, and performance plans. The third phase focuses on the implementation of the product or service. The fourth phase contains a project evaluation and outcome assessment (Rose 2013). The use of project management approaches in instructional design models is unusual. Several instructional design concepts already exist, which include traditional instructional designs of various aspects such as competencies, learning groups, and subjects (Esslinger-Hinz et al. 2013). However, they focus primarily on pedagogical and instructional issues rather than procedural aspects (Wang 2014). A process-oriented step-by-step guide is underrepresented in the field of FC research (Song et al. 2017). To fill this gap, a project management guide was chosen, to which pedagogical insights were added where appropriate and which is considered easy to understand and apply due to the limited number of four phases. To develop the process model for creating an FC, a systematic literature search was conducted to identify the required tasks and assign them to the

corresponding project management phases. The search was conducted in six databases and focused on identifying already existing reviews of FC research, as described in detail in **contribution 1**. The resulting process steps were described in textual terms and defined by eight milestones (M), as shown in Figure 5.

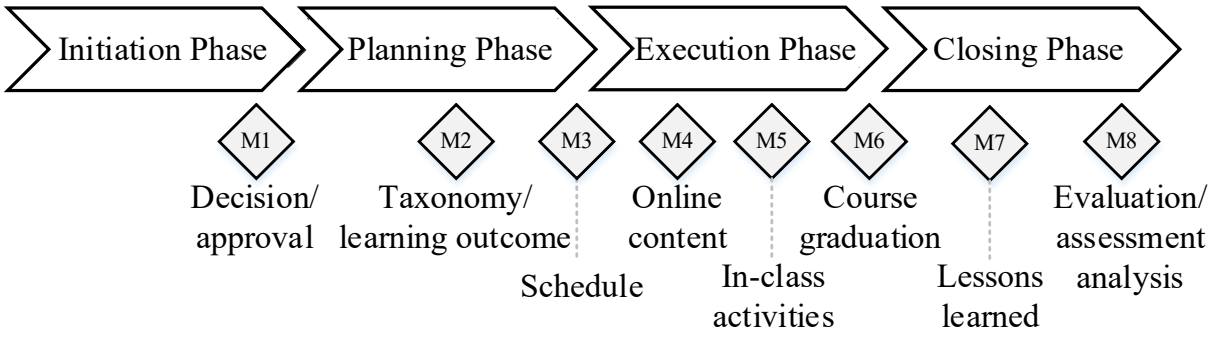


Figure 5. Milestones of FC Development (Vogelsang et al. 2019a)

In **contribution 2**, the textual descriptions were further developed by using Business Process Model and Notation (BPMN) models as reference models according to the framework of inductive reference model design (Fettke 2014). The BPMN models allow a sequential view of necessary activities and an assignment of tasks to stakeholders. In this context, the lanes of the BPMNs include different stakeholder groups. The "teaching team" includes teachers, assistants, and tutors. The "administration" lane contains supporting positions, such as the university management and IT departments. The lane named "students" can refer to the participants of the course as well as the student body in general or groups such as the student council. In the following, a summary of activities for each phase, including the milestones, is provided. The BPMN models can be found in the Appendix.

Initiation Phase: The objective of the initiation phase is to decide whether to use the FC approach to redesign an existing or create a new course. At first, teachers should consider the concept of FC, as well as its advantages and disadvantages. In doing so, personnel, material, and financial resources should be considered. A stakeholder analysis can be conducted to identify the stakeholders involved, as well as their benefits, challenges, and barriers (Rose 2013). Communication and involvement of the affected stakeholders, such as students and administrative staff, are crucial (Enfield 2013). It is also important to ensure that the teaching method is in line with regulations and the curriculum. Planning methods, such as bottom-up estimates or expert judgments, can be used to estimate personnel and material resources (Rose 2013). This should also consider any pedagogical and technical training that may be required for teachers or tutors. Support is provided at some universities by competence centers for didactics or digital teaching. Ideally, a teaching team is formed that consists, for example, of

professors, assistants, tutors, and information technology (IT) staff. At the end of the initiation phase, the teaching team decides whether to implement the FC method based on benefits and investments *(M1)*. The outcome could be a redesign, a completely new course, or a rejection of the FC approach (cf. Appendix 1).

Planning Phase: When implementing an FC, planning is crucial to ensure success (O'Flaherty and Phillips 2015), especially since one of the main challenges for teachers is the lack of time (Lo and Hew 2017; Tucker 2012). Planning an FC involves scheduling, content planning, and adjustments to the curriculum, as well as ensuring compliance with university regulations, such as those related to new forms of exams. To plan the content, the learning objectives of the course should first be determined. Learning taxonomies *(M2)* are useful for structuring the objectives (Hu et al. 2018) and reflect different levels of learning (Anderson et al. 2001). This allows for a clear division of content into sections and serves to align pre-class and in-class phases. Identifying the learning group is also crucial for planning content and methods, considering different learning types, prior experiences, and, if necessary, different disciplines (Bishop and Verleger 2013). Teachers usually use videos (self-produced or from other providers) for the pre-class phase (Bishop and Verleger 2013; DeLozier and Rhodes 2017; Velegol et al. 2015). Instructional videos are commonly accompanied by presentation slides (O'Flaherty and Phillips 2015) and divided into multiple sequences which are ideally between 10 and 20 minutes in length (Velegol et al. 2015). Also, additions in the context of discussion forums (Bhagat et al. 2016), quizzes on video content (Velegol et al. 2015), assignments, pre-readings, and automatized tutoring systems can further enrich the pre-class phase (DeLozier and Rhodes 2017; O'Flaherty and Phillips 2015). It is important to note that the preparation of pre-class content for FCs takes more time than preparing traditional lectures (Vazquez and Chiang 2015). In addition to planning the pre-class phase, methods for the in-class phase should be selected to apply the knowledge. Often, the in-class activities are prepared in detail during the current semester, so further guidance in this regard is provided in the execution phase.

The teaching team should also decide if LA will be used and whether the technical and human resources are available to do so. The aim of LA should be determined first to identify the data that needs to be collected (Jovanović et al. 2017). This also allows for the FC activities to be created in a way that will generate the data needed in view of later evaluations. At the end of the planning phase, activities like scheduling and the reservations of rooms are required *(M3)* (cf. Appendix 2).

Execution Phase: The execution phase includes all actions taken during the semester to facilitate learning and teaching. It primarily includes the supply of video tutorials *(M4)* and the

delivery of in-class sessions *(M5)*. To ensure success, rules and additional information about the FC should be communicated to students in advance, for example, in a kick-off meeting (Balan et al. 2015). To be effective, in-class activities such as discussions, quizzes, problem-solving, and collaborative learning must be appropriate for the learning objectives and group size (Bishop and Verleger 2013; McLean et al. 2016). Additionally, smartphone apps, pair-and-share activities, and clicker assessments are used in class to provide immediate feedback, test prior knowledge, identify knowledge gaps, and ensure continuous learning (O'Flaherty and Phillips 2015). Midterm exams are also commonly used to check students' progress during the semester. The continuous monitoring and adjustment of the course based on the needs and performance of both teachers and students are essential for effective instruction. Depending on the learning objectives, different forms of assessments can be used to grade students in FCs, such as oral or written exams, essays, projects, participation, and portfolios. The execution phase finishes with the graduation of the course *(M6)* (cf. Appendix 3).

Closing Phase: The final phase aims to evaluate the course and gather perceptions about the FC approach, content, and overall implementation. Despite the limited time frame, the teaching team should take time to collect thoughts, and write down lessons learned *(M7)*. Evaluating student performance and perceptions is also important (Chen et al. 2017). Teachers can decide on summative and/or formative kinds of evaluations. Most evaluations of FCs are based on self-reported scales with quantitative and qualitative data (Velegol et al. 2015). However, there is no standard tool for evaluating FCs. Evaluations can also be enriched by LA (Jovanović et al. 2017). The teaching team can use the final phase to revisit the content and continuously work on renewing the materials and methods used. In particular, pre-recorded online material should be critically revised (O'Flaherty and Phillips 2015). Results should be shared with the administration and students. This phase concludes with assessments and evaluations of the course *(M8)* (cf. Appendix 4).

In addition to the BPMNs, a shorter, compact guideline for practitioners that includes the most important activities of each phase was created. As teachers are usually the major drivers of FC projects, the guideline focuses on the tasks of the teaching team and is presented in the form of a checklist (cf. Figure 6). Checklists have the advantage of being easily understandable and expandable and can be used in combination with the BPMNs (Baumann et al. 2017). The purpose of the checklist is to provide a quick overview and it can be used as a starting point. The order of the tasks within the phases is not set, which allows flexibility while still providing orientation.

Figure 6. FC Checklist for the Teaching Team (Vogelsang et al. 2019b)

4.1.3 Implementation of a BI Module as an FC Using the Process Model

In the context of research question RQ1c, this Subsection demonstrates a concrete implementation of an FC using the developed process model in order to illustrate the applicability and effectiveness of the model. To achieve this goal, an already existing BI module at the University of Osnabrück was chosen as the subject for the redesign into an FC course. **Contribution 2** provides insights on the initial situation, the design and implementation of the FC using the process model as well as the lessons learned and student feedback.

Initial situation: The BI-module is an elective in the Bachelor's degree program in Business Administration (BA) and a compulsory course for IS students. Topics include data modeling, data warehousing, analytics, and information design. Knowledge transfer took place in the context of two 90-minute lectures per week. Students were also given weekly homework assignments in which they were expected to apply their knowledge in current software. The final grade was solely based on the result of the final exam. Student evaluations of the course have been below the university-wide average for several years. Discussions with students revealed that while the topics covered in the course were considered interesting and relevant, they had different learning styles and prior knowledge due to different backgrounds. Students found it difficult to concentrate during the long lectures and apply their knowledge outside of class. Therefore, the course was well suited to be redesigned as an FC with the aims of equalizing the differences in learning and knowledge, increasing interaction and interest in the course, and improving soft skills such as teamwork and independent learning. It was also intended to reduce the then comparatively high dropout and failure rates, as well as to increase attendance and average grades, and to achieve better results in the final evaluation.

Design and implementation: The planning phase included identifying and surveying stakeholders to uncover perceived benefits and barriers. The university management and IT didactics supported the project from the beginning, for example with the possibility to apply for funding and, in the case of IT didactics, with training and consultation hours. The idea was then presented in a meeting of the student council. After positive feedback from students, the required personnel and material resources were estimated: Six student tutors and a part-time teaching assistant for one year in addition to the two existing full-time positions, as well as funds for cameras, microphones, and software. Funds amounting to 40,000€ were acquired thanks to successful applications for third-party funding. The teaching team consisted of a professor, two assistants, and six student employees. A project plan was created to schedule the FC within 7 months, mostly during the current semester, with only a one-month lead time. This is due to both other faculty commitments and the curriculum requirement that the course must

be offered during the winter semester. As a result, much of the planning and execution phases occurred simultaneously, so that the course materials were each completed a week before the implementation date. The teaching team took an agile approach, inspired by Scrum and similar to the methods presented in **contribution 3**. After defining the learning objectives, the associated pre-class phase was developed where students were provided with three to four 10-minute videos in the LMS StudIP (Courseware module). Each video was presented on a dedicated Courseware page that included learning objectives, content descriptions, summaries, and self-assessment questions. In addition, students had the opportunity to work in groups of three on weekly assignments, which were subsequently corrected and returned to the students for feedback. Students received bonus points for completing the assignments. The weekly 90-minute in-class phases were divided into six sessions with approximately 25 participants to discuss the content of the pre-class phase in small groups, present results, and feedback on the tasks, and apply the knowledge in software such as Informatica and Tableau. The final grade was composed of an electronic midterm and final exam, while bonus points could further improve the grade.

Lessons learned and evaluation: During and at the end of the semester, the teaching team met regularly to reflect on the transition to the FC format. The process model proved valuable in the discussions as it provided a visual overview of the process and allowed tasks to be assigned according to the BPMNs. The model was adapted to the team's needs and further specified, for example, to ensure a more small-scale distribution of tasks within the team's various roles. Especially the resource planning in the initiation phase was important, as it allowed for the estimation and acquisition of additional financial resources. The iterative process of simultaneous planning and implementation allowed for continuous improvement of the content and was considered a reasonable and inevitable deviation from the process model. The team used the checklist only as a guide during the initial stages of project planning, to ensure coverage of important tasks. In conclusion, while the process model and checklist are useful tools, their generality necessitates adaptation and extension for specific use cases. The FC transformation was rated as successful by the teaching team. It was noticeable that the preparation of the in-class phase required significantly more time than anticipated since case studies and exercises had to be adapted and redesigned, especially for application in software. In addition, the interactivity of the in-class phase was initially unfamiliar to the students, and participation was correspondingly low despite high attendance, which however changed after three to four weeks.

Student feedback was also positive. In a survey, 109 students evaluated the course, a majority were satisfied with their decision to take the course, and 85% would recommend the FC format to others. In fact, 80% would prefer FCs over traditional lectures or video-only recordings. With 190 students registered, 155 of whom successfully completed the course, the number of participants in the course was more than three times as high as in previous years. The dropout rate was reduced from about 40% to 23%, and the grade point average improved from 3.3 to 2.7, with 1.0 being the best possible grade and 5.0 being the worst possible grade.

4.1.4 Supporting the Long-Term Integration of FCs at Universities

As discussed in Subsection 4.1.1, the effective implementation of FCs requires the inclusion of CM strategies (Hurtubise et al. 2015). This is because CM provides a structured approach to transitioning from current practices to new ones, which ensures that all stakeholders are involved and committed to the process (Kotter 1995). In the context of addressing research question RQ1d, the objective of this Subsection is to highlight the potential ways to promote the long-term integration of FCs through the application of CM. Even though the use of CM strategies is being discussed in the course of digitization processes at universities, they are rarely used in practice (Flavell et al. 2019; Hurtubise et al. 2015). **Contributions 4, 5, and 6** of this dissertation therefore specifically address this topic.

Contribution 4 examines existing CM models utilized in FC development. By conducting a systematic literature search, eight research articles were identified that explicitly describe their CM approach to developing and implementing FCs. The most frequently used CM model, besides self-developed models, was the model according to Kotter (1995). It consists of the following eight steps: 1) Establishing a sense of urgency, 2) forming a powerful guiding coalition, 3) creating a vision, 4) communicating the vision, 5) empowering others to act on the vision, 6) planning for and creating short-term wins, 7) consolidating improvements and producing more change, and 8) institutionalizing new approaches. Kotter's model is organized sequentially, however, the author later revised his statements and emphasized that it would be reasonable to deviate from the sequence and include agile elements (Kotter 2012). Due to its popularity, frequent use, and clarity, the model from Kotter (1995) was used in **contribution 4** to extend the process model introduced in Subsection 4.1.2. In this regard, the identified articles from the literature search were examined for individual CM tasks, which were then assigned to the phases of the process model and steps of the model of Kotter (1995) (Blömer et al. 2020b). To provide an overview of the distribution of CM tasks across the phases of the process model and Kotter's (1995) CM steps, Table 4 shows the corresponding frequencies.

Table 4. Overview of the Number of CM Tasks Adapted from Blömer et al. (2020b)

		Change Management Modell Kotter (1995)								
		Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	∑
FC Process Model	Initiation	6	1	2		1				10
	Planning	2	3	1	7	10	2			25
	Execution									0
	Closing							5	6	11
	∑	8	4	3	7	11	2	5	6	*46*

It can be deduced that of the 46 CM tasks identified, most are located in the planning phase of the process model (n=25). In addition, 10 tasks are assigned to the initiation phase and 11 tasks to the closing phase. This distribution shows that a considerable part of the tasks (n=35) precedes the actual implementation of the FC course. It is noteworthy that no CM tasks from literature could be assigned to the execution phase, which can be attributed to the focus on providing and processing learning materials (Blömer et al. 2020b). When considering the assignment of tasks according to Kotter's (1995) model, it becomes apparent that the majority of CM tasks are assigned to step 5 (empowering others to act on the vision) and step 1 (establishing a sense of urgency). It can be noted that all tasks that fall under the first six steps are concentrated in the initiation and planning phase of the project, while the CM tasks that belong to steps 7 and 8 are located in the closing phase. A detailed description of each of the CM tasks and the respective sources can be found in **contribution 4**. To illustrate some examples of CM tasks, three samples are provided in Table 5, which are labeled with the assignment to the phases of the process model, Kotter's (1995) CM steps, and the corresponding references.

Table 5. Examples of CM Tasks Adapted from Blömer et al. (2020b)

CM Task	**Phase**	**Step**	**References**
Communicate recent problems in teaching openly and include voices of industry leaders who demand new skills to demonstrate the need for didactical change.	Initiation	Step 1	(Collyer and Campbell 2015; Quinn et al. 2012; White et al. 2016)
Promote interdisciplinary networking inside and outside of the institution. Connect teachers in physical or online spaces to share knowledge and best practices.	Planning	Step 2	(Hutchings and Quinney 2015; van Twembeke and Goeman 2018; White et al. 2016)
Communicate positive outcomes through different channels, e.g., websites and e-mails, to all stakeholders. Recruit students and teachers of established FCs to promote success in workshops and meetings.	Closing	Step 8	(Daniel et al. 2018; Quinn et al. 2012)

In **contribution 4**, it remains unclear which stakeholder is responsible for which task. As the examples in Table 5 show, both teachers and the institutions or didactic competence centers could be accountable. Considering this, it is proposed to establish new roles such as FC coaches in HEIs to guide the CM process, taking into account the FC development phases, and to support and accompany stakeholders during the change process (Blömer et al. 2020b).

