



Flexibilizing and Customizing Education using Inverted Classroom Model

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ABSTRACT

Traditional academic teaching can be transformed and enhanced by the use of information and communication technologies (ICT) implemented in suitable didactical frameworks. The “inverted” or “flipped” classroom model can create diverse learning opportunities for heterogenic learning needs. Within a multicase study approach the research on two teaching projects at two German higher education institutions was conducted that provided an insight into students’ opinions toward the inverted classroom model.

KEYWORDS

Digital enhanced learning; education/training; flipped/inverted classroom; ICT

Introduction

A diverse world hosts diverse people with diverse learning needs. Today’s social development is determined by digitalization and the use of information and communication technologies (ICT). It is referred to as the *digital turn* (Kossek & Peschl, 2012) or the *global digital transformation* (Besch, 2016), which also concerns future teaching and learning (Bülow-Schramm, 2015). The significance of ICT for higher education has been shown in the annual Horizon Reports that indicates trends and challenges (Adams Becker et al., 2017). Furthermore, contemporary academic teaching faces additional challenges. It is expected to be competence-oriented, learner-centered, and to take into account the diversity of students (Arnold & Erkel, 2014; Hanft, Zawacki-Richter, & Gierke, 2015; Johnson et al., 2016). The use of ICT for e-learning provides opportunities to meet these requirements (Bargel, 2014; Paliwoda-Pękosz & Stal, 2015), however, the challenges are omnipresent in higher educational teaching. They stemmed from the typical structure of academic teaching (lectures, courses/seminars) that limits didactical design options.

The Inverted Classroom Model (ICM) – also known as Flipped Classroom Model – offers a good opportunity to enhance traditional teaching (Handke, 2014; Lehmann, Oeste, Janson, Söllner, & Leimeister, 2015; Schaper, 2012) and to meet the requirements for the competence orientation (Lehmann et al., 2015; Schaper, 2012), diversity orientation (Avogaro-Bentele, 2016), digitization (Handke, 2014), and flexibilization of higher education

(Arnold & Erkel, 2014). Inverting/flipping, an academic classroom which uses ICT can enhance flexible learning paths to enable skill growing and strengthening of human capital in transition countries (Chinapah & Otero, 2016). However, the research body that investigates this phenomenon is still scarce. In order to narrow this research gap and enrich their skills the authors have undertaken the research that aimed at answering the following main research question: How can ICT be used to create diverse learning opportunities and to facilitate learning needs within an inverted classroom?

In order to answer the main research question, a multicase study approach was applied that involved teaching projects at two German higher education institutions which use ICM. The results of the study provide guidance for educators about how they can benefit from ICT usage in an inverted classroom.

This manuscript is organized as follows. Next, a review of related literature is presented. Then, the research method that involves the multicase study approach is described. In the following sections, results of the two case studies are presented. Finally, implications are derived, and the paper concludes with the contribution and a summary of the research.

Literature review

For some time now, ICM has been promoted as promising for higher education, especially for lectures, and highlighted as an innovative teaching concept (Abeysekera & Dawson, 2015; Adams Becker et al., 2017; Crews & Butterfield, 2014;

van Treeck, Himpsl-Gutermann, & Robes, 2013). It was introduced as Inverted Classroom (Lage, Platt, & Treglia, 2000) and Classroom Flip (Baker, 2000), later established as Flipped Classroom (Bergmann & Sams, 2012), and is also known as Flipped or Inverted Learning. However, the basic idea is the same: classroom time is used for active learning, whereas the acquisition of basic knowledge is outsourced into the self-study time in the form of e-learning (Abeysekera & Dawson, 2015). It is essential for ICM that ICT support self-study (Lage et al., 2000). Hence, ICM can be classified as a form of blended learning (Handke & Schäfer, 2012; van Treeck et al., 2013) and addresses the need of blended learning within the higher education system (Jacob & Radhai, 2016). The incorporation of ICT can support digitalization and hence, ICM can contribute to teaching digitization at higher education institutions (Handke, 2014).

As a didactical framework, which can complement and develop an existing teaching arrangement (Engel, 2017), ICM may possibly be applied in every traditional setting in higher education and could adjust to learners' needs and requirements. Today, students demand high flexibility in learning (Lübben, Müskens, & Zawacki-Richter, 2015). The main potential of e-learning is to flexibilize learning in pace and place (Handke & Schäfer, 2012). Competence-oriented teaching aims at knowledge enhancement and the use of knowledge, and consequently relates to the development of skills to apply knowledge (Schaper, 2012). In Bloom's revised taxonomy (see Figure 1), which is a model of cognitive objectives based on each other, higher levels of competence require basic knowledge and understanding (Krathwohl, 2002). Similarly, academic competences, such as applications of scientific concepts to complex

requirements, analysis and reflection, the development of innovative concepts, and solutions require prior knowledge (Schaper, 2012).

