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# Flipping the IS Classroom – Theory-Driven Design for Large-Scale Lectures

*Research-in-Progress*

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## Abstract

*Universities face the challenge of increasing numbers of students leading to increasingly large lectures, and therefore decreasing interaction and collaboration, which are important factors for individual learning success and satisfaction. With this research-in-progress, we therefore propose a conceptual framework for a blended learning flipped classroom to redesign large-scale IS lectures, recognize the important role of peers in the student journey, and improve interaction. We therefore derive requirements from the theory of interaction for flipped classrooms. These requirements are addressed by design principles for flipped classrooms and implemented in a large-scale IS lecture. With the implementation, we are able to overcome large-scale lecture related limitations, and, as a practical contribution, help IS lecturers to face the according challenges. As a theoretical contribution, we enrich the body of large-scale learning-teaching-environments by considering explicitly the role of peers. The study is currently running in order to evaluate the concept.*

**Keywords:** flipped classroom, interaction, collaborative learning, peer learning, peer creation, peer assessment, large-scale lectures, learning success

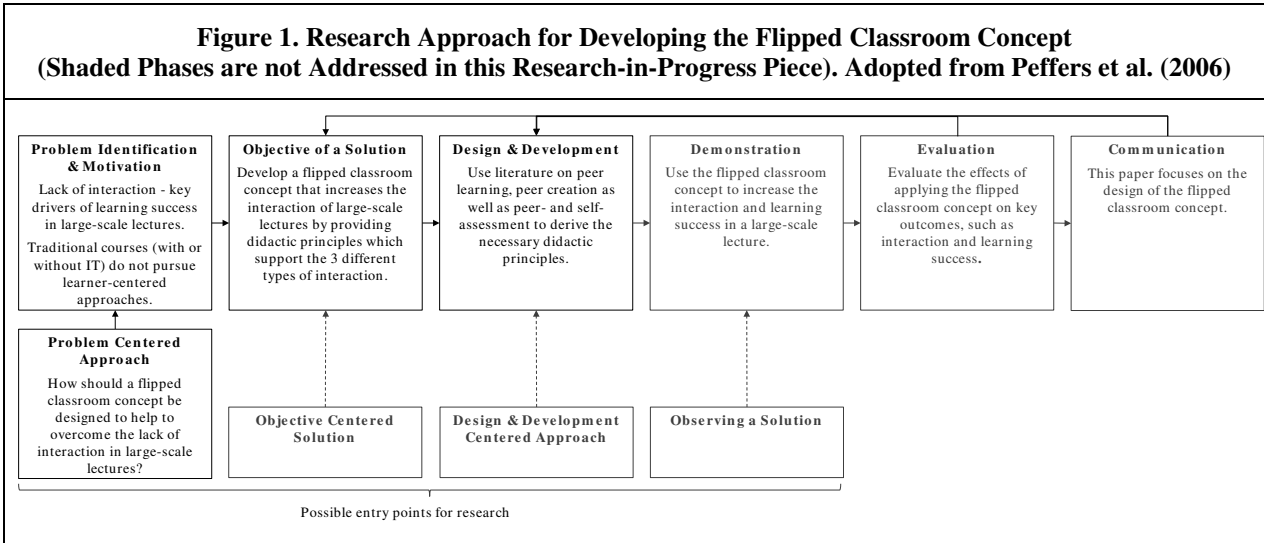
## Introduction

University large-scale lectures with an uneven lecturer-student proportion (sometimes more than 100 students per lecturer) are still common default at German universities (Leidenfrost et al. 2009). These large-scale lectures are characterized by high anonymity and suffer from a lack of interaction and collaboration - not only among learners themselves but also among learners and lecturers (Grießhaber 1994). Often, this accompanies with insufficient learning outcomes and unsatisfied learners (Lehmann and Söllner 2014). This development is unsatisfactory since fundamental elements of learning success include the opportunity to ask comprehension questions in order to get feedback and the possibility of sharing one's opinions concerning the learning content (Picciano 2002). Additionally, interaction and

collaborative learning with peers are regarded as significant predictors in terms of learning success (Moore et al. 1996), and positively influence the long-term satisfaction of learners (Alonso et al. 2009; Hardless et al. 2005). However, introducing interaction, collaboration, and feedback into a large-scale lecture is a widespread problem (Lehmann and Söllner 2014). Didactic mechanisms are needed in order to provide feedback for individual learning success verification and to assist collaborative learning for reflecting, creating, and discussing specific content. This allows learners and lecturers to identify missing knowledge and misunderstandings not during the final exam, but rather early on in the course of a continuous learning progress monitoring system (Bischof 2013; Mayer et al. 2009).