Although the extension of the process model by CM tasks is convenient for the users of the model, it was found during the identification and grouping of the tasks that a considerable amount of 33 tasks could not be assigned to any phase of the process model. These tasks are overarching and accompany the entire process. The restriction to the process model and Kotter's (1995) model appeared to be not optimal in this regard. Therefore, in **contribution 5** a new and more general CM guideline for FC development and implementation was developed, which is independent of existing models. For this purpose, the literature search from **contribution 4** was adapted and the inclusion criteria were eased, meaning that it was sufficient if individual CM tasks were explicitly described in the contributions. This search increased the number of articles to be analyzed from 8 to 20. To ensure a clear assignment of responsibilities in the guideline, an examination of the mentioned stakeholders was conducted first. Eight stakeholder groups were frequently mentioned: The HEIs management, faculty chairs, teachers, curriculum designer, FC project managers, FC project teams, IT staff, and students. To create the guideline, relevant CM tasks from the individual articles were first identified, collected, and interpreted. To this end, three researchers experienced in implementing FCs independently read the articles with respect to CM tasks and synthesized their findings. A total of 132 tasks were identified and clustered into 58 specific tasks based on their similar content. These tasks were then assigned to 34 more general topics, which in turn were grouped into ten categories. The guideline cannot be presented in a standardized sequence, but Figure 7 offers a possible structuring of the categories. A distinction can be made between a sequential core process with six upper categories (linked by arrows) and the four accompanying categories.

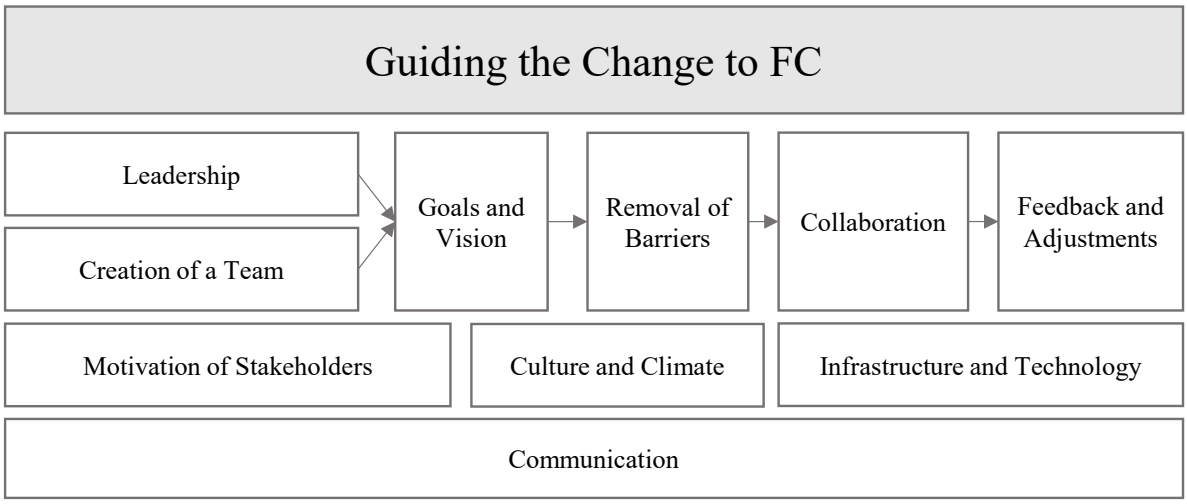


Figure 7. Overview of the CM Guideline (Blömer et al. 2020a)

For each category, **contribution 5** contains a table with topics, associated tasks, responsible stakeholders, and references. In addition, a textual description accompanies each category. Table 6 in this dissertation presents a limited selection of categories that are particularly relevant for the long-term promotion and integration of FC courses in universities and is based on the research of Adekola et al. (2017), Berglund et al. (2017), Bondarev et al. (2018), Charbonneau-Gowdy and Chavez (2018), Collyer and Campbell (2015), Daniel et al. (2018), Harris et al. (2016), Hurtubise et al. (2015), Liebscher et al. (2015), Morisse (2016), Nordquist et al. (2016), Pisoni et al. (2019), Schoop et al. (2016), van Twembeke and Goeman (2018), and White et al. (2016). The exact assignment of tasks to individual articles can be found in **contribution 5**.

Table 6. Overview of Selected CM Tasks Adapted from Blömer et al. (2020a)

Category	**Topic**	**Specific CM Task**	**Stakeholder**
Leadership	Leadership style	Give the project team and teachers enough autonomy, have faith in teachers, and use a mixture of top-down and bottom-up policies.	H
		Acknowledge teachers' fears and do not tell them their ways are outdated.	H
		Communicate clearly that excellent education is one of the HEIs major goals, not only research.	H
Removal of barriers	Time & effort	Release involved teachers in parts of their duties during the implementation of an FC.	H
	Financial resources	Minimize impact on staff time by supplying e-tutors or additional teaching assistants.	H
		Provide money for new infrastructure and technology, and ensure sustainable funding.	H

	Teacher training	Offer in-depth training for media competence, technology usage, LMS, and copyright issues. Provide easily understandable materials in the local language.	IT, H
	Student inclusion	Include students in decision-making processes from the beginning, create student-staff collaborations, and hire students for the development and planning of FCs.	T
	Student support	Offer classes for media skills, techniques to study efficiently, and time management.	IT, T
Collaboration	Community	Establish cross-university networks and name local coordinators who share experiences in regular meetings.	T, H
Motivation	Incentives	Create incentive systems that reward engaged staff with scholarships, promotions, and awards.	H
	Acknowledgement	Show teachers that their work is valued and communicate it openly.	H
	Needs	Survey students and find out about their fears and wishes.	T
		Survey the well-being and current workload of staff as well as their digital literacy and their wishes for training.	H
Culture and climate	Team spirit	Work together on institutional success, open communication, and trust.	H, T
Infrastructure & technology	Infrastructure	Cooperate with facility management and build flexible learning spaces for students, redesign laboratory space for group works and discussions, and provide teachers with shared workspaces.	H, T
Communication	Enlightening	Communicate with the students at the early beginning of FC projects, explaining the benefits, expectations, and responsibilities.	T
	Linkage	Support internal systems for communication and create communities of practice.	H
	Visibility	Promote achievements in a staff meeting, via e-mails and newsletters.	H
Legend: (H) HEI management including faculty chairs and project managers, (T) Teaching team, (IT) IT and didactics support			

Contribution 6 expands the research on the presented guideline. Stakeholders were interviewed regarding redundancy, ambiguity, and self-explainability of the tasks. As a result, the guideline was reduced to eight categories and 30 tasks, as “collaboration” and “culture and climate” were integrated into other categories. Additionally, a survey with 119 participants from the University of Osnabrück was conducted to understand the stakeholders’ responsibilities from their perspective. One of the findings of the survey is that the HEI

management plays a critical role in the successful implementation and integration of innovative teaching methods, such as FCs. However, this responsibility is not reflected in the collaboration currently taking place between other stakeholders and the HEI management. Participants considered the HEI management to be primarily responsible for the tasks assigned to the categories of leadership, motivation, goals, collaboration, and culture (Kötter et al. 2021). The HEI management can influence FC development, teacher motivation, and satisfaction by establishing framework conditions, such as a university-wide e-learning strategy, adequate funds for technology and training, and incentives (Berglund et al. 2017; Liebscher et al. 2015; van Twembeke and Goeman 2018). Specific CM tasks include, for example, effective communication with teachers (White et al. 2016), showing trust in teachers and their work (Hutchings and Quinney 2015), and providing financial resources for additional staff (van Twembeke and Goeman 2018) or partially releasing teachers from other tasks during the FC development (Berglund et al. 2017). It is also important that teachers' efforts and successes are seen, appreciated, and, where appropriate, rewarded by university management (Adekola et al. 2017). Yet, it becomes evident from the results of the survey that the cooperation between the HEI management and other stakeholders, such as students, the teaching team, as well as IT and didactics support, is rated as low or non-existent. The survey also illustrates that especially teachers and students would like to work more closely with the HEI management, whereas IT and didactics support does not regard this as essential. The results of **contribution 6** can serve as a basis for discussion to improve cooperation among stakeholders. It is important to cultivate a culture of mutual trust and appreciation among stakeholders to develop innovative teaching and integrate it into university operations in the long run (Blömer et al. 2020a; Kötter et al. 2021).

4.2 Usage of LA to Continuously Support FCs

This Section provides the results related to the second research question, which addresses how LA can help improve FC courses. Analogous to Section 4.1, this Section is divided into four Subsections, each addressing a sub-question (RQ2a-d). Subsection 4.2.1 introduces the challenges that students and instructors face in FCs. Subsequently, in Subsection 4.2.2, students' views on how LA could support them in FCs are explored. Subsection 4.2.3 then explains the actual implementation of LA through the development of a prototypical dashboard for students of the BI module. Subsection 4.2.4 provides an outlook on the teachers' perspective on LA.

4.2.1 Challenges of FCs for Students and Teachers

The objective of this Subsection is to illustrate the challenges encountered by students and teachers in FCs (RQ2a). This Subsection builds on the motivations and findings of **contributions 7** and **11**. Due to the circumstance that this research was conducted during the Covid-19 pandemic, the challenges refer to online-only instruction as well, since the in-class phase of FCs from 2020 to 2022 also had to take place online. The Subsection begins by highlighting the problems experienced from the students' perspective (1), followed by an exploration of the challenges faced by instructors (2).

(1) The success of an FC depends significantly on students independently engaging with the given materials during the pre-class phase (Rubio-Fernández et al. 2019). If this preparation does not occur, students cannot effectively participate in active learning activities during the in-class phase, causing the FC approach to lose its benefits and become inefficient (Pardo et al. 2019; Rubio-Fernández et al. 2019). FC participants are expected to have a high degree of autonomy, self-management skills, and independent learning, which are often lacking, especially at the beginning of their studies (Lai and Hwang 2016). Additionally, independent preparation and more frequent assignments and tests require students to spend more time studying during the semester in comparison to traditional courses (Chen et al. 2016; Tanner and Scott 2015). Another problem is that students do not have the opportunity to ask questions directly during the pre-class phase, for example when watching instructional videos, which can lead to frustration (Bergmann and Sams 2012). In addition, the variety of different materials (videos, readings, assignments) can overwhelm students (Ferguson 2012; Pardo et al. 2019). During the pre-class phase, students may also feel isolated and lose their connection to the group (Ferguson 2012).

There are also challenges during the in-class phase. It can generally take some time for students to get used to the new teaching format and to feel comfortable actively participating in the in-class phase (Gilboy et al. 2015). In addition, there are students who "hide" during group work and discussions and do not actively participate (Rubio-Fernández et al. 2019). This problem is especially prevalent in larger groups (Clark et al. 2016). Due to the Covid-19 pandemic, the in-class phase had to take place online. This can lead to an increased sense of isolation, which could negatively impact the effectiveness of teaching (Joshi et al. 2022).

(2) Instructors also face challenges in FC courses. They rely on students to engage with the materials provided to them. However, instructors do not receive feedback from students during the pre-class phase due to the separation of time and space (Clark et al. 2016). Visual cues such as nodding and yawning, which instructors receive during traditional lectures, are important signals of how students are coping with the course material (Dringus and Ellis 2005). Feedback is received by instructors only during the in-class phase through students' questions or their performance. In **contribution 11**, semi-structured interviews were conducted with 18 teachers from three universities, which were subsequently analyzed using a qualitative content analysis according to Mayring (2014). Participants were for instance asked about the disadvantages of hybrid and online teaching. Table 7 shows a summary of the categories derived from the individual responses. Among these, all interviewees criticized the low level of social interaction with students, which also resulted in poorer relationships. Furthermore, the participants observed an increasingly passive behavior of students, to the extent that teachers sometimes held monologues in videoconferences, as students did not actively participate and neither reacted to nor asked questions. According to the interviewees, this led on the one hand to a lack of feedback on how students were coping with the materials and content, and on the other hand to increasing frustration on the part of teachers. Some participants expressed concern about a possible decline in teaching quality resulting from the increasing formalization of lectures or the reuse of outdated instructional videos. Other commonly named disadvantages relate to the high effort teachers face in OT and possible technical issues (Rodda 2023a).

Table 7. Disadvantages of OT from Teachers' Perspective Adapted from Rodda (2023a)

Category	**Examples**
Social Interaction	Weaker relationship, little interaction, lack of feedback, loss of visual cues
Student behavior	Passive behavior, procrastination
Quality of teaching	Formalization of teaching, reuse of outdated materials
Effort	High expenditure of time, technical training
Technical problems	Software and hardware problems

4.2.2 Usage of LA to Support Students

To address the challenges of FCs and further enhance the benefits, the use of LA is a possible solution. This Subsection addresses the students' perspective, specifically on how LA can support them in FCs (RQ2b). To this end, the results of **contribution 7** are presented.

In **contribution 7**, a literature analysis as well as a written qualitative survey were conducted among 136 students of the BI module already taking place as an FC at that time. Participants had prior knowledge of data analysis and reporting but had no practical experience with LA. The purpose of the survey was to identify the opportunities and threats of LA from the perspective of students, to find out about their willingness to use LA, and whether the opportunities or threats outweigh each other. The results were synthesized using the qualitative content analysis according to Mayring (2014) and divided into categories and subcategories. The results are described in detail in **contribution 7**. Table 8 shows an overview of the categories, subcategories, and frequency of mentions for LA opportunities as perceived by participants. The three most frequently mentioned subcategories are highlighted in gray.

Table 8. Opportunities of LA from Students' Perspective Adapted from Rodda (2022)

Category	Subcategory	Frequency
1. University-wide course offers	1.1 New or adapted courses	7%
	1.2 Automated recommender system for courses	5%
2. Adaption of teaching in courses	2.1 Adaption of teaching method	4%
	2.2 Adaption of the scope of coursework	6%
	2.3 Adaption of content and materials	36%
	2.4 Additional explanations for complex topics	45%
3. Improvement of individual learning behavior	3.1 Adaption of learning behavior	20%
	3.2 Overview of learning progress	29%
	3.3 Continuous automated feedback	5%
	3.4 Overview of weaknesses and mistakes	18%
	3.5 Better self-reflection	15%
	3.6 Comparison to peers	33%
	3.7 Early detection of shortcomings	10%
	3.8 More targeted exam preparation	12%
	3.9 Better time management	24%
4. Transparency	4.1 Overview of current and past grades; GPA	13%
	4.2 Comprehensibility of final course grades	26%
5. Communication with instructors	5.1 Tailored, efficient help for individual students	8%
	5.2 Interventions for at-risk students	7%
	5.3 Anonymous feedback through LA data	4%

Students saw the greatest potential in additional explanations for complex topics, the adaption of content and materials, and the possibility to compare themselves to peers. Regarding current research, many of the benefits noted by students are also investigated in literature, such as the

positive effects of comparisons with fellow students, which can strengthen the sense of belonging to a group and promote motivation (Sclater 2017). Yet, some subcategories are not addressed in current research to the extent described by students. These include more focused exam preparation, better time management, and transparency of final grades (Rodda 2022).

To understand how LA can support students, it is also important to consider the risks that students see in LA. Table 9 outlines the categories, subcategories, and frequencies of LA threats mentioned by students, with the three most frequently named subcategories highlighted in gray.

Table 9. Threats of LA from Students' Perspective (Rodda 2022)

Category	Subcategory	Frequency
1. Ethical concerns	1.1 Insufficient or poor data protection	43%
	1.2 Violation of privacy	26%
	1.3 Continual monitoring	16%
	1.4 Reduction of students to metrics	4%
2. Inadequate LA systems	2.1 Technical difficulties	4%
	2.2 Collection of inadequate data	10%
	2.3 Collected data only refers to activity, not knowledge	8%
	2.4 Disregard of offline learning	3%
	2.5 Manipulation of the system by students	9%
3. Negative effects on student behavior	3.1 Increased pressure on students	26%
	3.2 Demotivation of students	15%
	3.3 Misinterpretation of data by students	15%
	3.4 Focus solely on data or learning objective	5%
4. Usage of LA by instructors	4.1 Lack of digital competencies and knowledge	6%
	4.2 Invalid interpretations and predictions	32%
	4.3 Discrimination of groups of learners	15%
	4.4 Discrimination of individual students	9%
	4.5 Less time for good quality teaching	10%
	4.6 Focus solely on course metrics	5%
	4.7 Less student-teacher-communication	8%
	4.8 Misuse of data	13%

From these results, it can be concluded that students place particular value on the protection of their data, their privacy, and on accurate data and predictions. It is also important to consider the risk that individual students may feel increased pressure to perform as a result of LA. In addition, concerns are raised about the potential for misinterpretation or discrimination against individual students. Many of the threats identified by students are similar to those discussed in the literature. In particular, ethical issues have been studied widely, and data protection and privacy guidelines already exist (Johnson 2014; Pardo and Siemens 2014; Swenson 2014). Some of the risks mentioned by students receive comparatively little or no attention in the literature. This applies, for example, to the concern that teachers will have less time for their

actual teaching tasks because of the time they invest in LA, or that data could be misused to retrieve content in exams that students have worked on poorly.

The findings of **contribution 7** also reveal that students see great potential in the use of LA. This is further illustrated by the fact that 89% of students indicated that LA opportunities outweighed the threats. Only 5% saw greater threats than opportunities, while 6% considered the ratio balanced (Rodda 2022). The positive attitude of students, who together with teachers are the most important stakeholders, ensures a solid foundation for the successful implementation and application of LA (Ifenthaler and Schumacher 2016; Siemens 2012). To provide prepared LA data to students, dashboards are most commonly used since they can be designed to be intuitive and interactive (Bodily et al. 2018; Nguyen et al. 2021). Therefore, the following Subsection discusses the development of an LAD for participants of the BI module.

4.2.3 Prototypical Implementation of an LAD

In this Subsection, the question of how a student-centered LAD can be designed (RQ2c) will be answered. For this purpose, a prototypical dashboard for the BI module at the University of Osnabrück was developed. This Subsection builds on **contributions 8-10**, which can be represented using the DSR process model introduced in Section 3.3 (cf. Figure 8) (Peffers et al. 2007). The combination of the demonstration and evaluation phases was conducted because the demonstration took place before each evaluation in the form of pre-tests to showcase the exemplary application of the artifact. **Contribution 8** describes the process of the requirement elicitation to design an LAD for students of the BI module. **Contributions 9** and **10** then explore the iterative development and evaluation of the prototype.