Media-assisted individual preparation and high interactivity are intended to promote an active, application-oriented and multiperspective study of learning content and thus are able to support a competence-oriented learning process (Schaper, 2012).

A student-centered approach must consider individual learning conditions, life situations and learning needs, which characterize the diversity of students. Students' diverse educational background and individual time budgets result in a diversity of prior knowledge, life and work experience, study styles, and learning pace (Bülow-Schramm, 2015; Lübben et al., 2015). To take them into consideration means to adapt learning arrangements to individual needs and to reap off the benefits of students' diversity (Hofsäss, 2007). Hence, differentiation and individualization, together with flexibilization constitute the current challenges of education.

Customizing and flexibilizing refer to various issues affecting teaching and learning, but time appears to be the most important factor (Maschwitz & Brinkmann, 2015). Since classroom time is limited, there might not be enough time for in-depth discussion or practical exercises. Unquestionably, ICM provides more in-class time to focus on active learning, interaction and learning-centered mediation, especially for large groups (Lehmann et al., 2015). Knowledge and understanding can be deepened, applied, and practiced actively and cooperatively in a class (Carbaugh & Doubet, 2015; Crews & Butterfield, 2014; van Treeck et al., 2013).

Zainuddin and Halili (2016) in their meta study analyzed 20 studies about ICM between 2013 and 2015.

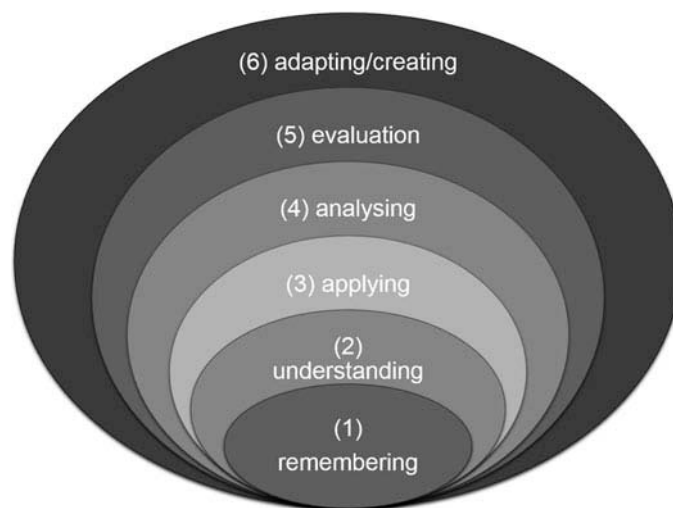


Figure 1. Taxonomy of cognitive learning objectives.

Source: Own elaboration on the basis of (Krathwohl, 2002, p. 215)

Results verified a distinction of ICTM from traditional academic teaching and a relation to the theory of Bloom's revised taxonomy (see [Figure 1](#)). Basic levels of achieving knowledge (level one and two) happen outside of class and in-class activities focus on the higher levels (level three to six). ICM has been implemented in schools and higher education around the world and is applied in various disciplines. Examples in higher education are computer science (Giannakos, Krogstie, & Aalberg, 2016), civil engineering, dietetic consultation, and mathematics (Haag & Freisleben-Teutscher, 2016). Core content areas in school education are English, social studies, maths, and science (Bretzmann, 2013). Nevertheless, the state of knowledge and research is not well defined and is partly unclear, as numerous meta studies have confirmed (Abeysekera & Dawson, 2015; Betihavas, Bridgman, Kornhaber, & Cross, 2016; Bishop & Verleger, 2013; Rahman & Mohamed, 2014; Karabulut-Ilgu, Jaramillo Cherez, & Jähren, 2017). For example, Abeysekera and Dawson (2015) call the approach "under-evaluated, under-theorized and under-researched" (p.2) and demand more specific research. Therefore, practice projects combined with empirical studies are needed (Abeysekera & Dawson, 2015; Karabulut-Ilgu et al., 2017). Their results can contribute to the theory, concept development, and thus to the systematization of the field.