A promising possibility to increase large-scale lecture quality as well as to enhance interaction and collaboration without massively increasing the workload of lecturers is to transform the IS classroom into a flipped classroom. Specifics of an IS classroom embrace transferring factual knowledge to the point of transferring metacognitive knowledge, which requires a well-balanced approach of self-study and several interaction sequences. A flipped classroom, which is also known as inverted classroom, is the reversal of a traditional learning-teaching-environment. Thereby, the teaching method is aligned as more learner-centered. Moreover, the presence allows for valuable comprehension questions as well as discussions on specific content. The goal of our research is to develop an approach for designing a theory-driven learning flipped classroom in a large-scale IS lecture in order to overcome the lack of interaction. The flipped classroom concept is conducted in an IS undergraduate course executed at a German university.

To achieve our research goal, we follow the design science approach (Hevner et al. 2004; Peffers et al. 2006), particularly the design science research approach of Peffers et al. (2006) (see Figure 1). Moreover, to ensure that our flipped classroom concept addresses all important types of interaction, we follow Briggs' (2006) theory-driven design approach by grounding our research on the theory of interaction and deviate didactical design principles for enhancing interaction and in consequence learning outcomes. In this paper, we present details on the first three phases advocated by Peffers et al. (2006) for the development of the flipped classroom concept.



Hence, the introduction has addressed the phase of problem identification and motivation. The next sections describe the objectives of a solution phase by identifying requirements from theory of interaction and creating didactic principles, which will be applied in the flipped classroom concept. We then describe the implementation of the flipped classroom concept for an undergraduate IS large-scale lecture on the third phase, design and development. The paper closes with our limitations, future research, next steps and expected contributions focusing on our planned demonstration and evaluation of the flipped classroom concept, which is expected to increase learner satisfaction and improve the learners' learning.

According to Hevner et al. (2004), this work provides an improvement. It contributes to the educational research by systematically developing a reusable flipped classroom concept to re-design a large-scale IS lecture to precisely transfer factual knowledge to the point of metacognitive knowledge within several

interaction sequences in a learner-centered approach and thus enhance lecture quality to increase learner's success and satisfaction. By actively integrating the learner into several peer learning activities, they transform from consumer to producer. To practitioners, this paper provides concrete ways on how to create a high-quality learning-teaching-environment in a large-scale lecture with limited resources in mind.

## **Related Work**

The approach of flipped classroom, also known as „inverted lecture“ (Gehring and Peddycord 2013) or „inverted classroom“ (Strayer 2012), changes the conventional way of lecture and homework. Thus, the process of acquiring knowledge or learning contents takes place at home. Students are required to teach themselves basic knowledge as homework, while they solve tasks that are usually supposed to be homework in class. This means that from now on mastery activities are an integral part of the schedule in class. Outside of class, learners have access to online videos and learning material where they study the subject matter on their own. In class, learners concentrate on understanding, applying, and analyzing the subject matter they previously studied (Keengwe et al. 2014). This is realized via group or individual problem solving activities, group discussions, or other learner-centered activities that enhance critical thinking, problem solving skills, or discussing (Garrison and Kanuka 2004; So and Brush 2008; Strayer 2012). In contrast to flipped classrooms, there are two other concepts that need to be considered for delineation (Martin 2012); firstly massive open online courses (MOOCs), and secondly small private online courses (SPOCs). MOOCs are mainstream courses accessible for all people worldwide interested in a topic (Wulf et al. 2014). The concept of SPOCs offers a restriction regarding the availability: large scales of people can participate in the online course, but it is not a course open to everyone. Hence, the possibility to join the course is provided to a selected group. Therefore, both concepts share certain aspects with the flipped classroom. Flipped classrooms therefore adopt to some extent the online component of both MOOCs and SPOCs (Martin 2012), as well as the private component of SPOCs. In addition, flipped classrooms are coined by their blended character, linking online and offline learning activities for a holistic teaching and learning concept.