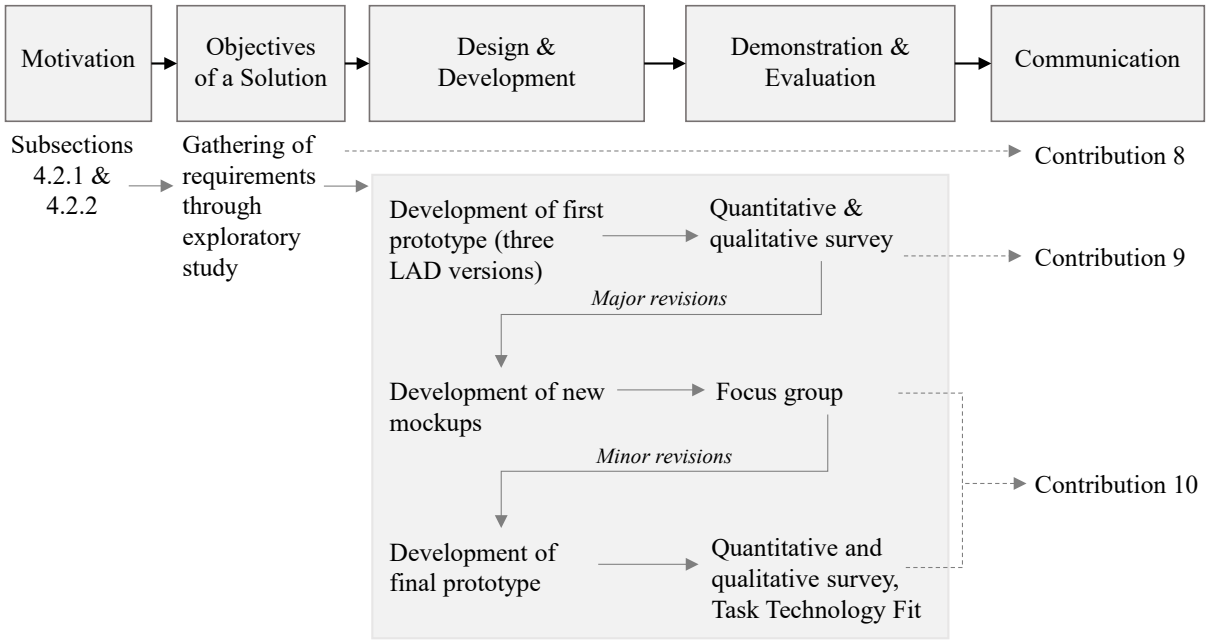


Figure 8. DSR Process for the LAD Development

The requirements regarding an LAD for the BI module were gathered with the help of a comprehensive mixed-methods study with 139 students. The study included two parts: An online survey and a task in which participants were required to create their own LAD using Tableau and a synthetic dataset. The participants were students of the BI module already taking place as an FC. Therefore, all participants had prior knowledge of data modeling, data analysis, and reporting. The analysis of the dashboards created by the participants and the responses to the questionnaire focused on three key aspects: The functional scope, the informational scope, and the visual presentation. The results are presented in detail in **contribution 8**. Figure 9 shows a summary of relevant requirements, sorted by the three key aspects.

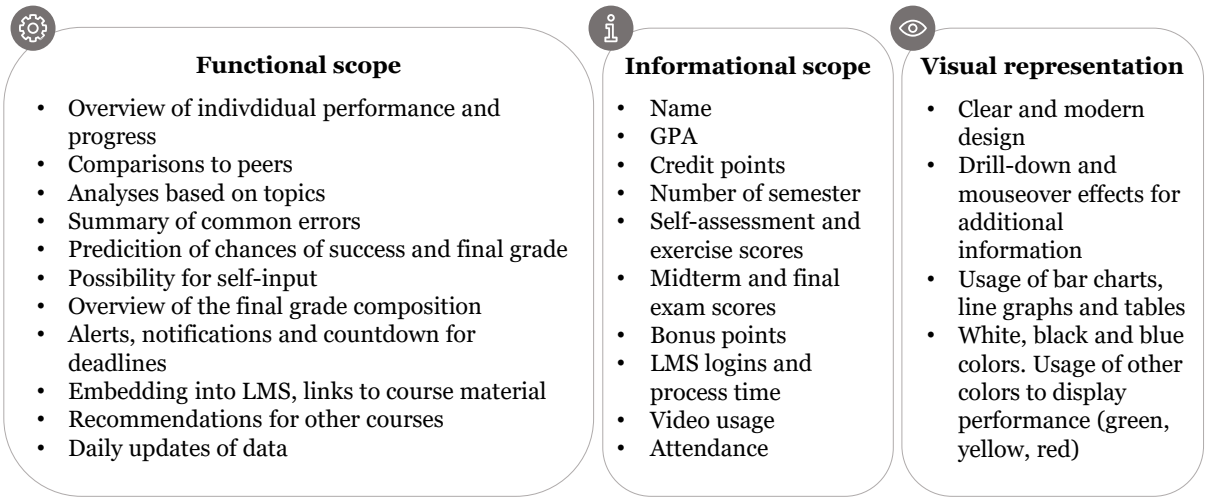


Figure 9. Overview of LAD Requirements (Rodda and Stahmann 2023)

Concerning the range of functions, the most frequently mentioned requirement was a clear presentation of individual performance and progress in the course, with the possibility of comparing oneself with fellow students. Participants expressed a desire for LA to analyze their data with respect to the course topics, such as data marts or information design, allowing them to track their progress and performance in the different subject areas. The prediction of the final grade or the probability of passing the course, as well as a self-entry data function enabling the collection of "offline learning behavior", were also important to the participants. Concerning the informational scope, the focus was clearly on learning activity data, in contrast, socio-demographic attributes were rather rejected. According to participants, data such as the results of self-assessment tests, homework assignments, and midterm exams should be primarily used for LA. On the contrary, data on nationality, place of residence, income, and activities on social media were rejected. A list of the acceptance and rejection rates for individual attributes can be found in **contribution 8**. With regard to the visual presentation, participants emphasized simplicity and clarity. Tables and classic visualization types such as bar charts were preferred.

Colors were mainly used to represent different levels of performance, often using a traffic light color scheme (Droit and Rieger 2020). The results of the study align well with findings from research on the state of the art of LADs (Matcha et al. 2020; Vieira et al. 2018) and research on the development of LADS (Bodily et al. 2018; Klerkx et al. 2017; Schumacher and Ifenthaler 2018; Ulfa et al. 2019). Since the requirements elicitation was specifically about the LAD for the BI module, module-specific components, such as the display of bonus points, were important to participants.

In **contribution 9**, the requirements were used as a foundation to develop and evaluate three prototypical LADs. For this purpose, data from 155 students from the LMS StudIP as well as the examination system of the University of Osnabrück were used as a data basis. The data model created consisted of 12 tables with a total number of 56.155 data entries. The integration of the data proved to be challenging, as the LMS had been designed for administrative purposes, and much of the data was either not collected or did not exist in a form suitable for further processing. As a result, it was not possible to meet all student requirements. For example, evaluations based on topics of the course could not be conducted. In addition, common errors and recommendations for other courses could not be provided using this database. Historical data would have been required for a more accurate prediction of the final grade. The three LAD versions created differ slightly in terms of design and features. Figure 10 shows the layout of dashboard version 1, implemented with Tableau, which includes interactive features such as drill-down and mouseover effects. This figure serves as an illustrative representation of all three versions. Detailed descriptions of the design and features can be found in **contribution 9**.

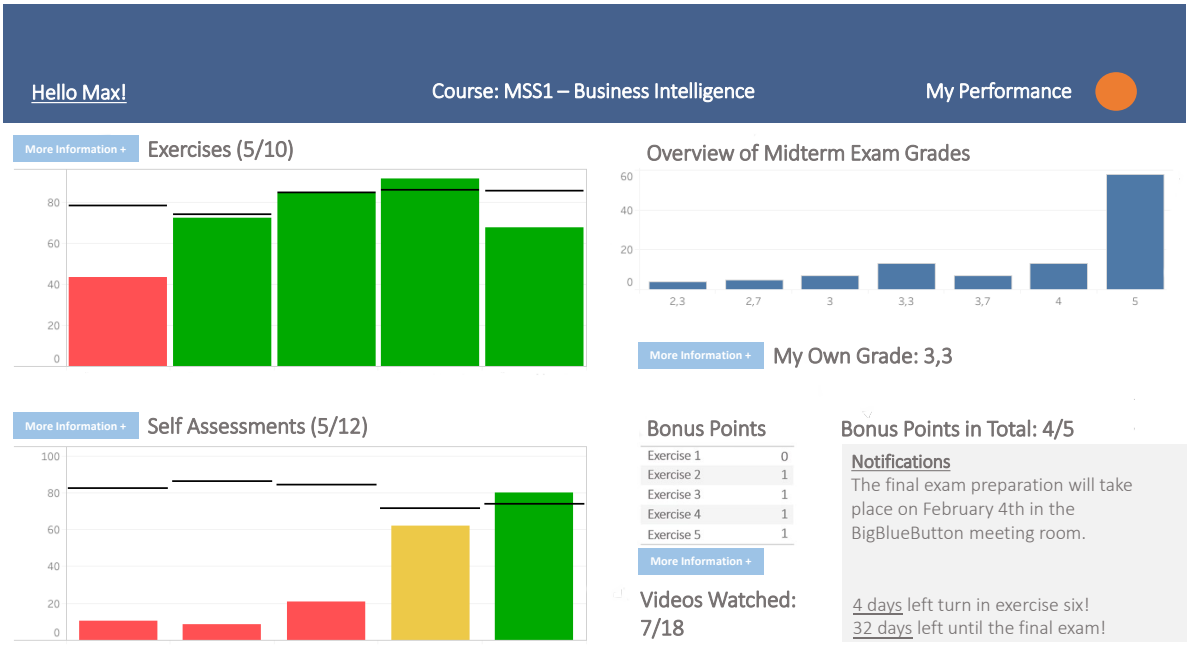


Figure 10. Prototype of the LAD Version 1 (Rodda 2023b)

The evaluation of all three dashboard versions was conducted using a questionnaire that was completed by 114 participants after testing the dashboard. The questionnaire contained 4 parts, (1) questions about the System Usability Score (SUS) (Brooke 1996), (2) the Short Visual Aesthetics of Website Inventory (VisAWi-S) (Moshagen and Thielsch 2013), (3) items related to individual functions and elements, and (4) open-ended questions. There were few significant differences between the individual LAD versions that affected individual elements. Version 1 performed most successfully in all parts and therefore serves as the basis for further development. The SUS score, which can range from 0 (worst score) to 100 (best score), scored above 80, which can be considered good (Bangor et al. 2008). The value of the VisAWi-S with 3.7 is in an acceptable range but can be improved (scale from 0 worst score to 5 best score). Particularly important were the answers to the open questions, which revealed that students still missed numerous functions that could not be implemented due to the limited database. They also expressed a desire for a more modern design and improved navigation with multiple subpages (Rodda 2023b).

For this reason, an artificial database was created as part of **contribution 10**, which could be used to implement all of the students' requirements. To create a modern design with multiple pages featuring intuitive navigation, mockups were developed and afterward evaluated by a focus group of 12 students. Since these designs and functions could no longer be implemented in the software previously used, the LAD was created in Power BI. Figures 11 to 13 show screenshots of selected pages of the dashboard.

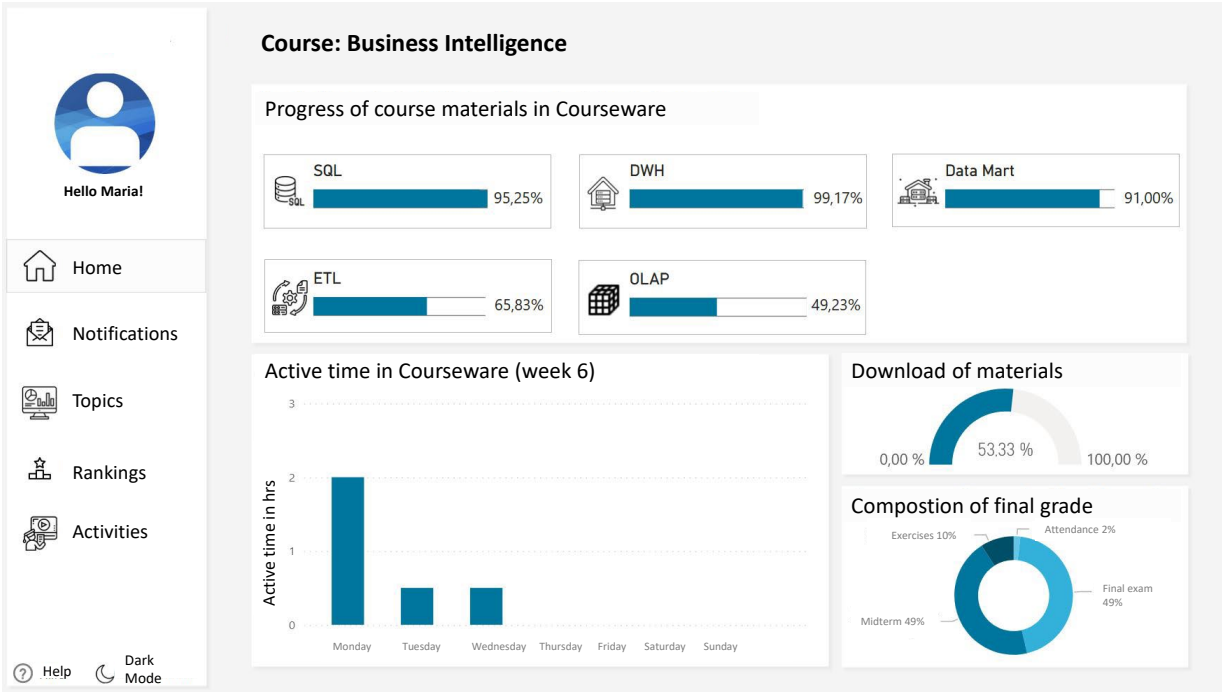


Figure 11. Home Screen (Rodda and Stahmann 2023)

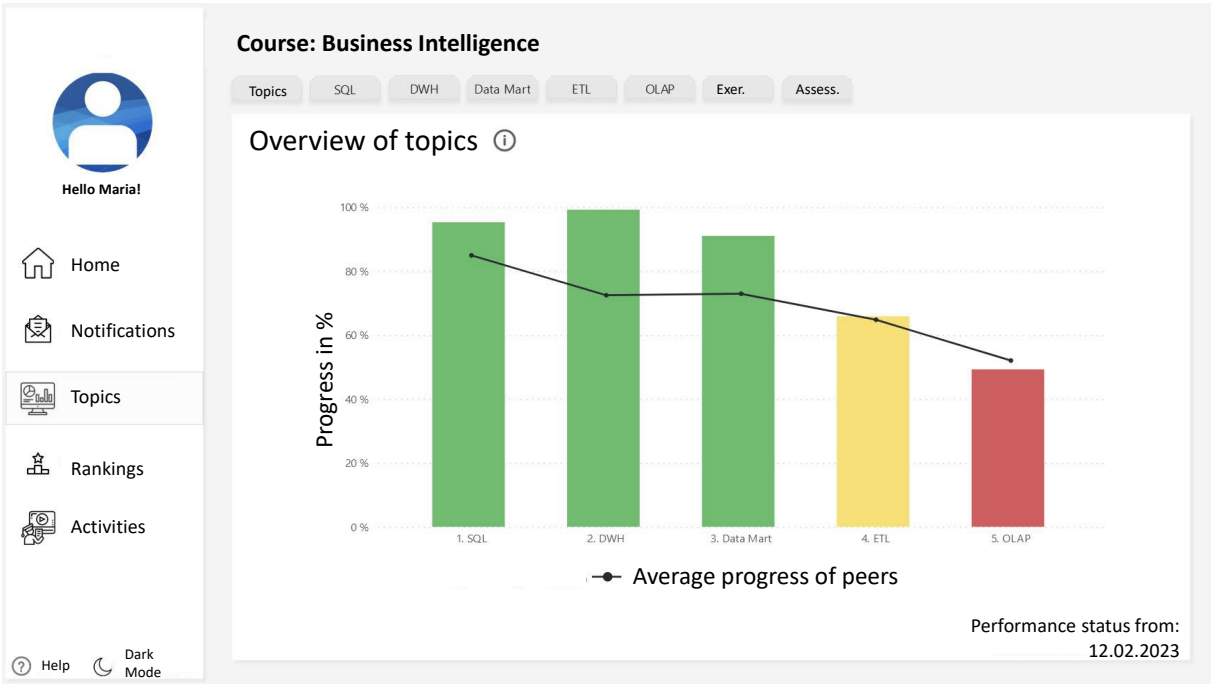


Figure 12. Overview of Progress by Topic (Rodda and Stahmann 2023)

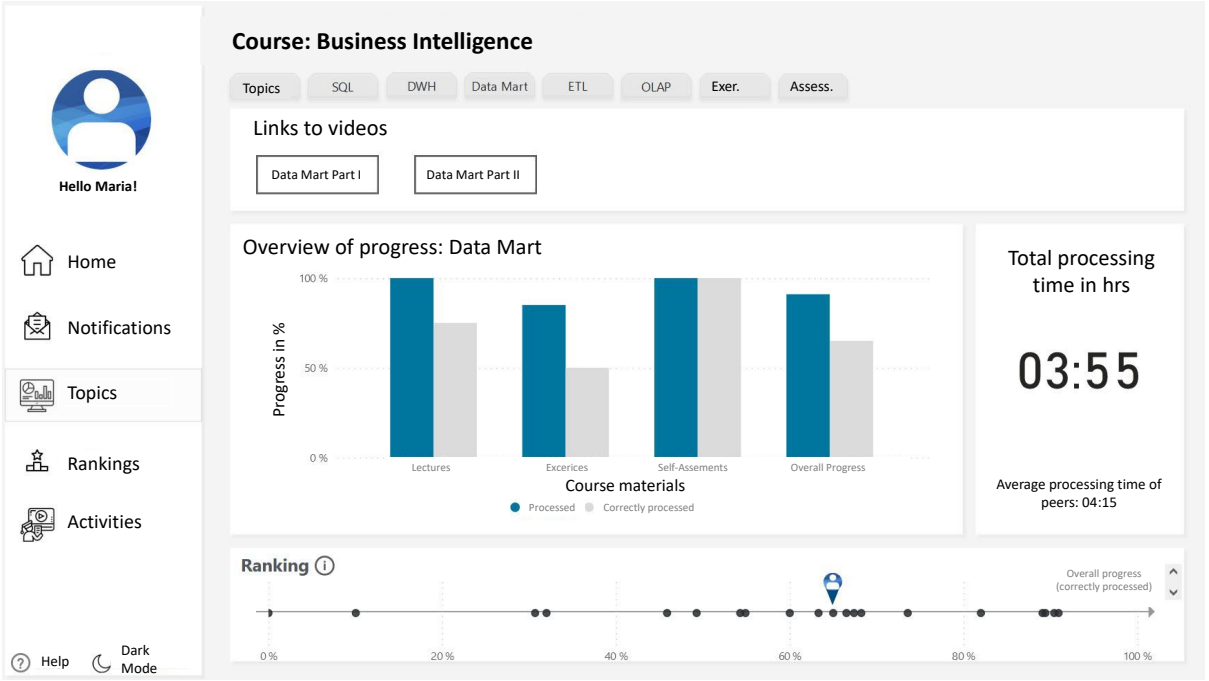


Figure 13. Overview of Progress for the Topic Data Mart (Rodda and Stahmann 2023)

This prototype was also evaluated with a questionnaire. For better comparability, SUS and VisAWi-S were surveyed again. Furthermore, participants were able to express their opinion on the range of functions and design in open questions. They were also asked if they would use the LAD for their studies. In the last part of the questionnaire, the Task Technology Fit (TTF) according to Goodhue (1998) was assessed. The TTF is used to evaluate whether a technological tool is suitable for the task a user is to perform. In this case, the aim was to

examine whether the dashboard could support users in the context of the SRL. For this purpose, a crucial aspect of SRL, the ability to monitor and assess one's performance and progress, was selected (Zimmerman and Campillo 2003). Participants in the study were asked to answer the standardized TTF questionnaire to indicate the extent to which the LAD supports them in this task. The questionnaire consists of 12 constructs which are rated on a scale from 1 (do not agree at all) to 7 (fully agree). To evaluate the TTF, a null hypothesis (H_0) was formulated, which stated that the use of the LAD would hinder or not impact the participants' ability to independently monitor and assess their academic progress and performance.