Abeysekera and Dawson (2015) noticed that, despite the ICT popularity, neither a consistent understanding nor reliable evidence of their effectiveness exists. The researchers' meta study shows that there seems to be a common understanding of the semesters ICM, but actually no common definition. They define ICM "[...] as a set of pedagogical approaches that: (1) move most information-transmission teaching out of a class (2) use class time for learning activities that are active and social and (3) require students to complete pre- and/or post-class activities to fully benefit from in-class work" (Abeysekera & Dawson, 2015, p. 3).

Numerous forms of ICM exist in higher education. With regard to ICM as an arrangement of learning-teaching time, in-class time can be replaced by self-study or expanded by assigning preparation in self-study (Giannakos et al., 2016). As far as methods are concerned, it can be generally distinguished between a video-based (video-recorded lectures) and a task-oriented (preparation tasks) version (Weidlich & Spannagel, 2014). Regardless of the chosen form, the approach may always give an opportunity to flexibilize teaching and academic learning. Within the self-study time, learners can self-determine their learning process: decide about the time and place, how much they learn, and if they need repetition. In-class time can then be

adapted to their needs and used for active, further and deeper learning.

As shown above, basic research is still needed. Although great preparation effort is necessary to implement an ICM concept into a traditional classroom, the chances and opportunities seem to outweigh the difficulties. Suggested or questioned benefits can only be proved by research on practice (Jensen, Kummer, & Godoy, 2015).

Research method

In order to answer the research question conveyed in the introduction a multicase study approach was undertaken that involved two German institutions of higher education that use the "flipped" or "inverted" classroom model. Both teaching projects have emerged from practical needs and follow the same basic conception: compulsory e-learning time in self-study is added to regular in-class time, which is mainly used for application and active cooperation whereas ICT is used especially for self-study preparation.

The first project, FLIPPED PART-TIME, implements the ICM for the flexibility of a module for part-time students at Dresden University of Applied Sciences. The second project, at Leipzig University ICM is applied to academic teaching within a semester-long course in teacher's education for second year full-time students. The studies on the two projects focus on different aspects of implementation, student's usage and its basic conditions within the framework of ICM. Based on the same theoretical concept, the studies are comparable with each other, also in a bigger frame (Abeysekera & Dawson, 2015; Karabulut-Ilgu et al., 2017). Nonetheless, they focused on different aspects of the main research question and their results will be complementary.

Generalizability is limited within the two studies due to the case study approach (Flyvbjerg, 2006). Since the two cases are representing examples of the basic ICM, research on them can provide a better understanding and knowledge of the current practice and also provide evidence-based hypothesis (Flyvbjerg, 2006).

Both studies focused on different aspects of the main research interest; hence, as a result they had different research objectives and used different research methods. For better comprehensibility, the two studies will be presented separately in the next two sections. Then, the common discussion of their results will be given.

Case study 1: Part-time students

Case study 1: Background

The project FLIPPED PART-TIME was part of an application-oriented consortium, which focused on creating a scalable framework for the ICM and guidelines for broadening ICT literacy for staff in higher education institutions. It focused particularly on applying ICM to a module especially designed for part-time students of the Dresden University of Applied Sciences. It should be noted that students have a variety of reasons for studying part-time, including employment, family, finances, engagements, and illness (Maschwitz & Brinkmann, 2015). If higher education institutions offer time-flexible learning opportunities by using ICT for blended learning, studying part-time can be successful (Bargel, 2014; Lübben et al., 2015). The module addressed first-year master students between 20 and 30 years of age. The topic of the first-semester course was Business-to-Business Marketing. It should be noted that Schiller, Goodrich, and Gupta (2013) already gained great experiences with a virtual marketing class. All participants had basic skills of using ICT and fundamental knowledge about business management. They were familiar with diverse teaching and learning methods, known by the target group analysis. This course was chosen for the trial run of research, because it had not been offered before. The basic conception was based on literature review. It addressed all levels of Bloom's revised taxonomy (see Figure 1). Basic knowledge was mostly acquired in e-learning sessions (level one and two) with methods of self-adjusted learning videos and texts. In face-to-face sessions knowledge was applied (level three to five) by using discussions, presentations, and working in groups (Huitt, 2011). Furthermore, learners monitored and evaluated their work (level six). The concept was based on the basic model of blended learning (Mikuszeit, 2014) and implemented ICM to outsource input from in-class to self-study time. Valuable face-to-face time was used for interaction and discussion (Giannakos et al., 2016). The decision to invert the module was based on the main intentions: flexibilizing learning in pace and place, activating participation, and implementing reflection. With discussions and group work, having more face-to-face time with the lecturers was possible. Besides, study resources were permanently available which reduced stress at the end of the semester. The basic ideas of this concept were to add e-learning sessions to face-to-face sessions, to give assignments for every face-to-face session, to offer coaching

sessions, and to assign a seminar paper at the end of the semester but before the exams. The module assessment was separated into 75% for presentation and developing knowledge (expert presentation, pro/con-discussion, presentation of a company, preparation of questions for an interview with a manager) and 25% for a seminar paper preparation (case study, presentation, and discussion). The detailed information about the course organization can be found in (Jantos, Heinz, Schoop, & Sonntag, 2016).