The concept of flipped classroom therefore requires several aspects concerning the learning material and the motivation of the students. In order to ensure that students are prepared for the lessons in class, they are required to view the lectures at home, and door-quizzes or interspersing machine-scored questions in the videos can be obligatory to ensure their preparation. However, from the students' points of view, there are serious drawbacks. For instance, the recorded lectures could be too long or not helpful in order to handle more difficult course material, as well as the difficult link of online and presence portions of the course (Strayer 2012). Blinding these drawbacks out, flipped classroom is regarded a more enjoyable learning experience, promises more confidence in the students' performances, and drives student motivation and responsibility in the learning process (Fox 2013; Lage et al. 2000; Strayer 2012). We want to foster these outcomes and also address the described issues by a theory-grounded approach for the design of flipped classroom for IS lectures that is discussed afterwards.

## **Requirements from Theory of Interaction**

We employ a theory-driven design approach and therefore derive design requirements from the theory of interaction to positively influence learning outcomes as our phenomena of interest (Briggs 2006). The meaning of the term 'interaction' in the disciplines of sociology, education, and psychology addresses the interrelation between human beings and their communicative actions amongst each other (Bryant and Heath 2000; Jäckel 1995). Regarding interaction, we specifically refer to the work of Moore (1989), in which the author differentiates between three types of interaction: learner-content-interaction, learner-lecturer-interaction, and learner-learner-interaction. We adopt these three types of interaction for our research and define interaction itself as learning activities, including exchange between learners, lecturers, and content (Moore 1989; Schrum and Berge 1997).

Prior research has shown that learners who interact with their lecturers are more actively involved in the learning process (Liu et al. 2003; Wang et al. 1990) and receive better results in the final exam compared to those who don't interact with others. The question-answer-game is the classic form of interaction between learners and lecturers. The lecturer can actively include the learner in the teaching process, as

well as assess the learning progress by means of the answers and provide direct feedback. The learners have the opportunity to contribute their ideas and thoughts by initiating new thought processes (Gagné et al. 1993; Morgan 1991). A study shows that learners with low or intermediate previous knowledge profit from a high degree of interaction and achieve higher learning results (Snell 1999).

An interactive setting in the learning-teaching-environment can enhance student motivation, attention, and participation in class, as well as foster greater exchange between students (Liu et al. 2003; Sims 2003). Thus, it is very relevant to integrate didactic principles in a large-scale lecture and to follow a learner-centered approach in order to activate learners. We develop a flipped classroom concept with high focus on learner-centered teaching. Therefore, we identified seven requirements from theory to ensure that all three types of interaction are addressed within our flipped classroom concept (see Table 1).

<b>Table 1. Requirements from Theory of Interaction</b>		
<b>Interaction type</b>	<b>Description</b>	<b>Requirements (R)</b>
<b>Learner-Learner-Interaction</b>	Learners should have the opportunity to connect with their fellow students during the learning process within conversations and discussions (Alavi et al. 2002) to enhance motivation (Eisenkopf 2010) and learning success (Fredericksen et al. 2000; Moore and Kearsley 2011). In collaborative assignments, students learn from each other and create new knowledge mutually (Topping 2005).	R1) Learners should be creating learning material collaboratively. R2) Learners should discuss among each other.
<b>Learner-Lecturer-Interaction</b>	Lectures should give advice and feedback to students and need to retain an overview of their students' performances (Bligh 1998). In addition, the teacher should verify which learning goals have been achieved or may not have been achieved. By interacting with lecturers, students can request clarification of unclear points and lecturers can reinforce correct interpretation (Thurmond and Wambach 2004).	R3) Learners should get feedback. R4) Learners should give feedback. R5) Learners should have the possibility to ask questions.
<b>Learner-Content-Interaction</b>	This interaction form takes place when students examine the course content (Moore and Kearsley 2011) and take part in class activities (Thurmond and Wambach 2004). Assignments regarding the learning content should be integrated in the learning-teaching-environment. Factors that affect the learner-content-interaction can be contact with the content (Leasure et al. 2000) and participation in class discussions (Jiang and Ting 1999).	R6) Learners should get content-specific assignments to answer on their own. R7) Learners should get content-specific assignments to discuss among each other.