In total, 73 valid questionnaires were evaluated. The SUS score demonstrated good usability, surpassing the score of 80 (Bangor et al. 2008). The VisAWi-S score improved slightly to 3.9. It should be noted that feedback from the open questions had become significantly more positive and the number of missing functions had decreased. When asked about additional features desired in the dashboard, 22 of the participants responded. The most common request, which was mentioned by 6 participants, was for specific recommendations for exam preparation. It was also suggested to replace the dashboard help page with dynamic help on each page and video tutorials. Comments regarding the design of the LAD included recommendations to adjust the font color and size for dark mode, to add more colors to the dashboard, and to offer a customizable home screen. In addition, 91% of the participants stated that they would use the LAD in their studies.

Regarding the TTF, a one-tailed t-test was conducted for each construct to test the null hypothesis "$E[x] \leq 4$", meaning that the expected value E[x] is less than or equal to 4 (neutral stance). Table 10 provides an overview of the constructs, the associated means ($\bar{x}$), standard deviations ($\hat{\sigma}$), as well as t- and p-values. The results reveal a good fit between technology and task. The median scores for all 12 constructs range from 5 to 6. The constructs accessibility and presentation of data were particularly well-rated. The null hypothesis could be rejected for all constructs individually and for the overall TTF at a significance level of $\alpha=0.99$. Hence, it can be concluded that the LAD is suitable to support users in self-monitoring and self-assessment (Rodda and Stahmann 2023).

Table 10. Summary of TTF Results (Rodda and Stahmann 2023)

	Key Data			**H_0 Hypothesis**	
Construct	**Items**	**$\bar{x}$**	**$\hat{\sigma}$**	**t-value**	**p-value**
The Right Level of Detail	2	5.4726	1.1338	15.6940	0.0000
Accuracy	2	5.4932	1.1033	16.3531	0.0000
Compatibility	3	5.2009	1.4161	12.5499	0.0000
Locatability	2	5.6438	1.0221	19.4331	0.0000
Accessibility	2	6.0685	0.7671	32.5838	0.0000
Meaning	1	5.6164	1.0492	13.1631	0.0000
Assistance	2	5.2808	1.1249	13.7577	0.0000
Ease of Use of Hardware and Software	2	5.9452	1.1251	20.8898	0.0000
System Reliability	2	5.6918	1.2009	17.02144	0.0000
Currency	2	5.5685	1.2143	15.6072	0.0000
Presentation	2	6.0616	0.9557	26.0649	0.0000
Lack of Confusion	2	5.0479	1.5101	8.3850	0.0000
TTF	*24*	*5.5736*	*1.2064*	*54.5972*	*0.0000*

4.2.4 Usage of LA to Support Teachers

The prior Subsections addressed student requirements and the creation of a student-centered LAD. To provide an outlook on future research and to include the perspective of instructors, **contribution 11** explores the opportunities and risks of LA as well as the requirements from the teachers' perspective. For this purpose, 18 teachers were interviewed. The approach has already been described in Subsection 4.2.1. In the present Subsection, the results relating to the teachers' attitudes towards LA and potential requirements for LA are presented.

The opportunities mentioned by participants can be grouped into five categories with several subcategories, which are explained in detail in **contribution 11**. Table 11 presents an overview of the categories, subcategories, and corresponding frequencies, with the three most commonly mentioned topics highlighted in gray. Teachers perceive LA as an opportunity to enhance their understanding and oversight of students' learning behaviors and use of instructional content. LA enables teachers to identify problem areas early on, customize instruction, and provide individualized support. By adjusting content, improving comprehension, and adapting the pace of learning, instructors can optimize their teaching practices. Furthermore, participants mentioned that LA could enhance students' learning behaviors, motivation, and self-assessment. The automation of feedback and recommendations offers an opportunity to reduce the workload of teachers and enable continuous improvement of teaching (Rodda 2023a).

Table 11. Opportunities of LA from Teachers' Perspective Adapted from Rodda (2023a)

Category	Subcategory	Frequency
1. Overview of student activities	1.1 Overview of progress	50%
	1.2 Insights into learning behaviors	17%
	1.3 Transparency	11%
	1.4 Connection	22%
2. Detection of problem areas and patterns	2.1 Early identification of problems or poorly addressed content	61%
	2.2 Patterns for success or failure	17%
	2.3 Comparisons over time	22%
3. Quality of teaching	3.1 Adaption of content to optimize courses	78%
	3.2 Feedback	28%
	3.3 Continuous re-evaluation of changes	33%
4. Student learning	4.1 Increased motivation and satisfaction	44%
	4.2 Less procrastination	11%
5. Automated feedback	5.1 Automated recommendation for actions	11%
	5.2 Data-driven decision support	11%

Alongside LA's opportunities, participants were also asked about potential threats (cf. Table 12). The most frequently cited threat was inadequate data protection. However, most participants stated that this was a responsibility of the institution if LA tools were made available to instructors and that they were less affected by it. There are also concerns about incorrect interpretation of data, for example, due to lack of knowledge or misleading information. Participants also expressed concerns about the high investments of resources and time needed for the analysis of data. LA results could also affect teachers' behavior towards students or lead to disadvantages for students who show little engagement. Some participants mentioned that they could be demotivated if they saw, based on the LA data, that carefully prepared content was hardly used by students. Additionally, LA could negatively impact students, if they feel constantly monitored or pressured to perform better.

Table 12. Threats of LA from Teachers' Perspective Adapted from Rodda (2023a)

Category	Subcategory	Frequency
1. Data protection	1.1 Data protection	83%
	1.2 Invasion of students' privacy	22%
2. Focus on data	2.1 Unreliable or meaningless data	22%
	2.2 Excessive weighing of key figures	28%
	2.3 Misinterpretations	56%
3. Impact on teachers	3.1 High investment of effort and resources	50%
	3.2 Overwhelming amount of data	11%
	3.3 Lack of technical expertise	11%
	3.4 Demotivation	11%
4. Discrimination against students	4.1 Different behavior towards students	50%
	4.2 Self-fulfilling prophecies or discrimination	17%
5. Impact on students	5.1 Constant feeling of being monitored, pressure	33%
	5.2 Frustration	22%

In all interviews, participants demonstrated a positive attitude toward LA. They expressed the desire to use LA, provided that the data are made available in an appropriate form. The preferred form of presentation is a clear and customizable dashboard that includes various filtering and aggregation functions. These functions would allow the data to be presented over time, for example, on a weekly or semester-by-semester basis. The dashboard should be integrated with the LMS and updated daily. Real-time data or access to raw data, on the other hand, was requested by only a small number of interviewees. In terms of data to be collected, for example, information on content usage, such as video usages and self-study test completion, as well as time spent in the LMS and students' prior knowledge were mentioned. Regarding evaluations, participants desired, for example, an overview of common errors and correlations between final grades and other data, such as the completion of assignments or prior knowledge (Rodda 2023a). Due to the small sample size, the participants' different experiences with LA, and the open-ended questions, the results only provide a first indication to conduct a more detailed analysis of the requirements together with the requirements already identified in the literature (Dourado et al. 2021) to develop an LAD for instructors.

5 Discussion

In the course of the discussion, implications for research (Section 5.1) and practice (Section 5.2) are provided. Subsequently, in Section 5.3, the limitations of the results and an outlook on future research are presented.

5.1 Implications for Research

This dissertation contains contributions that address various aspects of FC development and integration, as well as the application of LA. Within the contributions, research gaps were identified and findings were discussed. The results of the contributions provide implications for research, which are presented in this Section in accordance with the two research questions.

The first research question considers the development and integration of FC courses. Based on the literature review in **contributions 1** and **2**, it was shown that many case studies are available in FC research, but few overarching models for course development exist (Song et al. 2017). The developed process model leverages available FC research in the context of inductive modeling to provide a reference model for the future creation of FCs (Vogelsang et al. 2019b). Thus, it facilitates the generalization of knowledge previously limited to isolated case studies and presents it in a novel format that can serve as a foundation for future research efforts. In addition, this dissertation provides a multi-perspective view of FC research by addressing different stakeholders and their roles and collaboration in **contributions 4**-**6**. The extension of the process model by Kotter's (1995) renowned CM model presents an opportunity to bridge the gap between two loosely interconnected research domains (Flavell et al. 2019). By creating an overarching, model-independent CM guideline in **contribution 5**, pre-existing knowledge from case studies was also generalized and presented in a new context (Blömer et al. 2020b).

The second research question explores how LA can support students and teachers in FCs. **Contributions 7-11** provide a deeper understanding of teachers' and students' views on LA, as their perspectives have received little attention in the literature to date (Howell et al. 2018; Ifenthaler 2017). It was found that both groups recognize the potential of using LA and support its use. A comparison of the results of the surveys from **contributions 7** and **11** shows that opportunities and risks are alike from the perspective of both students and teachers (cf. Tables 8, 9 and Tables 11, 12). The high level of identified potential, as well as the similar views of the stakeholders, provide a solid foundation for successful LA implementations (Ifenthaler and Schumacher 2016). It should be noted, however, that the number of participants in the surveys varies widely, with 136 students compared to 18 faculty respondents. Students and teachers

consider LA opportunities to include an overview of progress and performance, feedback, early identification of problem areas, adaptation of instructional materials, improved time management, and less procrastination. Risks identified relate to data protection, privacy, an excessive focus on data, misinterpretation, and potential discrimination (Rodda 2022, 2023a). There is already extensive research on ethical concerns such as student privacy and data protection, which has led to the creation of related guidelines (Johnson 2014; Pardo and Siemens 2014). Other topics such as the potential for better time management and more targeted exam preparation, as well as the threat of intentional misuse of LA data, are still rarely addressed in current literature (Rodda 2022). To demonstrate the design and usefulness of an LAD, the DSR methodology was used in **contributions 9** and **10** to develop a prototypical LAD for the BI module. The iterative development and evaluation process of the LAD contributes to the generation of design knowledge in this research field (Rodda 2023b; Rodda and Stahmann 2023).

5.2 Implications for Practice

This dissertation focuses on design-oriented aspects and was written with a practical orientation due to the continuous reference to the BI module. As a result, implications with high practical relevance emerge from the results.

The lack of structured approaches to developing FCs is problematic, as the development of FCs is time-consuming and complex (Giannakos et al. 2014). The process model developed in **contributions 1** and **2** provides valuable support for teachers who are interested in creating an FC. The project management-oriented perspective of the model as well as its clear structure of only four phases make it easily understandable (Vogelsang et al. 2019b). Teachers can gain an overview of the processes and required tasks. The representation as a BPMN model illustrates the interactions and tasks of other stakeholders and provides an overview of parallel work steps. Another quick and easily understandable overview is provided by the checklist that focuses only on significant tasks for teachers and is easily extensible. By transforming the BI module into an FC, it was shown that the process model provides useful support, especially at the beginning of the transformation (Vogelsang et al. 2019b). Teachers are thereby also made aware of responsibilities that are normally not part of their core tasks, such as stakeholder analyses or a cost-benefit consideration before they ultimately decide to use the FC approach. Furthermore, agile approaches, as briefly described in **contributions 2** and **3**, can support instructors in creating FC courses despite limited time resources during the semester (Blömer et al. 2020c; Vogelsang et al. 2019b). For the long-term integration of the FCs, the underlying conditions at

universities were addressed in **contributions 4-6**. As more than 50% of organizational changes fail (Bondarev et al. 2018) and due to the specifics of the organizational structure of HEIs (Morisse 2016) the application of CM should take place at universities. For this purpose, in **contributions 5** and **6**, a CM Guideline was developed, which offers numerous concrete examples from case studies that provide stakeholders with specific steps to take when it comes to CM. It can also serve as a foundation for conversations among stakeholders to create adequate conditions for FC courses at HEIs (Blömer et al. 2020a; Kötter et al. 2021).

In the context of the investigations on the second research question, high potentials in the application of LA were identified, based on surveys with students and teachers (Rodda 2022, 2023a). However, these potentials remain mostly unused by universities (Nouri et al. 2019). The results of the surveys from **contributions 7, 8,** and **11** provide valuable views and requirements from students and teachers. These can serve as a platform for discussion among stakeholders and as an initial starting point for the development of LAS and dashboards. In this dissertation, the focus was placed on the iterative development of an LAD with a strong focus on the needs of the respective stakeholders. This included gathering requirements from students and involving them throughout the design process (**contributions 8-10**). Early stakeholder involvement in the development of LADs can increase user motivation and engagement, as well as improve satisfaction (Hutchings and Quinney 2015). Faculty and IT staff can be guided by this approach or use the prototypical LAD as an inspiration for custom designs. The results from **contribution 10** also indicate that LADs have the potential to assist students in self-regulated learning. LADs can support students' independent preparation during the pre-class phase and thus provide the prerequisites for active participation during the in-class phase (Rodda and Stahmann 2023). Teachers benefit from LA by identifying problems with pre-class phase materials early on and assessing student performance levels. This allows them to target students' needs and adapt their teaching materials accordingly (Rodda 2023a).

5.3 Limitations and Future Research

All contributions to this cumulative dissertation have been published in double-blind reviewed conferences or journals, ensuring sufficient quality, rigor, and relevance. The research in all contributions is based on accepted research methods and approaches, which were presented in Section 3.3. While certain limitations should be considered when interpreting the results, they also provide opportunities for further research in the field of FC and LA.

To begin with, the limited selection of methods used can be critically assessed. Due to the Covid-19 pandemic and the associated suspension of the in-class phase (Crawford et al. 2020),

the BI module implemented as an FC could only be evaluated in this format during one semester. In addition, due to the hygiene regulations during the Covid-19 pandemic (Aalst et al. 2020), the prototypical LAD could not be assessed in the context of a lab experiment, instead, the evaluation had to be conducted as an online study. Besides the methods already used, a quantitative evaluation of the process model or validation using expert interviews could contribute to further development. Moreover, longitudinal studies, to assess student satisfaction and performance in FCs would be desirable. To further improve the process model, an agile variant of the process model presented in Subsection 4.1.2 could be created. Concerning the use of LA, the implementation of the prototypical LAD and a longitudinal study to evaluate its usefulness would be beneficial. Randomized control trials could be conducted to investigate the impact of LADs on performance and self-regulated learning in courses. Based on instructor perspectives, a teacher-focused LAD could also be developed and evaluated.

Furthermore, there are limitations to the particular methods used. The systematic literature reviews in **contributions 1-6** are based on the approaches of Webster and Watson (2002) and vom Brocke et al. (2009). However, only a limited number of databases were searched with specific search strings. Therefore, the possibility of subjective bias in the selection and coding of literature can exist. To address this, an inter-coder agreement between at least two researchers was used to validate literature selection and coding (Landis and Koch 1977). There are also limitations in the use of qualitative content analysis in **contributions 7, 8**, and **11**, as well as in the analysis of the focus group evaluation (**contribution 10**) and the open-ended questions in the surveys (**contributions 9** and **10**). Again, to reduce subjective bias, coding, and scoring were conducted by at least two independent researchers. Nevertheless, interpretation errors and biases may occur (LeBreton and Senter 2008). Furthermore, the number of participants limits the generalizability of the results (Trochim and Donnelly 2008). It should also be noted that the participants were primarily students and instructors in the fields of IS and business administration, who may be more inclined towards technology and open to innovation compared to individuals from other disciplines. The majority of participants were from the University of Osnabrück, which again limits the generalizability of the results (Shipman 2014). The focus on the BI module allowed for a practical approach while demonstrating the relevance of the research, but also limits the transferability of the results. Replicative studies based on other databases may therefore reveal different results.

Both the FC approach and the use of LA offer potentials that go beyond the university context. Therefore, the results of this work can be adapted accordingly and used in schools as well as companies to improve student learning and employee training.