Case study 1: Objectives and research method

The following objectives guided the research into students' views on ICM:

- (a) What do students think about ICM?
- (b) What are the obstacles in ICM introduction?
- (c) Do recording and providing face-to-face sessions in an ICM help students?

They were answered within the study that involves:

- group discussion with eleven professors about the flipped classroom implementation in teaching economic science, where Business-to-Business-Marketing belongs to,
- survey on students' usage of ICT at the beginning of the course (14 of 25 students completely answered the survey),
- course evaluation survey at the end (15 of 25 students completely answered the survey),
- analysis of provided videos on YouTube (27 videos), which were recorded in the face-to-face sessions and completely watched.

Case study 1: Results

The following examples of the results describe how students use ICM. Almost all students watched videos (e.g., YouTube) ($n = 13$ of 15) and read articles in wikis (e.g., Wikipedia) ($n = 14$). No one uploaded videos to the World Wide Web ($n = 14$ of 15), almost no one wrote articles for wikis ($n = 13$ of 15), almost no one wrote messages for micro blogs (e.g., twitter) ($n = 13$ of 15), and almost no one writes articles in blogs ($n = 12$ of 15). Of the students who watch videos and read wikis online, 12 do it for learning purposes. Everyone uses social networks daily ($n = 10$ of 15) or a few times per week ($n = 4$ of 15). Based on these findings it can be concluded that the participants are consumers instead

of prosumers. This finding was taken into account in creating an adequate learning environment that incorporated only a small variety of ICT tools, e.g., blog.

The analysis of the usage of the recorded face-to-face sessions was done by click-counting of completely watched videos, provided on YouTube with the following results: most of the videos had single-digit clicks, but the video that received the highest number of clicks was about the explanation of ICM (number of hits: 44). Other videos that often had been watched presented the manager interviews conducted by students (number of hits: 37) and the video about introducing ICM and proving the reasonability of inverting the module (number of hits: 36). It has to be mentioned that usually all students participated in face-to-face sessions.

It became apparent that every student watched the explanation of the concept almost twice, on average. Understanding the concept seems to be fundamental for the successful ICM implementation. Figure 2 shows the item battery and students' ratings. Students were supposed to rate statements about the ICM from 1 (not agree) to 4 (agree):

Figure 3 shows students' rating of the three items. The following statements had to be rated:

- (1) Dependence: "The dependence on other students I recognized as ..."
- (2) Amount of work: "The total workload was ... compared to a "traditional" lecture."
- (3) Hours of work in groups: "The amount of hours working in groups was ..."

Items had to be rated on a scale from 1 (not enough) to 5 (too much). Figure 3 shows that one obstacle of the ICM implementation seems to be

"dependence on other students," especially regarding group assignments.

The main place where students studied module materials was at home (87%) and it was complemented by studying while commuting (13%). Ten students used a notebook or a personal computer, seven students used printed copies of the texts. No one started preparation earlier than 10 days before the face-to-face session. The majority of students accessed the module materials three or less days before the face-to-face class (50%). They usually spent more than three hours (12 students) to prepare to the face-to-face session. Students reflected on their changed responsibility for their learning mainly as a positive experience and wished for a simpler structure of the e-learning platform.

Case study 2: Inverted academic seminar

Case study 2: Background

The second study involved the project *ICM-Seminar in teacher's education* at the University of Leipzig, Germany. With the purpose to teach student-centered, competence-oriented, and digital-supported, the project started in 2015. It was planned to design a pilot to invert a complete academic course over one semester for full-time students of teacher's education (in special education) at the Faculty of Education. The main intentions were to motivate the students, to support their self-study and to make the time in class more beneficial, especially for the theory-practice-reference, which is fundamental in academic teacher's education.

After a preparation period that took three semesters, the pilot seminar was implemented in the summer semester of 2017. As a typical academic seminar, it was a weekly course of 90 minutes throughout one semester.



Figure 2. Evaluation of the ICM (Note: A scale from 1/not agree to 4/agree was used.).