## Design Principles to Guide the Process of Re-Design

In order to increase interaction and collaboration, as well as to provide feedback to learners during the learning process, we base our approach, despite the theory of interaction, on theories like peer learning, including different types like cooperative learning and peer creation. In addition, we focus on peer and self-assessment on how learners can receive individual feedback during their learning process. For a theory-driven deduction of design principles, we first give an overview of these theories. Afterwards, we identify design principles concerning the identified requirements from theory of interaction as theoretical foundation for our flipped classroom concept (see Table 2)

Peer learning is based on theories of social constructivism and refers to learning with and from companions of an equal status, called peers (Topping 2005). A group of people (2-5 people up to > 100 people) learn or attempt to learn something together through social interactions (Dillenbourg 1999). These interactions, such as discussions with peers, foster reflection and cognitive processes (Arbaugh 2010). That offers positive effects for the peer: e.g., knowledge gain which leads to learning success or improvement of communication skills and the peer learns to become responsible for its activities (Topping 2005). In addition, the peer learning process focuses on the learner and permits interaction between learners (Hua Liu and Matthews 2005). In most cases, a person with didactical know-how has to lead and assist the process (Harris 1998) and the same level of knowledge is required by the peers (Topping 2005). Very similar to peer learning is the concept of cooperative learning, which is more specific on how to structure the assignment and the collaborative work. The lecturer provides an extensive open-ended free text assignment in course of which learners prepare a group solution within their allocated group. The learners are responsible for their actions and improve interpersonal and communicative skills (Büttner et al. 2012).

Peer creation focuses on the development of learning material from peers for peers. This output can be used by an expanded group of people. Peer creation comprises mechanisms of co-creation (Wegener and Leimeister 2012), which indicate first insights on how people create artifacts together with the help of collaborative technologies in learning context. The peers add value to the learning material by yielding their own knowledge in form of learning content (Wegener and Leimeister 2012). For developing learning material, Wegener and Leimeister (2012) identified key principles which lead to first insights on how to design processes for documenting knowledge in a standardized and productive way (Oeste et al. 2014). This assumes that a lecturer clearly defines the assignment and makes peers accountable for their developed learning material as well as implies expert knowledge on them. Otherwise, the peers would not be able to document necessary knowledge in a correct way. The development of such learning processes often has a strong reference on specific content and context (Kollar et al. 2006).

To enhance interaction, feedback and individual learning success verification, peer and self-assessment are essential possibilities providing formatively individual feedback on the learning progress as well as corresponding interventions by means of technical-based observation processes even in groups with a higher number of learners (Bischof 2013; Piech et al. 2013). In the case of peer assessment, learners give each other feedback or credit points in terms of a performance during the learning process according to specifically defined criteria (Boud and Falchikov 2007). Peer assessment turns learners into experts themselves and gives them a deeper understanding of the learning content (Sadler and Good 2006). Learners will develop an awareness for their own strengths and weaknesses and will be able to compare their own performances (Darling-Hammond et al. 1995). In addition, learners train their abilities to think critically (Block et al. 1971; Zoller 1993). Furthermore, with the support of computer-based tests (machine grading), students can assess their individual learning success on their own without increasing lecturers' workload (Bischof 2013). Those tests allow for self-assessment and are characterized by a choice of solutions, e.g., multiple choice, true/false statements, assignment tasks, error marking (cf. (Mayer et al. 2009; Schiefner 2007)).

**Table 2. Design Principles for Flipped Classrooms**

Theory	Design Principle (D)	Req (R)
Peer Learning	D1) <i>Group formation</i> : Put together a group of learners and reconcile them to the same level of knowledge.	R1
	D2) <i>Assignment structure</i> : Define a clear instruction for several steps with subtasks to solve an assignment.	R6
	D3) <i>Assignment wording</i> : Formulate open questions with clear instruction on how learners should interact.	R2, R7
	D4) <i>Lecturer</i> : Provide a person with didactical know-how to escort learners.	R5
	D5) <i>Reciprocity</i> : Enhance interaction by providing tools to ensure reciprocity.	R2
	D6) <i>Accountability</i> : Make peers accountable for their solutions by social pressure.	R2
Peer Creation	D7) <i>Quality of outcome</i> : Provide peer review mechanisms to ensure correctness of outcome.	R1, R2
	D8) <i>Knowledge base</i> : Ensure knowledge of peers by providing learning material before collaboration.	R6
Assessment	D9) <i>Peer assessment</i> : Give learners criteria to evaluate each other's performances anonymously.	R3, R4
	D10) <i>Assessment</i> : Create assignments where learners formatively get individual feedback on their learning progress.	R3, R4, R6
	D11) <i>Lecturer evaluation</i> : Provide a person with know-how on learning content to answer questions.	R3, R5
	D12) <i>Automatic assessment</i> : Provide a knowledge test with individual quantitative evaluation of results.	R3