6 Conclusion

This dissertation aimed to investigate the systematic development and long-term integration of FCs at universities and to demonstrate how LA can contribute to support FC courses. To this end, 11 contributions were written and published, addressing different aspects of the topics.

To begin with, the development and integration of FC courses (RQ1) were addressed. As a foundation, a process model was developed based on substantial literature. This process model considers the development of FCs from the perspective of project management, addressing a research gap caused by the limited availability of systematic models for FC creation. Based on the process model, a BI module was successfully implemented as an FC course. The implementation demonstrated the usefulness of the process model, and student evaluations as well as comparisons with metrics from previous years showed positive effects of the FC transformation on student satisfaction and performance. To facilitate the long-term integration of FCs at universities and to address the tasks and needs of individual stakeholders, a CM approach at universities was proposed. This was addressed on the one hand by extending the process model to include CM tasks and on the other hand by developing a model-independent CM guideline.

Given that FC courses require a high degree of student autonomy and that the preparation of the pre-class phase is crucial for the success of FCs, this dissertation addressed how LA can support the participants in FC courses (RQ2). The focus was placed primarily on the perspective of students, whose views and requirements were ascertained through surveys. Subsequently, a prototypical LAD was developed and designed for the previously implemented BI module. The final evaluation showed a positive assessment in terms of usability and design as well as the ability of the LAD to support study participants in self-monitoring and self-assessment, which are important self-regulated learning skills. Finally, to provide an outlook on the perspective of teachers, the results of a study regarding their views on opportunities and risks as well as possible requirements for LA were discussed.

Due to its design-oriented focus, this dissertation offers not only implications for research but also tangible recommendations for practitioners. The findings from the contributions demonstrate that incorporating LA can be beneficial for both students and instructors in FCs and can have a positive effect on self-regulatory learning. Moreover, this dissertation provides a valuable foundation for further research in the field of FCs and LA, holding the potential to sustainably enhance learning in HEIs.

References

Aalst, W., Hinz, O., and Weinhardt, C. 2020. “Impact of COVID-19 on BISE Research and Education,” *Business & Information Systems Engineering* (62:6), pp. 463-466.

Adams Becker, S., Cummins, M., Davis, A., Freeman, A., Hall Giesinger, C., and Ananthanarayanan, V. 2017. “NMC Horizon Report: 2017 Higher Education Edition,” Austin, Texas: The New Media Consortium.

Adedoyin, O. B., and Soykan, E. 2020. “Covid-19 pandemic and online learning: the challenges and opportunities,” *Interactive Learning Environments* (31:2), pp. 1-13.

Adekola, J., Dale, V. H., and Gardiner, K. 2017. “Development of an institutional framework to guide transitions into enhanced blended learning in higher education,” *Research in Learning Technology* (25), pp. 1-16.

Al-Samarraie, H., Shamsuddin, A., and Alzahrani, A. I. 2020. “A flipped classroom model in higher education: a review of the evidence across disciplines,” *Educational Technology Research and Development* (68:3), pp. 1017-1051.

Anderson, L. W., Krathwohl, D. R., Airasian, P. W., Cruikshank, K. A., Mayer, R., Pintrich, P., Raths, J., Wittrock, and Merlin. 2001. *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives, abridged edition*, White Plains, NY: Pearson Education.

Baker, R. S., and Inventado, P. S. 2014. “Educational Data Mining and Learning Analytics,” in *Learning Analytics*, New York: Springer, pp. 61-75.

Baker, W. J. 2000. “The "Classroom Flip": Using Web Course Management Tools to Become the Guide by the Side,” in *Selected Papers from the 11th International Conference on College Teaching and Learning*, Jacksonville, FL: Florida Community College at Jacksonville, pp. 9-17.

Balan, P., Clark, M., and Restall, G. 2015. “Preparing students for flipped or team-based learning methods,” *Education and Training* (57:6), pp. 639-657.

Bandura, A. 1986. *Social Foundations of Thought and Action. A Social Cognitive Theory.*, Englewood Cliffs: Prentice Hall.

Bandura, A. 1991. “Social cognitive theory of self-regulation,” *Organizational Behavior and Human Decision Processes* (50:2), pp. 248-287.

Bangor, A., Kortum, P. T., and Miller, J. T. 2008. “An Empirical Evaluation of the System Usability Scale,” *International Journal of Human-Computer Interaction* (24:6), pp. 574-594.

Baumann, M., Baumann, M. H., Schönig, S., and Jablonski, S. 2017. “The Process Checklist,” *Enterprise Modelling and Information Systems Architectures* (12:1), pp. 1-42.

Bell, E., Bryman, A., and Harley, B. 2022. *Business research methods*, Oxford, United Kingdom, New York, NY: Oxford University Press.

Berglund, A., Havtun, H., Jerbrant, A., Wingård, L., Andersson, M., Hedin, B., and Kjellgren, B. 2017. “The pedagogical developers initiative—Systematic shifts, serendipities, and setbacks,” in *13th International Conceive Design Implement Operate Conference*, pp. 497-508.

Bergmann, J., and Sams, A. 2012. *Flip your classroom: Reach every student in every class every day*, Alexandria: International Society for technology in Education.

Betihavas, V., Bridgman, H., Kornhaber, R., and Cross, M. 2016. “The evidence for 'flipping out': A systematic review of the flipped classroom in nursing education,” *Nurse education today* (38), pp. 15-21.

Bhagat, K. K., Chang, C.-N., and Chang, C.-Y. 2016. “The Impact of the Flipped Classroom on Mathematics Concept Learning in High School,” *Journal of Educational Technology & Society* (19:3), pp. 134-142.

Bishop, J. L., and Verleger, M. A. 2013. “The Flipped Classroom: A Survey of the Research,” in *120th ASEE Conference and Exposition*, Atlanta, Georgia, pp. 1-18.

Blömer, L., Droit, A., and Hoppe, U. 2020a. “Enabling Stakeholders to Change: Development of a Change Management Guideline for Flipped Classroom Implementations,” in *CSEDU 2020*: *Proceedings of the 12th International Conference on Computer Supported Education,* Prague, Czech Republic, Setúbal, Portugal: Science and Technology Publications Lda, pp. 227-237.

Blömer, L., Droit, A., and Vogelsang, K. 2020b. “May the Change Be with You: The Need for New Roles to Support Flipped Classroom Development,”: *19th IFIP WG 6.11 Conference on e-Business, e-Services, and e-Society, I3E 2020*, Cham: Springer International Publishing, pp. 532-544.

Blömer, L., Voigt, C., Droit, A., and Hoppe, U. 2020c. “Agile Development of a Flipped Classroom Course,”: *19th IFIP WG 6.11 Conference on e-Business, e-Services, and e-Society, I3E 2020*, Cham: Springer International Publishing, pp. 581-592.

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., and Krathwohl, D. R. 1956. *Taxonomy of Educational Objectives-Handbook 1: Cognitive Domain*, New York: David McKay Company Inc.

Bodily, R., Ikahihifo, T. K., Mackley, B., and Graham, C. R. 2018. “The design, development, and implementation of student-facing learning analytics dashboards,” *Journal of Computing in Higher Education* (30), pp. 572-598.

Bondarev, M., Opryshko, A., and Trach, A. 2018. “University Students’ Readiness For E-Learning: Replacing Or Supplementing Face-To-Face Classroom Learning,” in *18th PCSF 2018*: *Professional Culture of the Specialist of the Future*, UK: Future Academy, pp. 1151-1160.

Bonoma, T. V. 1985. “Case Research in Marketing: Opportunities, Problems, and a Process,” *Journal of Marketing Research* (22:2), pp. 199-208.

Bower, M. 2019. “Technology-mediated learning theory,” *British Journal of Educational Technology* (50:3), pp. 1035-1048.

Briggs, A. R. J. 2007. “The Use of Modelling for Theory Building in Qualitative Analysis,” *British Educational Research Journal* (33:4), pp. 589-603.

Broadbent, J., and Poon, W. L. 2015. “Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review,” *The Internet and Higher Education* (27), pp. 1-13.

Brooke, J. 1996. “SUS: A 'Quick and Dirty' Usability Scale,” in *Usability Evaluation In Industry*, London: CRC Press, pp. 207-212.

Cabı, E. 2018. “The Impact of the Flipped Classroom Model on Students' Academic Achievement,” *The International Review of Research in Open and Distributed Learning* (19:3), pp. 202-221.

Charbonneau-Gowdy, P., and Chavez, H. 2018. “Endpoint: Insights for theory development in a blended learning program in chile,” in *Proceedings of the 17th European Conference on e-Learning*, Athens, Greece: Academic Conferences Limited, pp. 81-89.

Chen, F., Lui, A. M., and Martinelli, S. M. 2017. “A systematic review of the effectiveness of flipped classrooms in medical education,” *Medical Education* (51:6), pp. 585-597.

Chen, S.-C., Yang, S. J. H., and Hsiao, C.-C. 2016. “Exploring student perceptions, learning outcome and gender differences in a flipped mathematics course,” *British Journal of Educational Technology* (47:6), pp. 1096-1112.

Chen Hsieh, J. S., Wu, W.-C. V., and Marek, M. W. 2017. “Using the Flipped Classroom to Enhance EFL Learning,” *Computer Assisted Language Learning* (30:1), pp. 1-21.

Chien, C.-F., and Hsieh, L.-H. C. 2018. “Exploring University Students' Achievement, Motivation, and Receptivity of Flipped Learning in an Engineering Mathematics Course,” *International Journal of Online Pedagogy and Course Design* (8:4), pp. 22-37.

Chis, A. E., Moldovan, A.-N., Murphy, L., Pathak, P., and Muntean, C. H. 2018. “Investigating Flipped Classroom and Problem-Based Learning in a Programming Module for Computing Conversion Course,” *Educational Technology & Society* (21:4), pp. 232-247.

Clark, R. M., Besterfield-Sacre, M., Budny, D., Bursic, K. M., Clark, W. W., Norman, B. A., Parker, R. S., Patzer, John F., II, and Slaughter, W. S. 2016. “Flipping Engineering Courses: A School Wide Initiative,” *Advances in Engineering Education* (5:3), pp. 1-39.

Collyer, S., and Campbell, C. 2015. “Enabling Pervasive Change: A Higher Education Case Study,” in *Proceedings of EdMedia 2015-World Conference on Educational Media and Technology*, Waynesville, NC: AACE, pp. 249-255.

Crawford, J., Butler-Henderson, K., Rudolph, J., Malkawi, B., Glowatz, M., Burton, R., Magni, P. A., and Lam, S. 2020. “COVID-19: 20 Countries’ Higher Education Intra-Period Digital Pedagogy Responses,” *Journal of Applied Learning and Teaching* (3:1), pp. 9-28.

Daniel, B. 2015. “Big Data and analytics in higher education: Opportunities and challenges,” *British Journal of Educational Technology* (46:5), pp. 904-920.

Daniel, M., Hüther, J., and Ohngemach, C. 2018. “smile – Studierende als Multiplikatoren für innovative und digitale Lehre,” in *DeLFI 2018*: *Die 16. E-Learning Fachtagung Informatik der Gesellschaft für Informatik e. V*, Bonn, Berlin: Gesellschaft für Informatik, pp. 57-68.

Debuse, J. C. W., Lawley, M., and Shibl, R. 2008. “Educators' perceptions of automated feedback systems,” *Australasian Journal of Educational Technology* (24:4), pp. 374-386.

DeLozier, S. J., and Rhodes, M. G. 2017. “Flipped Classrooms: a Review of Key Ideas and Recommendations for Practice,” *Educational Psychology Review* (29:1), pp. 141-151.

Dourado, R. A., Rodrigues, R. L., Ferreira, N., Mello, R. F., Gomes, A. S., and Verbert, K. 2021. “A Teacher-facing Learning Analytics Dashboard for Process-oriented Feedback in Online Learning,” in *11th International Learning Analytics and Knowledge Conference*, New York, NY: Association for Computing Machinery, pp. 482-489.

Dringus, L. P., and Ellis, T. 2005. “Using data mining as a strategy for assessing asynchronous discussion forums,” *Computers & Education* (45:1), pp. 141-160.

Droit, A., and Rieger, B. 2020. “Learning Analytics in the Flipped Classroom – Learning Dashboards from the Students' Perspective,” in *Proceedings of the 53rd Hawaii International Conference on System Sciences*, Maui, Hawaii: Scholarspace, pp. 100-107.

Dusick, D. M., and Yildirim, S. 2000. “Faculty Computer Use and Training: Identifying Distinct Needs for Different Populations,” *Community College Review* (27:4), pp. 33-47.

Ellis, C. 2013. “Broadening the Scope and Increasing the Usefulness of Learning Analytics: The Case for Assessment Analytics,” *British Journal of Educational Technology* (44:4), pp. 662-664.

Enfield, J. 2013. “Looking at the Impact of the Flipped Classroom Model of Instruction on Undergraduate Multimedia Students at CSUN,” *TechTrends* (57:6), pp. 14-27.

Engeström, Y. 1987. *Learning by Expanding: An Activity Theoretical Approach to Developmental Research*, Helsinki: Orienta-Konsultit Oy.

Esslinger-Hinz, I., Giovannini, N., and Hannig, J. 2013. *Der ausführliche Unterrichtsentwurf*: *Mit Online-Materialien*, Weinheim, Basel: Beltz.

Esson, J. M. 2016. “Flipping General and Analytical Chemistry at a Primarily Undergraduate Institution,” in *The Flipped Classroom*: *Results from Practice*, Washington, DC, Oxford: American Chemical Society, pp. 107-125.

Evseeva, A., and Solozhenko, A. 2015. “Use of Flipped Classroom Technology in Language Learning,” *Procedia - Social and Behavioral Sciences* (206), pp. 205-209.

Fadel, C., Bialik, M., and Trilling, B. 2015. *Four-Dimensional Education*: *The Competencies Learners Need to Succeed*, Boston, MA: Center for Curriculum Redesign.

Ferguson, R. 2012. “Learning analytics: drivers, developments and challenges,” *International Journal of Technology Enhanced Learning* (4:5/6), pp. 304-317.

Fettke, P. 2014. “Eine Methode zur induktiven Entwicklung von Referenzmodellen,” in *MKWI 2014 - Multikonferenz Wirtschaftsinformatik*, Paderborn: Universitätsbibliothek Paderborn, pp. 1034-1047.

Flavell, H., Harris, C., Price, C., Logan, E., and Peterson, S. 2019. “Empowering academics to be adaptive with eLearning technologies: An exploratory case study,” *Australasian Journal of Educational Technology* (35:1), pp. 1-15.

Gamage, K. A. A., Jeyachandran, K., Dehideniya, S. C. P., Lambert, C. G., and Rennie, A. E. W. 2023. “Online and Hybrid Teaching Effects on Graduate Attributes: Opportunity or Cause for Concern?” *Education Sciences* (13:2), pp. 221-236.

Garrison, R. D., and Kanuka, H. 2004. “Blended learning: Uncovering its Transformative Potential in Higher Education,” *The Internet and Higher Education* (7:2), pp. 95-105.

Gašević, D., Dawson, S., and Siemens, G. 2015. “Let’s not forget: Learning analytics are about Learning,” *TechTrends* (59:1), pp. 64-71.

Giannakos, M. N., Krogstie, J., and Chrisochoides, N. 2014. “Reviewing the Flipped Classroom Research: Reflections for Computer Science Education,” in *Proceedings of the Computer Science Education Research Conference*, New York, NY, USA: ACM, pp. 23-29.

Gilboy, M. B., Heinerichs, S., and Pazzaglia, G. 2015. “Enhancing Student Engagement Using the Flipped Classroom,” *Journal of Nutrition Education and Behavior* (47:1), pp. 109-114.

Gillette, C., Rudolph, M., Kimble, C., Rockich-Winston, N., Smith, L., and Broedel-Zaugg, K. 2018. “A Systematic Review and Meta Analysis of Student Pharmacist Outcomes Comparing Flipped Classroom and Lecture,” *Amercian Journal of Pharmaceutical Education* (82:5), 484-490.

Goodhue, D. L. 1998. “Development and Measurement Validity of a Task-Technology Fit Instrument for User Evaluations of Information System,” *Decision Sciences* (29:1), pp. 105-138.

Greller, W., and Drachsler, H. 2012. “Translating Learning into Numbers: A Generic Framework for Learning Analytics,” *Educational Technology & Society* (15:3), pp. 42-57.

Gupta, S., and Bostrom, R. P. 2009. “Technology-mediated learning: A comprehensive theoretical model,” *Journal of the Association for Information Systems* (10:9), pp. 686-714.

Halili, S. H., and Zainuddin, Z. 2015. “Flipping the classroom: What we know and what we don’t,” *The Online Journal of Distance Education and e-Learning* (3:1), pp. 15-22.

Hao, Y., and Lee, K. S. 2016. “Teaching in flipped classrooms: Exploring pre-service teachers' concerns,” *Computers in Human Behavior* (57), pp. 250-260.

Harris, B. F., Harris, J., Reed, L., and Zelihic, M. 2016. “Flipped Classroom: Another Tool for Your Pedagogy Tool Box,” in *Developments in Business Simulation and Experiential Learning: Proceedings of the Annual ABSEL conference*, New Orleans, Louisiana, pp. 325-333.

Heikkinen, S., Saqr, M., Malmberg, J., and Tedre, M. 2023. “Supporting self-regulated learning with learning analytics interventions – a systematic literature review,” *Education and Information Technologies* (28:3), pp. 3059-3088.

Heinzl, A. 2008. “WI-Orientierungslisten WI-Journalliste 2008 sowie WI-Liste der Konferenzen, Proceedings und Lecture Notes 2008,” *Wirtschaftsinformatik* (50:2), pp. 155-163.

Hevner, A. R., March, S. T., Park, J., and Ram, S. 2004. “Design Science in Information Systems Research,” *MIS Quarterly* (28:1), pp. 75-105.

Howell, J. A., Roberts, L. D., Seaman, K., and Gibson, D. C. 2018. “Are We on Our Way to Becoming a “Helicopter University”? Academics’ Views on Learning Analytics,” *Technology, Knowledge and Learning* (23:1), pp. 1-20.

