




# Agile in Higher Education: How Can Value-based Learning Be Implemented in Higher Education?

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Keywords: Agile, Value-based Learning, Student-Centered Learning, Teaching.


Abstract: The corona pandemic has shown how important it is to be able to react quickly to changing conditions. In many organizations, agile process models and agile practices are used for this purpose. This paper examines how agility can be implemented in higher education. Using two case studies, we analyze how agile practices and agile values are implemented for knowledge and skills development. Our results present a student-centered approach where lecturers supported self-organized learning. In the student-centered approach, prior knowledge and experience of learners are taken into account, and the learning process is adjusted through continuous feedback. With the introduction of agility, a value shift towards value-based learning is taking place. Value-based learning supports competency-based teaching since the focus is less on imparting technical knowledge and more on imparting competencies.


## 1 INTRODUCTION


The corona pandemic has brought nearly the entire world into the home office and also turned teaching in schools and universities upside-down. While some of the lessons in schools are still held face-to-face with changing groups, colleges and universities have largely switched to digital teaching and exam formats. This changeover has taken place in a short period of time and poses challenges for both teachers and students. The survey of students and teachers on the first corona semesters by the *CHE Center for Higher Education Development* showed that students praised the variety of different digital formats, but at the same time wished for better didactic implementation and a motivating approach by teachers (Berghoff et al., 2021). The results of the study also show that both students and lecturers would like to see blended learning and digitally enriched face-to-face teaching in the future. In addition to quantitative studies on teaching during the corona pandemic, qualitative studies such as the *HFD working paper* (Bosse, 2021) broaden the perspective

on this topic. Bosse (Bosse, 2021) used interviews to assess different departments, including social sciences and economics, about their experiences with the transition to online teaching during the pandemic and their expectations for the future. The results show a desire for curriculum development with the teaching of competencies relevant to the digitized world as well as consistent use of digital tools and the development of new room concepts.

The shift to digital teaching has driven digital transformation in higher education institutions as new teaching and learning formats are tested and collaborative technologies such as MS Teams, Zoom, Miro, or Mentimeter are more widely used. Experiences from past digital semesters provide a good opportunity for lecturers to redesign their teaching strategies in the digital age. As digitization continues, traditional value systems are also being challenged and are constantly changing. In the economy, this is reflected in the increasing spread of agile process models in all industries (Digital.ai, 2021). Organizations use agile process models to solve complex problems and to be able to react

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quickly to changes in the environment. Agile process models originated in software development and are increasingly being used in areas outside of IT. For this purpose, agile process models such as Scrum (Schwaber et al., 2020) or Kanban (Anderson, 2010) are adapted to other areas (Pfeiffer et al., 2016), (Schön, 2018). A well-known example is represented by eduScrum® (Stolze et al., 2020). With eduScrum®, the Scrum framework was adapted for the education sector and a co-creative process was developed in which students feel responsible for their own work and learning process.

This paper examines the research question: *How can agility be implemented in higher education?* The context of higher education has also been changing at an accelerating pace in recent years, requiring lecturers to explore new ways to support students in acquiring knowledge and skills. To answer the research question, we examine concepts for integrating agile practices and agile values in higher education using two case studies at German universities of applied sciences in Berlin and Hamburg.

This paper is structured as follows: section 2 provides a brief overview of theoretical concepts of agile models and didactics. Section 3 describes the research method for the two case studies conducted. Section 4 presents our results and shows how agile practices and agile values were implemented in higher education in the two case studies. Then, section 5 discusses similarities and differences. Section 6 concludes this work with a summary and future work.

## 2 BACKGROUND

In the following, we provide a brief overview of theoretical concepts of agile process models and agile practices as well as didactic concepts.