## Concept of a Large-Scale Flipped IS Classroom

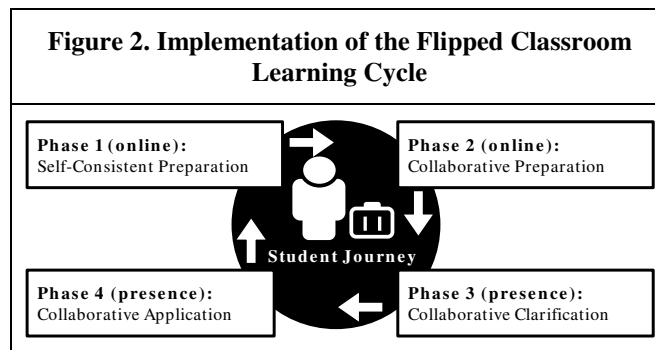
### *Background of the IS Large-Scale Lecture*

The implementation of our flipped classroom is conducted at a German university in the course Introduction to Business Informatics, which is attended by business administration and economics undergraduate students. This course is offered each semester and is attended by 150 to 300 participants. It was designed in the past as a traditional frontal lecture with a high teacher centrality. The 12 sessions of the course are supplemented by tutorials, which are supervised by student assistants. Students are until

now graded by means of a written exam at the end of a semester, which is our reference object for measuring learning success as a dependent variable of our flipped classroom. All students attending the course use a university learning management system (LMS). They are provided with the script, other learning materials and can communicate with the instructors of the course. These are, apart from the lecturer, a scientific assistant who supports back-office activities, as well as four student assistants.

### Implementation and Re-design

Based on the identified design principles, the flipped classroom concept aims to raise interaction, learner satisfaction, and moreover to enhance individual learning success in a large-scale IS lecture. For that purpose, we developed a recurring learning cycle with a duration of three weeks. The whole course consists of five learning cycles with each cycle comprising four phases (see Figure 2): (1) self-consistent preparation; (2) collaborative preparation; (3) collaborative clarification; (4) collaborative application. Each phase aims to address specific cognitive process dimensions, e.g., transfer of factual knowledge in the first phase or transfer of procedural knowledge in the third phase. Thus, learning objectives on higher process dimensions can only be achieved, if a learner passes through the whole cycle. The overall goal is to actively get the learner involved in learning activities. Furthermore, we aim to get students prepared for self-directed learning: Outside of class, learners will prepare the learning content on their own with provided learning material, slides and learning videos. Within collaborative learning, students will work together creating answers to content-specific assignments. In class, the time is used for comprehension questions, valuable discussions concerning the before collaboratively created answers and further assignments to foster a deeper understanding of the learning content.



In the first phase, namely self-consistent preparation, the learners will study the learning material on their own, consisting of videos and slides in small units, provided by the lecturer via the LMS, where it can be used independently of time and place. Furthermore, knowledge tests consisting of single-/multiple-choice questions are offered via LMS, where the learners automatically receive individual formative assessment. In case of unsatisfied results, the learner has the possibility to repeat learning content by means of videos and slides. In the second phase, collaborative preparation, learners need to prepare a solution for a part of an extensive open-ended free text assignment (each group is assigned different assignment parts). For this, learners will work together in groups of up to 30 participants while using their own LMS group forum. In addition, student assistants will control the learners' work in each group forum, guide the process in collaborative working, as well as provide help when needed. Each group needs to bring their solutions on slides, which are used as input for the next phase, the collaborative clarification, which is held in presence (Janson et al. 2014). In case a group is not delivering any solution, no answers can be presented and discussed. This has negative consequences for all learners, because nobody will receive the whole solution of the open-ended free text assignment. Therefore, we assume that all groups deliver assignment-specific answers, otherwise social pressure among learners increases significantly. The last phase, collaborative application, is dedicated to the tutorials. The tutorials are held by student assistants in 12 different groups consisting of the same learners who worked together previously during the collaborative preparation. During the tutorials, learning content and assignments regarding application knowledge are mediated and practiced. The student assistants provide learners with individual feedback and give hints. A very detailed description of all four phases is presented in Table 3.