Hu, R., Gao, H., Ye, Y., Ni, Z., Jiang, N., and Jiang, X. 2018. “Effectiveness of flipped classrooms in Chinese baccalaureate nursing education: A meta-analysis of randomized controlled trials,” *International journal of nursing studies* (79), pp. 94-103.

Hurtubise, L., Hall, E., Sheridan, L., and Han, H. 2015. “The Flipped Classroom in Medical Education: Engaging Students to Build Competency,” *Journal of Medical Education and Curricular Development* (2), pp. 35-43.

Hutchings, M., and Quinney, A. 2015. “The Flipped Classroom, Disruptive Pedagogies, Enabling Technologies and Wicked Problems: Responding to "The Bomb in the Basement",” *Electronic Journal of e-Learning* (13:2), pp. 106-119.

Ifenthaler, D. 2017. “Are Higher Education Institutions Prepared for Learning Analytics?” *TechTrends* (61:4), pp. 366-371.

Ifenthaler, D., and Schumacher, C. 2016. “Student perceptions of privacy principles for learning analytics,” *Educational Technology Research and Development* (64:5), pp. 923-938.

Johnson, J. A. 2014. “The Ethics of Big Data in Higher Education,” *The International Review of Information Ethics* (21:7), pp. 3-10.

Joshi, O., Chapagain, B., Kharel, G., Poudyal, N. C., Murray, B. D., and Mehmood, S. R. 2022. “Benefits and challenges of online instruction in agriculture and natural resource education,” *Interactive Learning Environments* (30:8), pp. 1402-1413.

Jovanović, J., Gašević, D., Dawson, S., Pardo, A., and Mirriahi, N. 2017. “Learning analytics to unveil learning strategies in a flipped classroom,” *The Internet and Higher Education* (33), pp. 74-85.

Kaplan, B., and Duchon, D. 1988. “Combining Qualitative and Quantitative Methods in Information Systems Research: A Case Study,” *MIS Quarterly* (12:4), pp. 571-586.

Karabulut-Ilgu, A., Jaramillo Cherrez, N., and Jahren, C. T. 2018. “A systematic review of research on the flipped learning method in engineering education,” *British Journal of Educational Technology* (49:3), pp. 398-411.

Kerr, B. 2015. “The flipped classroom in engineering education: A survey of the research,” in *2015 International Conference on Interactive Collaborative Learning (ICL)*: *20-24 Sept. 2015, Firenze, Italy*, Piscataway, NJ: IEEE, pp. 815-818.

Kim, M. K., Kim, S. M., Khera, O., and Getman, J. 2014. “The experience of three flipped classrooms in an urban university: an exploration of design principles,” *The Internet and Higher Education* (22), pp. 37-50.

Klasen, D., and Ifenthaler, D. 2019. “Implementing Learning Analytics into Existing Higher Education Legacy Systems,” in *Utilizing Learning Analytics to Support Study Success*, Cham: Springer International Publishing, pp. 61-72.

Klerkx, J., Verbert, K., and Duval, E. 2017. “Learning Analytics Dashboards,” in *Handbook of Learning Analytics*, SoLAR, pp. 143-150.

Koo, C. L., Demps, E. L., Farris, C., Bowman, J. D., Panahi, L., and Boyle, P. 2016. “Impact of Flipped Classroom Design on Student Performance and Perceptions in a Pharmacotherapy Course,” *American Journal of Pharmaceutical Education* (80:2), pp. 1-9.

Kothiyal, A., Majumdar, R., Murthy, S., and Iyer, S. 2013. “Effect of think-pair-share in a large CS1 class,” in *Proceedings of the ninth annual international ACM conference on International computing education research*, New York, NY: ACM, pp. 137-144.

Kotter, J. P. 1995. “Leading Change: Why Transformation Efforts Fail,” *Harvard Business Review* (2), pp. 59-67.

Kotter, J. P. 2012. “Die Kraft der zwei Systeme,” *Havard Business Manager* (12), pp. 2-15.

Kötter, J., Blömer, L., Voigt, C., Droit, A., and Hoppe, U. 2021. “Through the Lens of Different Stakeholders: Development and Application of a Change Management Guideline for Flipped Classroom Implementations,” in *Computer Supported Education*: *12th International Conference, CSEDU 2020, revised selected papers*, Cham: Springer, pp. 216-244.

Krathwohl, D. R. 2002. “A revision of Bloom's taxonomy - An overview,” *Theory into Practice* (41:4), pp. 212-218.

Lage, M. J., Platt, G. J., and Treglia, M. 2000. “Inverting the classroom: A gateway to creating an inclusive learning environment,” *The Journal of Economic Education* (31:1), pp. 30-43.

Lai, C.-L., and Hwang, G.-J. 2016. “A self-regulated flipped classroom approach to improving students’ learning performance in a mathematics course,” *Computers & Education* (100), pp. 126-140.

Lambach, D., Kärger, C., and Goerres, A. 2017. “Inverting the large lecture class: active learning in an introductory international relations course,” *European Political Science* (16:4), pp. 553-569.

Landis, J. R., and Koch, G. G. 1977. “The Measurement of Observer Agreement for Categorical Data,” *Biometrics* (33:1), pp. 159-174.

LeBreton, J. M., and Senter, J. L. 2008. “Answers to 20 Questions About Interrater Reliability and Interrater Agreement,” *Organizational Research Methods* (11:4), pp. 815-852.

Lehmann, K., Oeste, S., Janson, A., Söllner, M., and Leimeister, J. M. 2015. “Flipping the Classroom – IT-unterstützte Lerneraktivierung zur Verbesserung des Lernerfolges einer universitären Massenlehrveranstaltung,” *HMD Praxis der Wirtschaftsinformatik* (52:1), pp. 81-95.

Liebscher, J., Petschenka, A., Gollan, H., Heinrich, S., van Ackeren, I., and Ganseuer, C. 2015. "E-Learning-Strategie an der Universität Duisburg-Essen - mehr als ein Artefakt?" *Zeitschrift für Hochschulentwicklung (ZFHE)* (10:2), pp. 93-109.

Lo, C. K., and Hew, K. F. 2017. "A critical review of flipped classroom challenges in K-12 education: possible solutions and recommendations for future research," *Research and Practice in Technology Enhanced Learning* (12:1), pp. 1-22.

Long, P., and Siemens, G. 2011. "Penetrating the Fog: Analytics in Learning and Education," *Educause Review* (46:5), pp. 31-40.

Loviscach, J. 2019. "Inverted Classroom Model: mehr als nur eine Vorbereitung mit Videos," in *Handbuch Innovative Lehre*, Springer, Wiesbaden, pp. 87-97.

Lundin, M., Bergviken Rensfeldt, A., Hillman, T., Lantz-Andersson, A., and Peterson, L. 2018. "Higher education dominance and siloed knowledge: a systematic review of flipped classroom research," *International Journal of Educational Technology in Higher Education* (15:1), pp. 1-30.

Mason, G. S., Shuman, T. R., and Cook, K. E. 2013. "Comparing the Effectiveness of an Inverted Classroom to a Traditional Classroom in an Upper-Division Engineering Course," *IEEE Transactions on Education* (56:4), pp. 430-435.

Matcha, W., Uzir, N. A., Gasevic, D., and Pardo, A. 2020. "A Systematic Review of Empirical Studies on Learning Analytics Dashboards: A Self-Regulated Learning Perspective," *IEEE Transactions on Learning Technologies* (13:2), pp. 226-245.

Mayring, P. 2014. *Qualitative content analysis - theoretical foundation, basic procedures and software solution*, Klagenfurt: SSOAR.

McCredden, J., Reidsema, C., and Kavanagh, L. 2017. "Designing an Active Learning Environment Architecture Within a Flipped Classroom for Developing First Year Student Engineers," in *The flipped classroom*: *Practice and practices in higher education*, Singapore: Springer Nature, pp. 97-129.

McGrath, D., Groessler, A., Fink, E., Reidsema, C., and Kavanagh, L. 2017. "Technology in the Flipped Classroom," in *The flipped classroom*: *Practice and practices in higher education*, Singapore: Springer Nature, pp. 37-56.

McLaughlin, J. E., Roth, M. T., Glatt, D. M., Gharkholonarehe, N., Davidson, C. A., Griffin, L. M., Esserman, D. A., and Mumper, R. J. 2014. "The flipped classroom: a course redesign to foster learning and engagement in a health professions school," *Academic Medicine* (89:2), pp. 236-243.

McLean, S., and Attardi, S. M. 2023. "Sage or Guide? Student Perceptions of the Role of the Instructor in a Flipped Classroom," *Active Learning in Higher Education* (24:1), pp. 49-61.

McLean, S., Attardi, S. M., Faden, L., and Goldszmidt, M. 2016. "Flipped classrooms and student learning: not just surface gains," *Adavances in Physiology Education* (40:1), pp. 47-55.

Missildine, K., Fountain, R., Summers, L., and Gosselin, K. 2013. "Flipping the classroom to improve student performance and satisfaction," *The Journal of nursing education* (52:10), pp. 597-599.

Moffett, J., and Mill, A. C. 2014. “Evaluation of the Flipped Classroom Approach in a Veterinary Professional Skills Course,” *Advances in Medical Education and Practice* (5), pp. 415-425.

Morisse, K. 2016. “Inverted Classroom in der Inverted Classroom in der Hochschullehre–Chancen, Hemmnisse und Erfolgsfaktoren,” in *Das Inverted Classroom Modell*: *Begleitband zur 5. Konferenz Inverted Classroom and Beyond,* Pölten, Pölten: FNMA, pp. 17-28.

Moshagen, M., and Thielsch, M. 2013. “A short version of the visual aesthetics of websites inventory,” *Behaviour & Information Technology* (32:12), pp. 1305-1311.

Mutch, A., Young, C., Smith, N., van Dooren, K., Ranatunga, C., Gillan, C., Brooker, K., Fowler, G., and Fitzgerald, L. 2017. “Flipping a Collaborative Classroom to Gain Deeper Understanding of the Health System,” in *The flipped classroom*: *Practice and practices in higher education*, Singapore: Springer Nature, pp. 257-271.

Myers, M. D., and Newman, M. 2007. “The qualitative interview in IS research: Examining the craft,” *Information and Organization* (17:1), pp. 2-26.

Nguyen, A., Tuunanen, T., Gardner, L., and Sheridan, D. 2021. “Design principles for learning analytics information systems in higher education,” *European Journal of Information Systems* (30:5), pp. 541-568.

Nordquist, J., Sundberg, K., and Laing, A. 2016. “Aligning physical learning spaces with the curriculum: AMEE Guide No. 107,” *Medical Teacher* (38:8), pp. 755-768.

Nouri, J., Ebner, M., Ifenthaler, D., Saqr, M., Malmberg, J., Khalil, M., Bruun, J., Viberg, O., Conde González, M. Á., Papamitsiou, Z., and Berthelsen, U. D. 2019. “Efforts in Europe for Data-Driven Improvement of Education – A Review of Learning Analytics Research in Seven Countries,” *International Journal of Learning Analytics and Artificial Intelligence for Education* (1:1), pp. 8-28.

Nunamaker, J. J. F., and Briggs, R. O. 2011. “Toward a broader vision for Information Systems,” *ACM Transactions on Management Information Systems* (2:4), pp. 1-12.

O’Flaherty, J., and Phillips, C. 2015. “The use of flipped classrooms in higher education: A scoping review,” *The Internet and Higher Education* (25), pp. 85-95.

OECD. 2019. *OECD Future of Education and Skills 2030 Concept Note*: *Conceptual Learning Framework*, Organization for Economic Cooperation and Development.

Österle, H., Becker, J., Frank, U., Hess, T., Karagiannis, D., Krcmar, H., Loos, P., Mertens, P., Oberweis, A., and Sinz, E. J. 2011. “Memorandum on Design-Oriented Information Systems Research,” *European Journal of Information Systems* (20:1), pp. 7-10.

Öztürk, M., and Çakıroğlu, Ü. 2021. “Flipped learning design in EFL classrooms: implementing self-regulated learning strategies to develop language skills,” *Smart Learning Environments* (8:1), pp. 1-20.

Pardo, A., Gasevic, D., Jovanovic, J., Dawson, S., and Mirriahi, N. 2019. “Exploring Student Interactions With Preparation Activities in a Flipped Classroom Experience,” *IEEE Transactions on Learning Technologies* (12:3), pp. 333-346.

Pardo, A., and Siemens, G. 2014. “Ethical and privacy principles for learning analytics,” *British Journal of Educational Technology* (45:3), pp. 438-450.

Peffers, K., Tuunanen, T., Rothenberger, M. A., and Chatterjee, S. 2007. “A Design Science Research Methodology for Information Systems Research,” *Journal of Management Information Systems* (24:3), pp. 45-77.

Pisoni, G., Marchese, M., and Renouard, F. 2019. “Benefits and Challenges of Distributed Student Activities in Online Education Settings: Cross-University Collaborations on a Pan-European Level,” in *2019 IEEE Global Engineering Education Conference (EDUCON)*, Dubai: IEEE, pp. 1017-1021.

Pokhrel, S., and Chhetri, R. 2021. “A Literature Review on Impact of COVID-19 Pandemic on Teaching and Learning,” *Higher Education for the Future* (8:1), pp. 133-141.

Quinn, D., Amer, Y., Lonie, A., Blackmore, K., Thompson, L., and Pettigrove, M. 2012. “Leading change: Applying change management approaches to engage students in blended learning,” *Australasian Journal of Educational Technology* (28:1), pp. 16-29.

Rahman, A. A., Aris, B., Mohamed, H., and Zaid, N. M. 2014. “The influences of Flipped Classroom: A meta analysis,” in *2014 IEEE 6th Conference on Engineering Education (ICEED)*, Piscataway, NJ: IEEE, pp. 24-28.

Recker, J. 2021. *Scientific Research in Information Systems*: *A Beginner's Guide*, Cham, Switzerland: Springer.

Reips, U.-D. 2002. “Standards for Internet-based experimenting,” *Experimental psychology* (49:4), pp. 243-256.

Ritzhaupt, A. D., and Sommer, M. 2018. “Impact of the Flipped Classroom on Learner Achievement and Satisfaction in an Undergraduate Technology Literacy Course,” *Journal of Information Technology Education* (17:1), pp. 159-182.

Rodda, A. 2022. “Understanding Opportunities and Threats of Learning Analytics in Higher Education – A Students’ Perspective,” in *The Role of Digital Technologies in Shaping the Post-Pandemic World*: *21st IFIP WG 6.11 Conference on e-Business, e-Services and e-Society I3E 2022 Proceedings*, Cham: Springer International Publishing, pp. 111-122.

Rodda, A. 2023a. “How can Learning Analytics Enhance Online Teaching? A Teacher’s Perspective,” in *ICDEc: International Conference on Digital Economy*, Springer, LNBIP 485, pp. 97-110.

Rodda, A. 2023b. “Student-centered Design and Evaluation of a Learning Analytics Dashboard,” in *ICDEc: International Conference on Digital Economy*, Springer, LNBIP 485, pp. 67-80.

Rodda, A., and Stahmann, P. 2023. “Towards a Student-Centered Learning Analytics Dashboard: Design, Development and Evaluation,” in *AMCIS 2023 Proceedings.* 17. https://aisel.aisnet.org/amcis2023/sig_ed/sig_ed/17.

Rose, K. (ed.). 2013. *A guide to the project management body of knowledge*: *(PMBOK guide)*, Plantation, FL: J.Ross Publishing.

Rubio-Fernández, A., Muñoz-Merino, P. J., and Delgado Kloos, C. 2019. “A learning analytics tool for the support of the flipped classroom,” *Computer Applications in Engineering Education* (27:5), pp. 1168-1185.

Sandhu, N., Singh, D., and Sharma, S. 2021. “Flipping the Business Classroom: Benefits and Challenges,” *International Journal of Sociotechnology and Knowledge Development* (13:3), pp. 60-76.

Schoop, E., Köhler, T., Börner, C., and Schulz, J. 2016. “Consolidating eLearning in a Higher Education Institution: An Organisational Issue integrating Didactics, Technology, and People by the Means of an eLearning Strategy,” in *Workshop Gemeinschaften in Neuen Medien*: *(GeNeMe)*, Dresden: TUDpress, pp. 38-50.

Schryen, G. 2015. “Writing Qualitative IS Literature Reviews—Guidelines for Synthesis, Interpretation, and Guidance of Research,” *Communications of the Association for Information Systems* (37:1), pp. 286-325.

Schultze, U., and Avital, M. 2011. “Designing Interviews to Generate Rich Data for Information Systems Research,” *Information and Organization* (21:1), pp. 1-16.

Schumacher, C., and Ifenthaler, D. 2018. “Features students really expect from learning analytics,” *Computers in Human Behavior* (78), pp. 397-407.

Sclater, N. 2017. *Learning analytics explained*, New York: Routledge.

Shipman, M. D. 2014. *The Limitations of Social Research*, New York: Routledge.

Siemens, G. 2012. “Learning analytics: Envisioning a research discipline and a domain of practice,” in *Proceedings of the 2nd International Conference on Learning Analytics and Knowledge,* Vancouver Canada, New York: ACM, pp. 4-8.

Song, Y., Jong, M. S. Y., Chang, M., and Chen, W. 2017. “Guest editorial:“HOW” to design, implement and evaluate the flipped classroom?-A synthesis,” *Educational Technology & Society* (20:1), pp. 180-183.

Sonnenberg, C., and vom Brocke, J. 2012. “Evaluations in the Science of the Artificial – Reconsidering the Build-Evaluate Pattern in Design Science Research,” in *International Conference on Design Science Research in Information Systems*, Berlin, Heidelberg: Springer, pp. 381-397.

Stewart, D. W., Shamdasani, P. N., and Rook, D. W. 2007. *Focus groups*: *Theory and practice*, Thousand Oaks, CA: Sage Publications.