### 2.1 Agile Process Models and Agile Practices

*“Agile is the ability to create and respond to change. It is a way of dealing with, and ultimately succeeding in, an uncertain and turbulent environment.”* (Agile Alliance, 2020)

Agile process models have become a highly discussed and popular topic in recent years. Many organizations today are already using agile process models and agile practices. Agile practices are concrete procedures for implementing agile values and principles. Agile values refer to a value set that is

used as a basis for the application of agile process models. Originally, the agile values were captured in the *Agile Manifesto* with four values (cf. *individuals and interactions, working software, customer collaboration, responding to change*) (Beck et al., 2001). Agile process models such as Scrum (Schwaber et al., 2020) or Kanban (Anderson, 2010) have their origins in software development. In IT, these models have been used for decades to solve complex problems. The use of agile process models is intended to increase transparency and accelerate change, as well as minimize risks and errors in the development process. To this end, it is attempted to reduce the design phase to a minimum and to achieve executable software as early as possible in the development process. In comparison to plan-oriented approaches, such as the waterfall model, the iterative development and testing of incremental solutions and the collection of feedback are in the foreground in agile process models. This approach requires a change of mindset, because solutions are not planned in detail in advance, but are developed and optimized on an ongoing basis and the basis of feedback from relevant stakeholders.

Agile process models are also being used more and more frequently in other areas outside IT, as presented in the annual *State of Agile* study (Digital.ai, 2021). The study shows that organizational culture in particular has an influence on the successful use of agility. Furthermore, it becomes clear that resistance to change and a lack of understanding of the agile mindset are often problematic for the introduction of agility within an organization. The agile mindset encompasses fundamental assumptions such as believing in the competence and responsibility of individuals, encouraging collaboration, continuous learning and improvement, encouraging creativity, promoting innovation, and taking moderate risks (cf. Tolfo et al., 2011). The agile mindset and the adaptation of agile values, principles and practices are also interesting for higher education didactics, as autonomous, project-based and iterative learning in short cycles with continuous feedback can support the development of competencies in higher education.

### 2.2 Didactic Concepts

Didactic concepts for agility in higher education are still a relatively young field of practice and research. On the one hand, there are concepts for agile didactics in the sense of agile interactions of teachers and learners in the classroom, and on the other hand, didactic concepts for integrating agile practices from

the field of software development into other subject areas of higher education. As an example of concepts for agility in higher education, the book *Agile University Didactics* is often cited (Arn, 2020), in which agile didactics, in contrast to planned didactics, is defined as a mixture of planned and unplanned teaching, a didactics that emerges from communication and interaction, especially when learners and teachers not only meet at eye level but encounter each other openly (Arn, 2020). In this approach, lecturers play the dual role of teachers and coaches at the same time. They teach according to the principle of structured improvisation and react to the feedback of the learners in analogy to the interaction with customers in agile software development (Arn, 2020).

Agile principles are used in different contexts and disciplines, e.g. in economics with the aim to improve lifelong learning and employability of students (Cubric, 2013), in doctoral studies to support collaborative learning between doctoral students (Stewart et al., 2009, Schön, 2018), and at the university with the aim to improve studying and teaching (Mayrberger et al., 2017). Other didactic concepts in higher education rely on methods of agile software development and propose concepts and principles for the redevelopment of universities. For example, Baecker, (2017) emphasizes the conversion from primarily vertical to primarily horizontal organizational structures and acting in networks at universities in the sense of scientific communities as well as a stronger interlocking with professional practice. This approach can be transferred both to the management structures at universities and to the design of teaching, in which not only one teacher is involved, but different teachers interact, as the case study at *Berlin University of Applied Sciences* shows.

Based on agile approaches and process models such as Scrum, didactic methods such as eduScrum® are also being developed and used. Here, eduScrum® is described as a framework for coaching learners in which the responsibility for the learning process is transferred to the learners (Stolze et al., 2020). eduScrum® is based, similar to Scrum, on the collaboration of teams with the associated descriptions of roles, ceremonies, artifacts, and rules. Another example is the *Agile Manifesto for Teaching and Learning* by Krehbiel et al., (2017), which defines the agile principles, concepts and practices for higher education in analogy to the *Agile Manifesto* from software development. The objective is to increase student engagement, encourage students to take responsibility for learning, improve the level and quality of collaboration, and produce high-quality

results in teaching. With a similar objective, the concept of agile learning with *Just in Time Teaching* (JiTT) is also proposed, which builds on the principles of constructivism and self-determination theory and emphasizes adaptive teaching with coupled teaching-learning cycles and continuous feedback loops (Meissner et al., 2014).