<b>Table 3. Description of the Learning Cycle</b>		
<b>Phase 1: Self-Consistent Preparation</b>		<b>Des. Prin.</b>
Goal	Self-directed preparation to acquire factual knowledge.	D2; D3; D8; D10; D12
Availability	Available online. Learning material as download from LMS.	
Interaction	Learner – Content	
Assignment of task	Work through learning materials (videos, slides, reader) and solve knowledge test.	
Role of learner	Consumes learning material and organizes self-directed learning speed.	
Role of lecturer	Facilitates learning content in form of videos, slides, and knowledge test on the LMS.	
Output	Learner has acquired factual knowledge. Learner has received direct feedback by an automated knowledge test. Learner is prepared to solve the next task. Learners are on the same knowledge level.	
<b>Phase 2: Collaborative Preparation</b>		
Goal	Application and transfer of factual knowledge.	D1; D2; D3; D4; D5; D6; D7; D9
Availability	Available online. Possibility to participate in a group forum available in the LMS.	
Interaction	Learner – Learner / Learner – Lecturer (student assistant)	
Assignment of task	Provide individually and then collaboratively a solution of a free text sub assignment.	
Role of learner	Presumes and produces learning material.	
Role of lecturer	Moderation of collaborative learning activities and consolidation of several developed group solutions.	
Output	Peer-created solution for a sub assignment in form of high quality learning content documented on 2-4 slides as valuable input for the next phase in the classroom during interaction with the lecturer.	
<b>Phase 3: Collaborative Clarification</b>		
Goal	Collaborative clarification and consolidation of developed solutions of the free text sub assignment. Gain deeper understanding of learning content with an interactive learner-lecturer discussion.	D4; D5; D6; D7; D11;
Availability	Learners have access via live stream or in presence in the classroom.	
Interaction	Learner – Lecturer	
Assignment of task	Listen to lecturer, who presents group solutions supplemented by further explanations to the groups. Other learners discuss questions regarding the learning goals and lecturer supplements the answers.	
Role of learner	Consume solutions of subtasks from other groups and actively add explanations to their developed solution and ask questions about other developed solutions from other groups.	
Role of lecturer	Presents developed solutions (in slides) from sub tasks. Moderates discussions.	
Output	Learner has a deeper understanding of learning content and can evaluate its correctness.	
<b>Phase 4: Collaborative Application</b>		
Goal	Collaborative application of knowledge and methods on several assignments.	D1; D2; D3; D4; D5; D11
Availability	Tutorial takes place in the classroom. Participants are divided into 12 groups of up to 30 people.	
Interaction	Learner – Lecturer (student assistant)	
Assignment of task	Learners participate in tutorial and solve assignments for application knowledge.	
Role of learner	Contributes to tutorial by asking questions and solving assignments for application knowledge.	
Role of lecturer	Student assistant summarizes learning content, provides assignments, and gives feedback.	
Output	Learner has a deeper understanding of learning content and is able to apply knowledge.	

## Research Design and Method

In line with the design science research approach, we evaluate our flipped classroom concept to derive insights for future semesters. Therefore, we propose a mixed-methods approach that is embedded in an explorative and longitudinal research design with several measurement points during and after the semester. The outline of our study can be found in Table 4.



**Table 4. Data Collection and Analysis Summary**

Data	Collection	Analysis Method	Purpose	Expected Outcome
Quantitative	Online survey with several measurement points	t-test for independent samples with SPSS 22 as tool of analysis.	Test the effects of the flipped classroom design on interaction, learning satisfaction, and learning success.	Confirm that the flipped classroom design increases interaction, learning satisfaction, and learning success.
Class and Online Discussions	Class discussions are video documented observations and online discussions are exported from the LMS.	Text analysis with a grounded theory approach with ATLAS.ti as tool of analysis.	Complement quantitative data with rich qualitative data, especially with respect to class behavior and LMS appropriation.	Gain complimentary insights on how students interact within the flipped classroom and additionally with the offered IT artifacts.
Interviews	Structured interviews with participants of the lecture.	Text analysis with a grounded theory approach with ATLAS.ti as tool of analysis.	Complement quantitative data with rich qualitative data.	Gain deep insights into the in class and online behavior of the lecture participants.