Swenson, J. 2014. “Establishing an ethical literacy for learning analytics,” in *Proceedings of the Fourth International Conference on Learning Analytics And Knowledge*, New York, NY: ACM, pp. 246-250.

Tan, C., Yue, W.-G., and Fu, Y. 2017. “Effectiveness of flipped classrooms in nursing education: Systematic review and meta-analysis,” *Chinese Nursing Research* (4:4), pp. 192-200.

Tanner, M., and Scott, E. 2015. “A Flipped Classroom Approach to Teaching Systems Analysis, Design and Implementation,” *Journal of Information Technology Education: Research* (14), pp. 219-241.

Tremblay, M. C., Hevner, A. R., and Berndt, D. J. 2010. “The Use of Focus Groups in Design Science Research,” in *Design Research in Information Systems*, Boston, MA: Springer, pp. 121-143.

Trochim, W. M. K., and Donnelly, J. P. 2008. *Research methods knowledge base*, Mason, Ohio: Atomic Dog.

Tsai, Y.-S., Poquet, O., Gašević, D., Dawson, S., and Pardo, A. 2019. “Complexity leadership in learning analytics: Drivers, challenges and opportunities,” *British Journal of Educational Technology* (50:6), pp. 2839-2854.

Tucker, B. 2012. “The Flipped Classroom - Online Instruction at Home Frees Class Time for Learning,” *Education Next* (1), pp. 82-83.

Ulfa, S., Fattawi, I., Surahman, E., and Yusuke, H. 2019. “Investigating Learners' Perception of Learning Analytics Dashboard to Improve Learning Interaction in Online Learning System,” in *5th International Conference on Education and Technology*, Piscataway, NJ: IEEE, pp. 49-54.

van Twembeke, E., and Goeman, K. 2018. “Motivation Gets You Going and Habit Gets You There,” *Educational Research* (60:1), pp. 62-79.

Vazquez, J. J., and Chiang, E. P. 2015. “Flipping Out! A Case Study on How to Flip the Principles of Economics Classroom,” *International Advances in Economic Research* (21:4), pp. 379-390.

Velegol, S. B., Zappe, S. E., and Mahoney, E. 2015. “The Evolution of a Flipped Classroom: Evidence-Based Recommendations,” *Advances in Engineering Education* (4:3), pp. 1-37.

Veletsianos, G., Johnson, N., and Seaman Jeff. 2021. *Digital Faculty: Faculty Expectations About the Future of Higher Education*, Bay View Analytics.

Venkatesh, V., Brown, S. A., and Bala, H. 2013. “Bridging the Qualitative-Quantitative Divide: Guidelines for Conducting Mixed Methods Research in Information Systems,” *MIS Quarterly* (37:1), pp. 21-54.

Verband der Hochschullehrer für Betriebswirtschaftslehre e.V. 2015. “Journal Quality Index 3.0,” available at https://vhbonline.org/vhb4you/vhb-jourqual/vhb-jourqual-3, accessed on Apr 27 2023.

Vieira, C., Parsons, P., and Byrd, V. 2018. “Visual learning analytics of educational data: A systematic literature review and research agenda,” *Computers & Education* (122), pp. 119-135.

Vogelsang, K., Droit, A., and Liere-Netheler, K. 2019a. “Designing a Flipped Classroom Course – a Process Model,” in *Proceedings of the Internationale Tagung Wirtschaftsinformatik*, Siegen, pp. 345-359.

Vogelsang, K., Droit, A., and Liere-Netheler, K. 2019b. “Designing a Flipped Classroom Course – A Process Model,” *Enterprise Modelling and Information Systems Architectures* (14:4), pp. 1-23.

vom Brocke, J., Simons, A., Niehaves, B., Niehaves, B., Riemer, K., Plattfaut, R., and Cleven, A. 2009. “Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process,” in *Information systems in a globalising world*: *ECIS 2009, 17th European Conference on Information Systems*, Verona: Università di Verona, Facoltà di Economia, pp. 2206-2217.

Wang, Z. 2014. “Research on Teaching Design and Application of Flipped Classroom Mode,” in *Proceedings of the 2014 International Conference on Education Technology and Information System*, Jinan: Atlantis Press, pp. 379-383.

Webster, J., and Watson, R. T. 2002. “Analyzing the Past to Prepare for the Future: Writing a Literature Review,” *MIS Quarterly* (26:2), pp. xiii-xxiii.

WEF. 2020. *The Future of Jobs Report*: *Technical Report*, World Economic Forum.

White, P. J., Larson, I., Styles, K., Yuriev, E., Evans, D. R., Rangachari, P. K., Short, J. L., Exintaris, B., Malone, D. T., Davie, B., Eise, N., Mc Namara, K., and Naidu, S. 2016. “Adopting an Active Learning Approach to Teaching in a Research-Intensive Higher Education Context Transformed Staff Teaching Attitudes and Behaviours,” *Higher Education Research and Development* (35:3), pp. 619-633.

Wilde, T., and Hess, T. 2007. “Forschungsmethoden der Wirtschaftsinformatik,” *Wirtschaftsinformatik* (49:4), pp. 280-287.

Wong, T. H., Ip, E. J., Lopes, I., and Rajagopalan, V. 2014. “Pharmacy Students’ Performance and Perceptions in a Flipped Teaching Pilot on Cardiac Arrhythmias,” *Amercian Journal of Pharmaceutical Education* (78:10), pp. 1-6.

Wright, A. L., Greenfield, G., and Hibbert, P. 2017. “Flipped tutorials in business courses,” in *The flipped classroom*, Singapore: Springer, pp. 289-307.

Yen, M.-H., Chen, S., Wang, C.-Y., Chen, H.-L., Hsu, Y.-S., and Liu, T.-C. 2018. “A framework for self-regulated digital learning (SRDL),” *Journal of Computer Assisted Learning* (34:5), pp. 580-589.

Yigitbasioglu, O. M., and Velcu, O. 2012. “A review of dashboards in performance management: Implications for design and research,” *International Journal of Accounting Information Systems* (13:1), pp. 41-59.

Zappe, S., and Leicht, R. “Flipping" the classroom to explore active learning in a large undergraduate course,” in *Proceedings of the 2009 American Society for Engineering Education Annual Conference and Exhibition*, pp. 1-27.

Zhao, Y., and Watterston, J. 2021. “The changes we need: Education post COVID-19,” *Journal of Educational Change* (22:1), pp. 3-12.

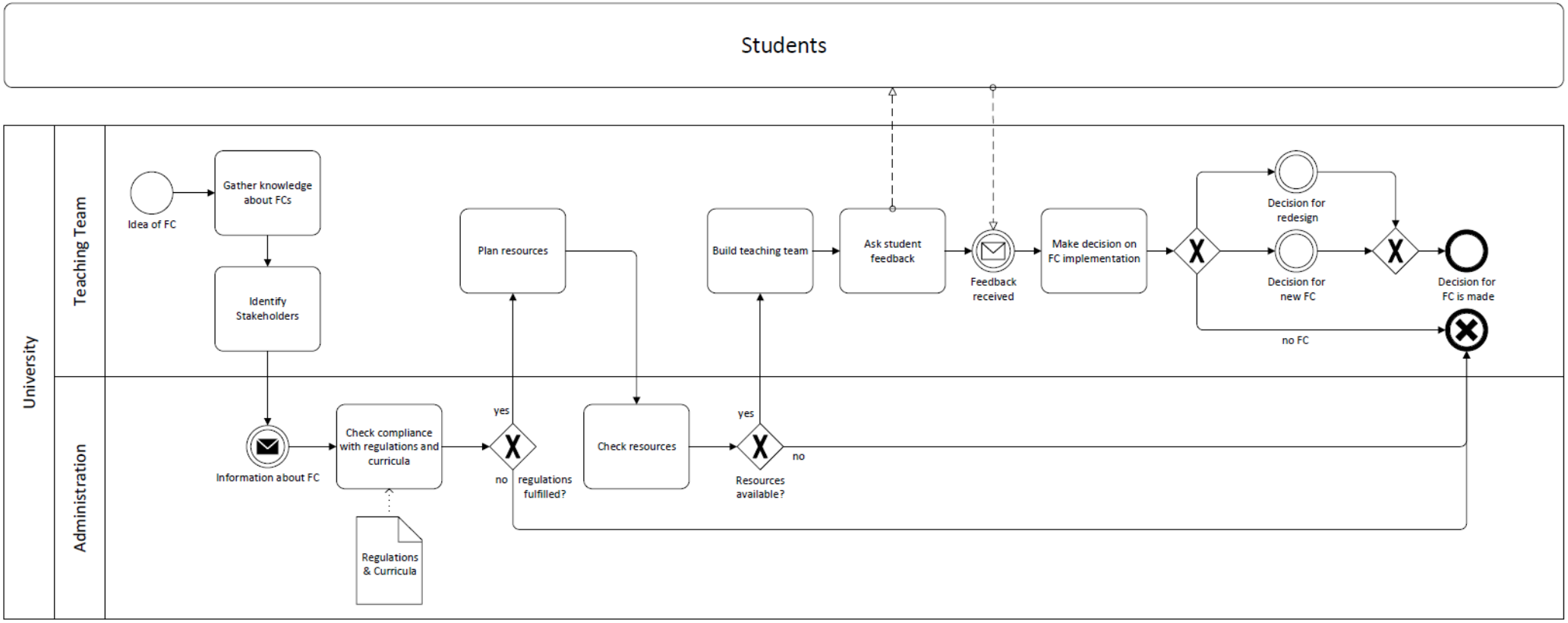
Zimmerman, B. J. 1989. “A Social Cognitive View of Self-Regulated Academic Learning,” *Journal of Educational Psychology* (81:3), pp. 329-339.

Zimmerman, B. J., and Campillo, M. 2003. “Motivating Self-Regulated Problem Solvers,” in *The Psychology of Problem Solving*, Cambridge, UK: Cambridge University Press, pp. 233-262.

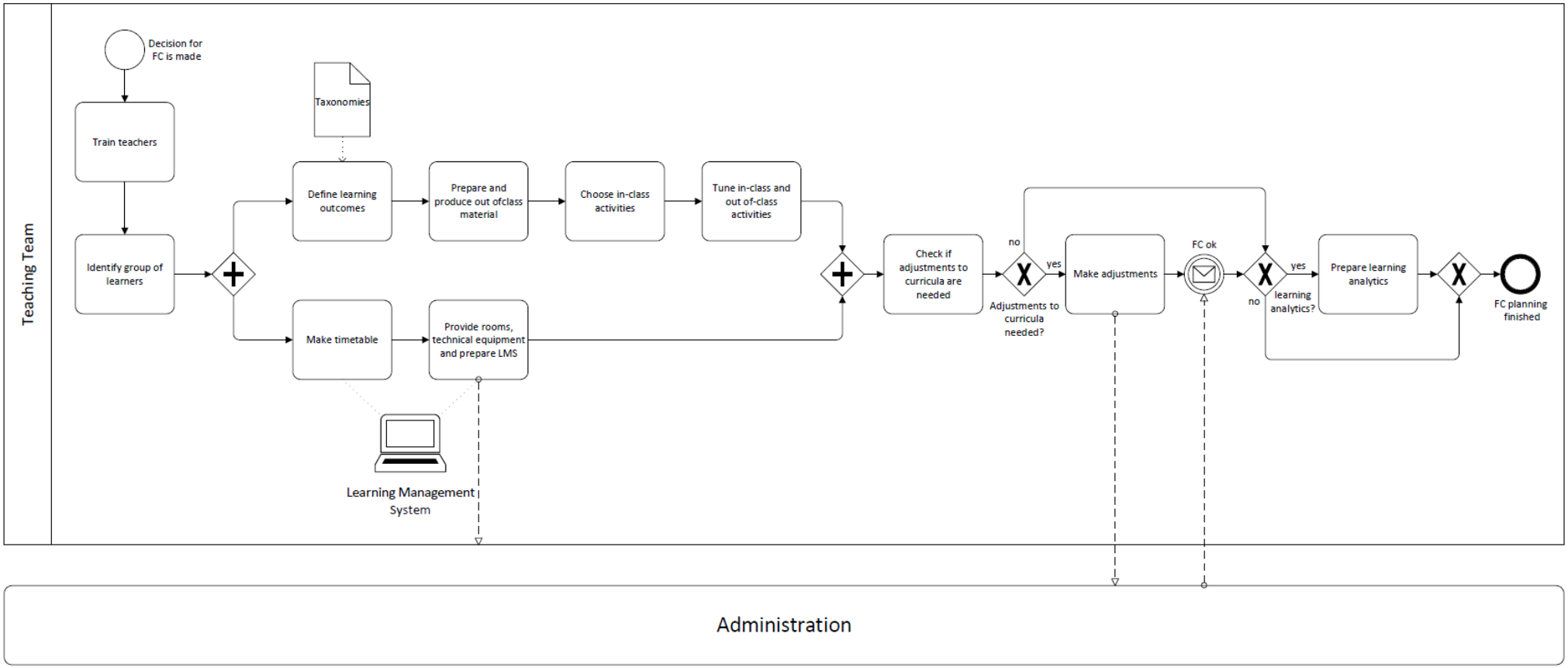
Zuber, W. J. 2016. “The flipped classroom, a review of the literature,” *Industrial and Commercial Training* (48:2), pp. 97-103.

Appendix

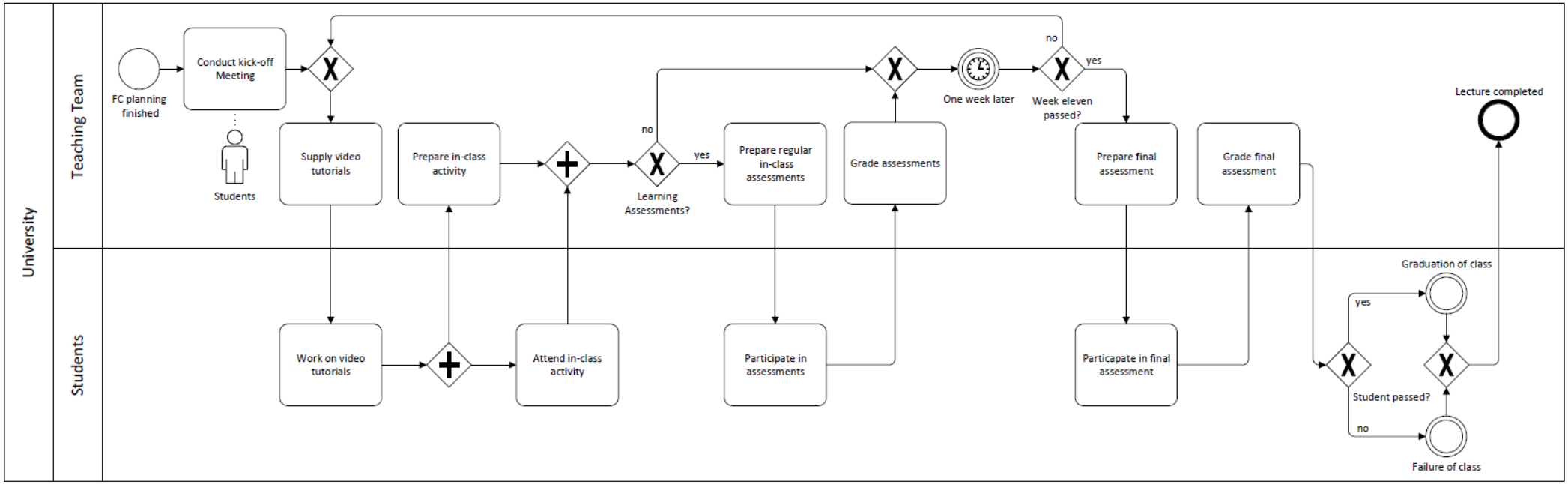
Appendix 1: Initiation Phase of FC Development (Vogelsang et al. 2019b, p.7)



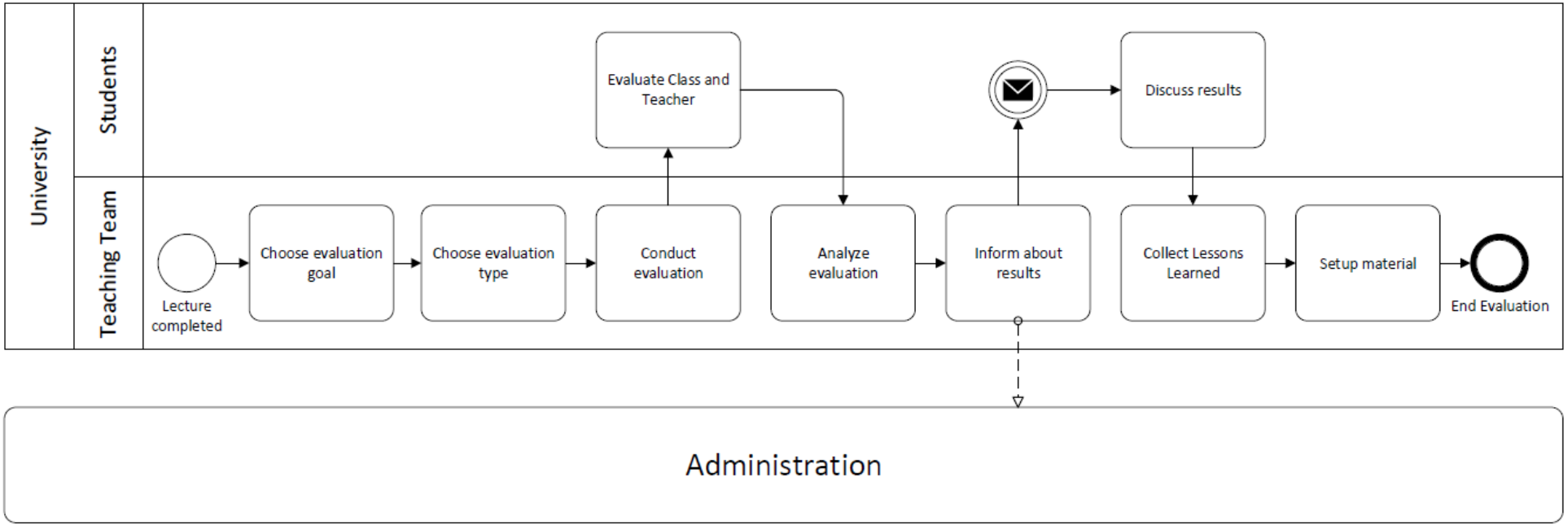
Appendix 2: Planning Phase of FC Development (Vogelsang et al. 2019b, p. 8)