Figure 3. Evaluation of students' work impression (Note: A scale from 1/too less to 5/too much was used.).

It was part of an obligatory module in teacher's education (also including a lecture and another seminar) for second-year full-time students. It should be noted that the majority of the students attended university right after school. The main topic of the seminar was *individual support and differentiated teaching in inclusive classes*. The seminar aimed at deepen selected topics of the lecture, to link the knowledge and skills, and to prepare for the practical school training during the semester.

For evidence-based teaching and also to adapt academic teaching to students' needs and wishes, pretests of individual inverted classes were designed, tested, evaluated, and further developed. In the course of three semesters, selected seminars were chosen to test the enhancements.

A seminar concept was designed according to the Constructive Alignment (Biggs & Tang, 2009) based on competence objectives, which can only be reached by participating in both self-study preparation and in-class activity. The preparation was task-oriented (Weidlich & Spannagel, 2014). Weekly tasks were offered within digital assignment packages for each topic and required to be done self-responsibly. They were accessible within the learning management system Moodle (a web-based course management system and a learning platform). The assignments included particular tasks and a selection of resources including videos, texts, and web content. By linking the self-study preparation to in-class activities, the acquired knowledge was the foundation for active collaboration in class (Van Treeck et al., 2013). Then the focus was on achieving higher competencies such as applying, analyzing, evaluating, and creating (Krathwohl, 2002). In class, the group's potential was to be put into use. Activating and collaborative methods, application, and practice references characterized in-class time. For both, preclass and in-class time, self-adjusted, cooperative, and reflexive learning were stimulated (Schaper, 2012). Furthermore, ICT and related teaching methods were used.

The seminar was completely inverted. It was based on the results of the pretests in the course of three semesters. The methods and results of the pretests leading to the final pilot are presented within this article. For more didactical information, see the previous paper, where the concept is described in detail (Engel, 2017).

Case study 2: Objectives and research method

The following research objectives guided this case study:

- (a) How do students respond to studying within an inverted seminar?
- (b) How to adjust an inverted seminar concept to students' needs and wishes?

The project has been planned since August 2015. In the course of three semesters, individual ICM-classes have been tested, evaluated and developed to prepare the initial seminar concept, which was evaluated in a qualitative study. The overall outcomes of the evaluation included results of three research stages and aimed to answer the research questions. The first part of the research conducted in the winter semester of 2015/16 involved a formative evaluation, where 67 students were asked to write open answers to selected items (after one half of the seminar students were asked four questions about their wishes for the following half and were supposed to write their answers on memo cards: 1) What do you wish for more often?; What do you want to be avoided?; What else do you wish for?; What else do you want to tell the lecturer?). In the second and third part of the research, a questionnaire with close-ended questions to each inverted class was used (see an overview in Appendix). In the summer semester of 2016, there were 112 participants and 79 participants in the winter semester of 2016/17. The data were used to describe the students' usage and evaluation of an inverted seminar. In addition, we wrote a research journal to keep record of further observations and findings (including important experiences of the lecturer, oral informal feedback from students and perceived particularities, and challenges).

Case study 2: Results

Between 40 and 70% of the students prepared for in-class-time by using the digital assignment packages. Fifty percent of the respondents appreciate the inverted arrangement, but also mention a high workload. An interesting result was a student's choice of materials, compared for the two semesters, preferring texts and websites to videos in one group, as Figure 4 shows.

The e-portfolios were part of a specific seminar in the winter semester, and that is why they were not offered in the summer. Additional material concerning the topic in a wider range was made available within the assignment packages. The chart shows very clearly that the additional material was not used as often as others. It seemed to be unnecessary. These findings were taken into account in the next semester and additional materials were not offered.

Through the analysis of the data sources, the following results can be derived:

- the workload for one assignment should be at a maximum of 90 minutes, according to students' rating,

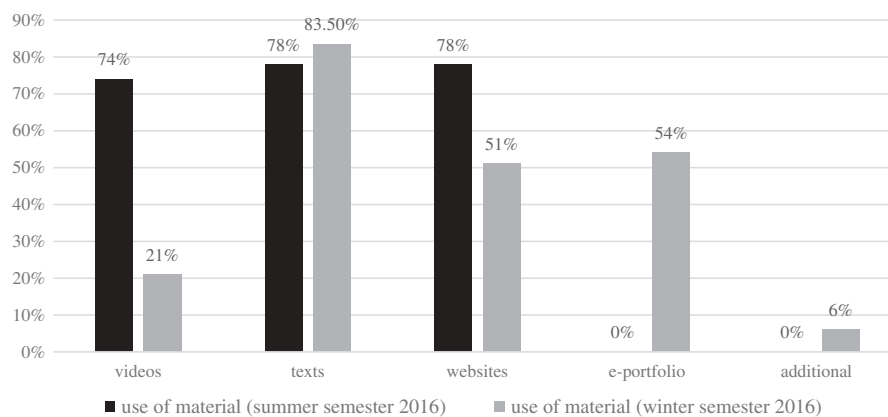


Figure 4. Comparison of the material usage (during two semesters).