We employ a mixed-methods approach to evaluate the effects of flipped classroom design on interaction and learning outcomes with a quantitative study and to improve our design for the next design cycle with an complementary qualitative study (Venkatesh et al. 2013). The quantitative data collection has already started and more than 250 participants of our course are registered. The participants were assigned a unique code to identify them properly in our longitudinal research design. Overall, we evaluate the interaction and learning outcomes. In addition, we check for several control variables. In our first evaluation (t1) at the beginning of the summer term, we measure all control variables, including personality (Rammstedt and John 2007), self-regulated learning (Pintrich and De Groot 1990), and technology readiness (Parasuraman 2000). In our second evaluation point, we measure the initial interaction with the scales of Siau et al. (2006) as a learning process variable (t2). At the end of the summer term, we finally measure the learning satisfaction with the scales of Arbaugh (2001) as a learning outcome variable, and again interaction (Siau et al. 2006), to account for longitudinal changes that are suggested by research (Gupta and Bostrom 2009). Finally, learning success as a key learning outcome is measured by means of the exam results. Since our lecture is embedded in an ongoing action research project (Wegener et al. 2012), we use the same type of scales and final exam, and are thus able to show whether our flipped classroom design improves interaction and learning outcomes. Hence, a past study is used as a control group, to test if the concept significantly improves interaction, learning satisfaction, and learning success. To evaluate our hypotheses, we use a t-test for independent samples and our tool of analysis is SPSS 22.

The qualitative data collection focuses the learners' perspectives on our learning community under study. For this purpose, we primarily collect qualitative data in our LMS to capture the authentic online interaction of the participants. Additional data are collected by recording all lectures on video. Finally, we conducted structured interviews with randomly chosen participants of the lecture, to capture rich insights on how they perceived the new didactical concept. To analyze our qualitative data, all data are either transcribed or online data imported in our tool of analysis, ATLAS.ti. To analyze the qualitative data, we use a grounded theory approach to account for the explorative nature of our work (Glaser and Strauss 2009).

## Limitations and Future Research

There are, however, several limitations coming with the nature of an explorative research design. Working with students in a real setting within a complex learning arrangement, involving various didactic mechanisms means that it is very difficult to identify causal relations. Since we gather our data in a real setting, we cannot precisely prove that an increase in interaction, learning satisfaction, and learning success will solely result from the flipped classroom design integrating the diverse didactic mechanisms. A field research project is subject to several confounders, so changes in interaction, learning satisfaction,

and learning success could also arise from other external effects (Bortz et al. 2009). Hence, future research should conduct our study as an experimental design with students randomly divided in test and control groups. The findings yielded from an experiment will bring more valid results regarding the effects of the flipped classroom design on interaction, learning satisfaction, and learning success. The second limitation comes along with the variable of learning success which we measure via the final exam. The learning success is a very complex variable, difficult to measure, and can be affected by various effects – even outside of class (Hölbling et al. 2010). Even if we use the same exam from a past semester as reference point, it cannot be guaranteed that rating is the same each semester.

## **Next Steps and Expected Contribution**

The preliminary design of our flipped classroom concept presented in this paper is finished and now being tested in a large-scale lecture at a German university during the summer term. However, we are still a research-in-progress, since today, we are in the middle of the semester and still in the course of evaluating the flipped classroom concept. In line with previous research findings (Bitzer and Janson 2014), we expect that students will receive better results in the final exam and that they are more satisfied with the teaching method of flipped classroom. In addition, it is expected that the results show, despite the challenges of university large-scale lectures, that learner-centered interaction enriched with peer learning mechanisms as well as time- and resource-saving formative individual learning success verification are possible. Moreover, the goal is to extensively test the flipped classroom concept and collect feedback for further development. These activities resemble the demonstration phase of Peffers et al.'s (2006) design science research process. However, we additionally aim to investigate the concept's effect on interaction and learning success (evaluation phase).

Thus, the expected results of completed research will be practically relevant for scientists, lecturers, and tutors alike, since they provide insights on how large-scale lectures can be designed in order to overcome the lack of interaction, by incorporating mechanisms of peer learning as well as peer creation and formative assessment in a learner-centered teaching. Moreover, the results serve IS lecturers as a practical contribution to face the challenges of large-scale IS lectures that are coined by limited lecturer time and resources. Therefore, we offer theory-driven design guidelines to overcome these problems. Therefore, our expected results are highly relevant for practitioners who have to face learners' low persistence and high drop-out rates, which is the case in traditional large-scale lectures (Garavan et al. 2010; Jordan 2014). As a theoretical contribution, we enrich the body of large-scale learning services by considering the role of peers and by providing an approach on how to integrate interaction mechanisms based on peer learning, peer creation, and formative assessment to overcome the challenges of large-scale lectures. Moreover, our results are of high relevance and transferability for other learning services.

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