Appendix 3: Execution Phase of FC Development (Vogelsang et al. 2019b, p. 10)



Appendix 4: Closing Phase of FC Development (Vogelsang et al. 2019b, p. 12)



Part B – Research Contributions

Contribution 1

Table 13. Overview Contribution 1

Title	**Designing a Flipped Classroom Course – a Process Model**
Authors	Kristin Vogelsang **Alena Droit** Kirsten Liere-Netheler
Year	2019
Publication Outlet	Proceedings of the 14th International Conference on Wirtschaftsinformatik (WI 2019)
Ranking	VHB: C WKWI: A
Status	Published
Bibliographic information	Vogelsang, K., Droit, A., and Liere-Netheler, K. 2019. "Designing a Flipped Classroom Course – a Process Model," in Proceedings of the Internationale Tagung Wirtschaftsinformatik, pp. 345-359.
Abstract	Digital learning has become more than just a trend in the modern world. Blended learning concepts are well established in different areas of application. An important concept in this domain is the so-called flipped classroom. This approach repurposes class time to focus on application and discussion, while the acquisition of basic knowledge will happen at home, enabled by online lectures. In the past, research demonstrated and discussed the advantages of flipped classroom concepts within case studies. Still, standardized guidelines for the development of flipped classrooms are rare. However, it is necessary to learn from the past to improve future education. Thus, we analyzed reviews on flipped classroom research and used these to develop a generic process model for the realization of flipped classroom concepts. The model is based on phases taken from project management, which help to structure the procedure and associated tasks.
Identification	-
Link	https://aisel.aisnet.org/wi2019/track04/papers/5/
Copyright	CC BY-NC-ND 4.0

Contribution 2

Table 14. Overview Contribution 2

Title	**Designing a Flipped Classroom Course – a Process Model**
Authors	Kristin Vogelsang **Alena Droit** Kirsten Liere-Netheler
Year	2019
Publication Outlet	Enterprise Modelling and Information Systems Architectures
Ranking	VHB: C
Status	Published
Bibliographic information	Vogelsang, K., Droit, A., and Liere-Netheler, K. 2019. "Designing a Flipped Classroom Course – A Process Model," Enterprise Modelling and Information Systems Architectures (14:4), pp. 1-23.
Abstract	Digital learning has become more than just a trend in the modern world. Blended learning concepts are well established in different areas of application. An important concept in this domain is the so-called flipped classroom (FC). This approach repurposes class time to focus on application and discussion, while the acquisition of basic knowledge will happen at home, enabled by online lectures. In the past, research demonstrated and discussed the advantages of flipped classroom concepts within case studies. Still, standardized guidelines for the development of flipped classrooms are rare. However, it is necessary to learn from the past to improve future education. Thus, we analyzed reviews on flipped classroom research and used these to inductively develop a reference process model for the realization of flipped classroom concepts. The model is based on phases taken from project management, which help to structure the process and associated tasks. The results present the process model shown in Business Process Model and Notation (BPMN) and applicable checklists for the development of a FC course. The process model was applied and evaluated during the implementation of a flipped classroom at a university. Future research should concentrate on evaluation of the model as well as a deeper elaboration of upcoming roles and their tasks in order to derive further guidance for teachers and organizations.
Identification	DOI: 10.18417/emisa.14.4
Link	https://dl.gi.de/items/d7271de0-2825-4ac5-a550-e95e870e3290
Copyright	CC BY-SA 4.0

Contribution 3

Table 15. Overview Contribution 3

Title	**Agile Development of a Flipped Classroom Course**
Authors	Linda Blömer Christin Voigt **Alena Droit** Uwe Hoppe
Year	2020
Publication Outlet	I3E 2020, Springer Lecture Notes in Computer Science (LNCS)
Ranking	VHB: C WKWI: B
Status	Published
Bibliographic information	Blömer, L., Voigt, C., Droit, A., and Hoppe, U. 2020. "Agile Development of a Flipped Classroom Course," in Responsible Design, Implementation and Use of Information and Communication Technology (Vol. 12066), I3E 2020. Lecture Notes in Computer Science, M. Hattingh, M. Matthee, H. Smuts, I. O. Pappas, Y. K. Dwivedi, and M. Mäntymäki (eds.), Cham: Springer, pp. 581–592.
Abstract	Digital course designs such as the Flipped Classroom (FC) are increasingly enriching university education. However, before implementing such an FC, teachers face the challenge of creating content in the form of materials and activities and finding a suitable development method. This is very time-consuming, which is why circumstances such as lack of time and personnel can make implementation difficult. In other areas, agile approaches have already proven to be effective in enabling flexible and efficient development. We use this opportunity to overcome different barriers in the context of FC development by creating an agile model for FC development. To achieve this, we first examined the previous research on agile development approaches concerning the implementation of an FC by a systematic literature review, concluding that no appropriate model exists yet. Building upon this, we designed an AgileFC Development Model, which can be used by teachers to create their FC. This model is very generally designed so that it can be easily adopted. On the other hand, it can be adjusted to a particular situation without effort. We also illustrate the application of the model using a small case study
Identification	ISBN: 978-3-030-44998-8
Link	https://doi.org/10.1007/978-3-030-44999-5_48
Copyright	

Contribution 4

Table 16. Overview Contribution 4

Title	**May the Change Be with You: The Need for New Roles to Support Flipped Classroom Development**
Authors	Linda Blömer **Alena Droit** Kristin Vogelsang
Year	2020
Publication Outlet	I3E 2020, Springer Lecture Notes in Computer Science (LNCS)
Ranking	VHB: C WKWI: B
Status	Published
Bibliographic information	Blömer, L., Droit, A., and Vogelsang, K. 2020. "May the Change Be with You: The Need for New Roles to Support Flipped Classroom Development," in Responsible Design, Implementation and Use of Information and Communication Technology (Vol. 12066), I3E 2020. Lecture Notes in Computer Science, M. Hattingh, M. Matthee, H. Smuts, I. O. Pappas, Y. K. Dwivedi, and M. Mäntymäki (eds.), Cham: Springer, pp. 532–544.
Abstract	The usage of digital media to provide learning content is becoming increasingly popular. One form of e-learning is the Flipped Classroom (FC). FC courses, however, are still heavily dependent on the commitment of individual teachers. Repeatable descriptions of approaches or institutionalized support are rare. The high amount of work involved discourages many teachers from using FCs. Strategic course development should therefore be conducted collaboratively by several stakeholders. Change management approaches offer a solution to deal with the integration of strategies for change and consider all stakeholder groups. This paper aims to combine an FC process model and a change management approach to include all stakeholders. Based on a literature review, we develop an integrative approach and summarize the necessary aspects of change. Our results show that for the successful integration and development of FC courses, we need new roles that support the process and assure the stakeholder's acceptance.
Identification	ISBN: 978-3-030-44998-8
Link	https://doi.org/10.1007/978-3-030-44999-5_44
Copyright	

Contribution 5

Table 17. Overview Contribution 5

Title	**Enabling Stakeholders to Change: Development of a Change Management Guideline for Flipped Classroom Implementations**
Authors	Linda Blömer **Alena Droit** Uwe Hoppe
Year	2020
Publication Outlet	Proceedings of the 12th International Conference on Computer Supported Education (CSEDU)
Ranking	-
Status	Published
Bibliographic information	Blömer, L., Droit, A., and Hoppe, U. 2020. "Enabling Stakeholders to Change: Development of a Change Management Guideline for Flipped Classroom Implementations," in Proceedings of the 12th International Conference on CSEDU (Vol. 1), Setúbal: SciTePress, pp. 227–237.
Abstract	The successful introduction of the popular blended learning method Flipped Classroom (FC) is a major challenge because many stakeholders are affected. However, the transformation is dependent on the commitment of engaged individuals, who rarely have access to institutionalized support. Repeatable descriptions of strategic approaches and recommendations for how to manage a successful change in Higher Education Institutions are rare. This paper aims to synthesize research findings concerning Change Management (CM) approaches in a flipped learning context. Based on a systematic literature review, we develop a Guideline with specific recommendations for successful CM to develop and implement FC courses.
Identification	ISBN: 978-989-758-417-6 DOI: 10.5220/0009352402270237
Link	https://www.scitepress.org/Link.aspx?doi=10.5220/0009352402270237
Copyright	CC BY-NC-ND 4.0

Contribution 6

Table 18. Overview Contribution 6

Title	**Through the Lens of Different Stakeholders: Development and Application of a Change Management Guideline for Flipped Classroom Implementations**
Authors	Jonas Kötter Linda Blömer Christin Voigt **Alena Droit** Uwe Hoppe
Year	2021
Publication Outlet	Communications in Computer and Information Science (CCIS), Springer
Ranking	-
Status	Published
Bibliographic information	Kötter, J., Blömer, L., Voigt, C., Droit, A., and Hoppe, U. 2021. "Through the Lens of Different Stakeholders: Development and Application of a Change Management Guideline for Flipped Classroom Implementations," in Computer Supported Education. CSEDU 2020. Communications in Computer and Information Science (Vol. 1473), Lane, H.C., Zvacek, S., Uhomoibhi, J. (eds). Cham: Springer, pp. 216– 244.
Abstract	Teaching is becoming increasingly digital: At higher education institutions, more and more face-to-face courses are being replaced by digital teaching formats. At least since the outbreak of the corona pandemic, the introduction of digital teaching methods has been pushed forward under high pressure. This change has an effect on numerous stakeholders. However, there are still only a few recommendations or strategic approaches that show the stakeholders what tasks they and others should take. There is a lack of a general guideline on which all parties involved can orient themselves in order to introduce digital teaching jointly and efficiently. Based on a literature review, this paper presents such a Change Management Guideline identifying stakeholders, tasks and responsibilities. For such a digital change, cooperation between different stakeholders is indispensable. However, the distribution of tasks and cooperation in practice could deviate from theory and, furthermore, be experienced differently by those involved. The aim of this work is to use the guideline in order to identify the tasks and responsibilities through the lens of different stakeholders at a German university. In addition, the cooperation should be investigated through the different perspectives. For this purpose, stakeholders were surveyed in order to identify their point of view. Finally, recommendations for optimizing cooperation and thus a successful transition to digital teaching formats will be presented.
Identification	ISBN: 978-3-030-86438-5
Link	https://doi.org/10.1007/978-3-030-86439-2_12
Copyright	

Contribution 7

Table 19. Overview Contribution 7

Title	**Understanding Opportunities and Threats of Learning Analytics in Higher Education – A Students' Perspective**
Authors	**Rodda, Alena**
Year	2022
Publication Outlet	I3E 2020, Springer Lecture Notes in Computer Science (LNCS)
Ranking	VHB: C WKWI: B
Status	Published
Bibliographic information	Rodda, A. 2022. "Understanding Opportunities and Threats of Learning Analytics in Higher Education – A Students' Perspective," in Proceedings of the 21st IFIP WG 6.11 Conference on e-Business, e-Services and e-Society, pp. 111-122.
Abstract	The Covid-19 pandemic has further fueled an increase of e-learning in higher education. The widespread use of online learning generates vast amounts of academic data. This data can be collected and analyzed with the help of Learning Analytics to improve teaching and learning. Although students are essential stakeholders of Learning Analytics, their views are underrepresented in current research. Therefore, this paper aims to give an overview of opportunities and threats regarding the use of Learning Analytics from students' perspective. For this purpose, a qualitative study with 136 students was conducted, and the answers were coded and classified by multiple researchers. The results show a generally positive attitude toward Learning Analytics. Noticeable in comparison with existing research were small-scaled answers of participants that focus primarily on the course level and students' everyday lives. The identified opportunities and risks provide a good foundation for further research.
Identification	ISBN: 978-3-031-15341-9
Link	https://link.springer.com/chapter/10.1007/978-3-031-15342-6_9
Copyright	

Contribution 8

Table 20. Overview Contribution 8

Title	**Learning Analytics in the Flipped Classroom – Learning Dashboards from the Students' Perspective**
Authors	**Droit, Alena**; Rieger, Bodo
Year	2020
Publication Outlet	Proceedings of the 53th Hawaii International Conference on System Sciences (HICSS-53)
Ranking	VHB: C WKWI: B
Status	Published
Bibliographic information	Droit, A., and Rieger, B. 2020. "Learning Analytics in the Flipped Classroom – Learning Dashboards from the Students' Perspective," in Proceedings of the 53rd Hawaii International Conference on System Sciences, pp. 100-107.
Abstract	Blended learning courses offer the opportunity to collect large amounts of learning data that can help students to improve their performance. The presentation of learning data often takes place in the form of Learning Analytics dashboards, which are already in use at some universities. Students, who are the primary data providers and at the same time the main users, should be involved in the process of developing Learning Analytics dashboards from the beginning. Since there are only a few guidelines for designing these dashboards in literature, we conducted a study with 139 business and information systems students who, in addition to answering a questionnaire, also designed their dashboards with the help of a case study. The dashboard analysis provides detailed insights into the design of the functional and information scope, as well as the presentation of the data for Learning Analytics dashboards.
Identification	ISBN: 978-0-9981331-3-3
Link	https://aisel.aisnet.org/hicss-53/cl/teaching_and_learning_technologies/12/
Copyright	CC BY-NC-ND 4.0

Contribution 9

Table 21. Overview Contribution 9

Title	**Student-centered Design and Evaluation of a Learning Analytics Dashboard**
Authors	Rodda, Alena
Year	2023
Publication Outlet	Proceedings of the 8th International Conference on Digital Economy, Lecture Notes in Business Information Processing (LNBIP)
Ranking	VHB: C
Status	Published
Bibliographic information	Rodda, A. 2023. "Student-Centered Design and Evaluation of a Learning Analytics Dashboard," in Proceedings of the International Conference on Digital Economy, Springer, LNBIP 485, pp. 67–80.
Abstract	The digitization of teaching at universities has increased significantly in recent years, with online and hybrid courses becoming more popular. These formats allow students a high degree of autonomy, but also require them to work independently and organize themselves. However, students often lack these skills. Learning analytics (LA) evaluations, provided as dashboards, can help students to continuously monitor their learning progress and compare themselves to their peers. Nevertheless, the student perspective has often been underrepresented in LA research. There is also a lack of standardized knowledge and processes for implementing LA and making LA information available to end users. This paper aims to develop and evaluate a LA dashboard for a university course based on the requirements of the students, using data from a university's learning management and examination system. Three dashboard versions are designed and evaluated quantitatively and qualitatively in a study with 114 participants. The results will be discussed, along with limitations and potential future research directions.
Identification	DOI: 10.1007/978-3-031-42788-6_5
Link	https://www.springerprofessional.de/student-centered-design-and-evaluation-of-a-learning-analytics-d/26051642
Copyright	

Contribution 10

Table 22. Overview Contribution 10

Title	**Towards a Student-Centered Learning Analytics Dashboard: Design, Development and Evaluation**
Authors	**Rodda, Alena** Stahmann, Philip
Year	2023
Publication Outlet	Proceedings of the Americas' Conference in Information Systems (AMCIS)
Ranking	VHB: D WKWI: C
Status	Published
Bibliographic information	Rodda, A. and Stahmann, P. 2023. "Towards a Student-Centered Learning Analytics Dashboard: Design, Development and Evaluation," in: AMCIS 2023 Proceedings, 17, https://aisel.aisnet.org/amcis2023/sig_ed/sig_ed/17.
Abstract	This paper explores the development of a student-centered Learning Analytics Dashboard (LAD) to promote self-regulated learning. With increasing digitization, online teaching has become an important feature in higher education. However, online learning leads to new challenges for students such as isolation or high self-management requirements. LADs can support students by providing data and analytics on their learning behavior and progress. Yet, there is limited research on the design of LADs, especially with respect to student needs. In this paper, we use design science research methodology to design, develop and evaluate a LAD in two iterations. We assess the usability, visual aesthetics, and Task Technology Fit of the dashboard against the background of self-regulated learning theory. The results show that our LAD is capable of supporting students in the tasks of self-evaluation and self-assessment.
Identification	ISBN: 978-1-958200-05-6
Link	https://aisel.aisnet.org/amcis2023/sig_ed/sig_ed/17
Copyright	Copyright is retained by the authors.

Contribution 11

Table 23. Overview Contribution 11

Title	**How can Learning Analytics Enhance Online Teaching? A Teacher's Perspective**
Authors	Rodda, Alena
Year	2023
Publication Outlet	Proceedings of the 8th International Conference on Digital Economy, Lecture Notes in Business Information Processing (LNBIP)
Ranking	VHB: C
Status	Published
Bibliographic information	Rodda, A. 2023. "How Can Learning Analytics Enhance Online Teaching? A Teacher's Perspective," in Proceedings of the International Conference on Digital Economy, Springer, LNBIP 485, pp. 97–110.
Abstract	This paper examines the perspectives of teachers on the use of Learning Analytics (LA) to enhance online teaching in higher education institutions during the post-Covid era. The increasing shift towards online teaching as a result of the pandemic has presented a number of challenges for teachers. As online teaching is likely to remain a part of the higher education landscape, it is important to understand teachers' views on the topic. This study explores how LA could support teachers in their online teaching. For this purpose, we conducted 18 interviews with instructors from German and Dutch universities about the changes that online teaching has led to, opportunities and threats of LA, the information teachers require about their students, and the ability of LA to enhance the advantages of online teaching and mitigate its disadvantages. Our results show that teachers' opinions of LA are generally positive and that they would use LA if it were available in form of an intuitive and interactive dashboard. LA also offers the possibility to alleviate many of the problems in online teaching identified by the instructors.
Identification	DOI: 10.1007/978-3-031-42788-6_7
Link	https://link.springer.com/chapter/10.1007/978-3-031-42788-6_7
Copyright	© Springer Nature Switzerland AG