- students demand precise tasks and an overview of the digital material. The format of the assignment packages should be uniform,
- material is preferred in German, according to students' feedback (sometimes English texts, videos, or websites were offered, when more suitable),
- transparency of the objectives and the coming activities in class help students to prepare for the in-class sessions,
- students need one week in advance to prepare for face-to-face class and they want to be reminded of it,
- students demand explicit reference to their work results in class.

In [Table 1](#), the findings and observations, which are associated with the usage of ICT, are explained (left column). Next to it (right column) you will find conclusions and derived consequences concerning the design of the inverted seminar. Therewith it is demonstrated how elements of ICT were first implemented and which consequences were derived out of students' responses. Besides, students' feedback and wishes were taken into account. Final changes to the pilot concept are marked in bold.

The final established pilot was implemented in the summer semester of 2017. As a didactic framework, it aimed at benefit more from in-class time. A total of 109 students were enrolled and separated into four seminar groups. 9 out of 12 individual seminar units throughout the semester were inverted. Evaluation research on the pilot focused on usage and valuation of specific elements of the inverted seminar concept to find usage patterns. It also concerns practical implementation and development. The results of the research will be available by the end of 2017. Some of the data will also be used for an ensuing empirical exploration research latterly. With the collection and analysis of qualitative data, it aims at student's learning experiences within the inverted seminar to find influences of ICM on students' learning.

Discussion and implications

Both studies included in the case study approach applied ICM in higher education and used the same basic ICM concept. Also, the participants were around the same age. ICM was applied to more than one teaching unit and the conditions were similar. The studies differed in participant types (part-time and full-time students) and in investigated modules.

ICM has successfully been implemented in different scientific fields, classroom settings and with different students, as confirmed in the two cases. That is also the reason why differences of the two projects can be acknowledged as variations of the basic conception. Both projects show how traditional academic teaching can be transformed by the use of ICT and how it could meet the demands of modern academic teaching.

The following implications for ICM usage in practice are derived from the study:

- timing: keep it simple with regular face-to-face sessions, too long breaks between face-to-face sessions may interrupt students' working routine (as they just got used to it),
- teaching strategy: schedules should be comprehensible and also flexible to respond to prevailing participants' needs (also to offer consulting),
- e-learning: we recommend one platform, it should be well-structured and comprehensible for all participants,
- material: find present resources and use existing material referring to the specific topic, let the learners rate it and also preselect material to offer an appropriate amount,
- tasks: state clear tasks and show targets, give deadlines, give guidelines, ensure results and give feedback, include reflection, and focus by guiding questions,

Table 1. Results of the pretests: Findings and consequences.

Findings and observations	Conclusions and consequences
<p>First evaluation/winter semester of 2015/16</p> <p>The digital assignment packages were provided in the Mahara E-portfolio software (a Personal Learning Environment, which complements the use of the learning platform Moodle). It was considered a suitable format to display the assignments, because the pages are structured like a simple website, easy to use. The students confirmed that this is a good alternative to just a digital worksheet.</p> <p>The time needed for preparation – in the course of complete processing – was considered to be very high. Students needed up to 4–6 hours.</p> <p>Many students reported the folder structure in Moodle as confusing. (A Moodle-course for the entire module with one lecture and two seminars was used.)</p> <p>The students wanted the assignment packages to be available immediately after class.</p> <p>Some students criticized that the tasks were not always precise. They said, they did not exactly know what to do. The option to ask by e-mail was not used. Thus, they came to class without preparation. One reason often given for not doing the assignments was that students just forgot. That is why some of them asked to be reminded.</p> <p>The use of digital applications presented itself as a challenge. This was demonstrated by an initially hesitant use, i.e., of etherpad (a collaborative real-time editor included in Moodle) or padlet (an open access website which offers virtual panels) in self-study. Both were applied to save or create collaborative work results. It became clear that the students did not use them and even rejected them due to lack of knowledge.</p> <p>Second Evaluation/summer semester of 2016:</p> <p>The evaluation showed that the majority of the students (almost 77%) needed a time of 60 to 90 minutes to complete the assignments, which they found appropriate.</p> <p>In this semester, many students mentioned that they found it difficult to find direction on the Mahara website.</p> <p>Some students, who were not able to be in class regularly, pointed out that the assignment packages together with the handout would give them a helpful orientation to catch up and for their self-study. Because one Moodle course is used for all 4 seminar groups, all students would get the handouts after the last group has dealt with the topic. However, many would like to use the handout right after or already in class.</p> <p>There have been some requests, if all tasks and all materials had to be processed and also if they still had to do them in case they are familiar with the topic. This made clear that the explanation at the end of a class was not enough.</p> <p>On average, only 48% of the participating students completed the assignments (completely or partly). A main named reason was a high personal workload.</p> <p>Third evaluation/winter semester of 2016/17:</p> <p>The four groups of students in this semester were only informed about the way working within the seminar. The seminar concept was neither named nor discussed. The participation rate was in part below 10%. On average only around 30% of the students prepared for class.</p> <p>The majority recognized the higher workload. Half the students rated it good. But the other 50% were not able to decide how to value the way they worked.</p>	<p>As a consequence, the format was chosen to display the assignment packages for the following two semesters.</p> <p>The solution was to set the time to a maximum of 90 minutes considering the workload for the seminar. 90 minutes correspond to half the workload for self-study. As a result, the preparation time accounts for about one third of the total workload of the seminar.</p> <p>The amount of tasks and material has been adapted and limited to three tasks and material according to three types of sources (e-texts, videos, web content) alongside three options for each.</p> <ul style="list-style-type: none"> • In the following semester, a separate Moodle course for the seminar was set up. <p>It was then decided and communicated that the tasks will be available on Moodle at least one week before to guarantee enough time for preparation.</p> <p>Consequently, more attention had to be paid to the expression of the tasks. At the end of the in-class time, the tasks would now be introduced and explained.</p> <p>Because students seemed not used to do assignments regularly, it was assumed that they need a time of habituation. A temporary solution was a reminder by e-mail about half a week before.</p> <p>This was surprising, because only simple web-based applications were used. As a consequence, digital applications are introduced and tried out in-class and only then used for preclass assignments.</p> <p>Accordingly the amount and workload for the assignments, for a time of 90 minutes, was kept.</p> <p>As the structuring options with Mahara are limited, a uniformly structured presentation format was developed and introduced to get an overview and find the content more easily.</p> <p>The PowerPoint slides used in class are shortened to a handout for the students and appended with in-class results. It is available on Moodle after class. The procedure will be kept up.</p> <p>Because the time delay could influence or even prevent self-determined learning, separate Moodle course for each group would solve the problem. The Moodle course can thus be used to meet group-related needs and also enables in-group communication.</p> <ul style="list-style-type: none"> • An additional reference points out to check prior knowledge. Based on that, students should decide if and how many tasks and materials they will use. • Knowing that they take more than one course with high self-study workload and personal workload is added, an excessive demand should be prevented. A reduction of the time (to around 60 min) was realized. <p>It is assumed that a clear communication about the way of working has an impact on participation and preparation of the students.</p> <p>For the ICM concept, this has to be considered. As a basic principle the way of working, reasons and objectives have to be explicated and continually implemented.</p> <p>Therefore, in the pilot first in-class time will be used to introduce the working method of ICM. An exemplary in-class ICM-procedure will be practiced to outline the significance. Also, it has to be continually marked within the assignment packages, what the objectives are. They are displayed separately for the self-study and in-class part.</p>

(Continued)

Table 1. (Continued).

Findings and observations	Conclusions and consequences
<p>The students of this semester showed a clear dissatisfaction and even rejected to use the Mahara software. Given reasons were personal dislikes, that it was not user-friendly structured and technical difficulties, i.e., with the access or the availability of the linked content. These challenges led students to attend unprepared.</p>	<p>Due to the fact that the Mahara access was not always running smoothly and sometimes links to the content were not working, it was understandably. The rejection of Mahara was discussed in class. Students asked for a simpler format. After a test with two formats for an assignment in Moodle and in Mahara, the results of usage (one third used Moodle and two third used Mahara) led to the decision to find another format. Assignments in the format of Moodle book (a display format of Moodle with pages) are the final solution.</p>
<p>Every now and then student asked if worksheets and copies used in class would be available digitally for direct reuse, because it would be convenient as using own devices anyways.</p>	<p>Considerate of saving resources and of regarding the diverse needs, in-class work materials will be available digitally on Moodle.</p>

- assessment: precise criteria should be given right at the beginning of the course,
- kick-off: in the first face-to-face session, the ICM concept, its way of working and tools should be introduced and explained,
- motivation: in face-to-face sessions the explicit linking to the preparation and the students' results should be apparent; time for questions at the beginning of the face-to-face session is the most important.

The derived implications for implementation in practice are the key results. The detailed results contribute to the maturity of the ICM framework and provide data to basic research about ICM. Therewith, this case study can provide data for further research, either to prove hypotheses in other comparable studies or to bring up new hypotheses as the base for following research.

Still, more research is necessary in more different fields and with students in different environments to understand the ICM framework and to find further chances and obstacles of ICM.

Although our implications for practice are verified by literature and project experiences, they cannot be generalized. Since the research was limited to the two cases, the results can only be seen as the background for further research. Nonetheless, it gives an insight into the usage of ICM in two different German institutions of higher education.

Concerning the basic conception of ICM it will be necessary to conduct further research on its benefits. The authors on the basis of their experience are convinced that there is a series of contextual factors that influence the success of ICM, however they have not been investigated in this study. The investigation of these factors might constitute a promising path for future research.

Conclusion

The multicase study was conducted to find out how ICT can be used to create diverse learning opportunities and to facilitate learning needs within an inverted classroom. Both case studies focus on aspects of implementation, such as student's usage and its conditions within the framework of ICM. Therefore, students' data about usage, especially of ICT, in general as well as within the actual teaching were collected. Questionnaires and hard data from IT tools were used to answer the research question and to derive implications for practice. The key results are implications how preclass preparation and in-class activity could be arranged according to students' needs. Therewith the study contributes to basic research on ICM and provides data for further research. Thus,

results and findings may constitute contributions both to the theoretical framework and to the practical development of the concept.

Education plays an important role for the development of a country and its economy. Therefore, highly qualified graduates are needed. Students' qualification depends on the quality of higher education. With competence-oriented teaching in higher education, the development and advancement of competences will be required. To implement it, appropriate methods are needed. ICM seems to be a suitable teaching framework to meet students' needs and requirements for higher education.

This case study might encourage considering advantages and chances. Even by using a "light" version of the ICM, the idea can be transferred. If you want to apply ICM to your own teaching in higher education, we recommend trying it. It is not required to change everything at once, especially when resources are limited. Take the chance and try a short, "light" version of ICM by inverting just one topic of a lecture or one unit of a course. By sending an e-mail with material and tasks for preparing the following face-to-face session, it can be quick and easy. Get the feedback of your students about their experiences. This could be a first and easy step to participate in digitized learning and teaching. It is a chance to design flexible education and learning opportunities to face the diverse needs of learners in knowledge societies, and it is an even greater chance for emerging countries to face the requirement of advanced education in a world of fast growing knowledge.

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Appendix

Case study 2: Questionnaire overview

This questionnaire served to collect data about students' preparation for each individual class. We wanted to know if students prepared for in-class time and how they used the digital assignment packages in order to adapt them accordingly.

The questionnaire was given to all students who were present in class. Mostly closed-ended questions were given.

- (a) It was asked if students prepared for class (answer options: “completely,” “partly,” or “not”)
 - if they did not prepare or only partly, they were asked to give reasons (open question),
 - if they did not prepare, they were also asked if they were able to cope with activities in the seminar without preparation (answer options: “very good,” “quite good,” “partly,” “to a less extent,” or “not at all”).
- (b) Regarding preclass preparation, students who prepared for class were asked:
 - how many of the given tasks they took,
 - how much time they needed and how they would rate that workload (answer options: “modest,” “reasonable,” or “too high”),
 - which of the offered material/resources they used for their preparation (answer options: videos, texts, web content, e-portfolios*, or additional material),
 - if students think the assignment was helpful to prepare for in-class time (answer options: “yes,” “partially,” or “no”).
- (c) Regarding in-class activities students were also asked:
 - how they think their preparation results would connect to respective activities in class (answer options: “completely,” “to a great extent,” “partially,” “to a smaller extent,” or “not at all”) and for the reasons (open question),
 - to assess if previously gained knowledge would have been repeated, deepened, solidified and applied in class (each item had to be valued with “very good,” “quite good,” “partly,” “to a less extent,” or “not at all”) and to give reasons for their valuation (open question).
- (d) There was also an open question included to give students the chance to communicate wishes or comments.

*e-portfolios were only included in the questionnaire used in winter semester 2015/16.

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