### 3 RESEARCH METHOD

This paper investigates the research question: *How can agility be implemented in higher education?* To this end, we conducted two case studies at two universities of applied sciences in Germany during the corona pandemic. Therefore, we examine concepts for integrating agile process models and agile practices in digital studies using two case studies from universities in Berlin and Hamburg. Complex phenomena with their respective contexts are investigated in case studies (Baxter et al., 2008, Yin, 2003). A case study allows us to collect data in practice to better understand the context of higher education.

#### 3.1 Context of Case Study 1 - Berlin University of Applied Sciences

*Berlin University of Applied Sciences* is a public, technical University of Applied Sciences with around 13,000 students and over 70 accredited bachelor's and master's degree programs in the fields of applied engineering, natural sciences and economics. Key qualifications such as the ability to work in a team and social skills play a central role in the studies. The use of digital technologies in teaching is part of the university's digitization strategy.

The case study examined involves the mandatory module *Agile Project Management* (6 CP with 4 SWS) in the degree program Business Administration Digital Economy (B. Sc.), in the departments of Economics and Social Sciences. The students are rather interested in technology, but generally have little to no prior knowledge of agile principles and methods.

#### 3.2 Context of Case Study 2 - HAW Hamburg

*HAW Hamburg* is a public University of Applied Sciences in northern Germany with over 70 accredited bachelor's and master's degree programs. In the winter semester of 2020/2021, there were a

total of 17,125 enrolled students. HAW Hamburg pursues the goal of developing sustainable solutions for the social challenges of the present and the future. The case study is the optional course *Agile Project Management* (6 CP with 4 SWS), which is offered at the Faculty of Technology and Information Technology primarily for Bachelor students in the 5th or 6th semester of the degree program Business Informatics (B.Sc.). Students of other study programs can also participate in the module, as far as the capacities allow. Thus, the target group of the module is rather technically affine and already has some prior knowledge regarding agile process models.

### 3.3 Data Collection and Analysis

These two case studies were conducted during the summer semester 21. Due to the corona pandemic, digital teaching was conducted this semester and the teaching and learning concepts were tailored accordingly to the digital format. For the data collection, an analysis of the course material of the case studies was carried out. The course material was analyzed with regard to didactic goals, teaching concepts and methods as well as learning controls. In addition, the extent to which agile practices and agile values were applied in the course was examined. The results of this analysis are presented in the form of a narrative comparison in the following chapter. For better comparability of the two case studies, a table is created that presents an overview of implemented agile practices and agile values.

## 4 RESULTS

In the following, the two case studies are described and an analysis is made with regard to agile practices and agile values.

### 4.1 Case Study 1 - Berlin University of Applied Sciences

The *Agile Project Management module* at *Berlin University of Applied Sciences* is a mandatory module in the 3rd semester of the Business Administration Digital Economy degree program and is offered entirely in English in order to strengthen the internationality in the degree program and prepare students for working in international projects. In the following, a description of the didactic goals, the teaching concept and methods, as well as the learning assessments and digital awards are given. In addition,

it will be explained how agile practices and agile values have been implemented.

#### 4.1.1 Didactic Goals

The learning objectives of the module were developed as learning outcomes in the sense of competence orientation in orientation to the revised learning objectives taxonomy of (Anderson et al., 2001) and formulated in the module handbook as follows: (1) students know theoretical and methodological basics of agile project management, they can classify agile project management as a methodological approach and compare it with other approaches; (2) students have a general overview of the central frameworks, methods, instruments and application areas of agile project management in business management practice; (3) students can apply methods, instruments and decision-making tools of agile project management in practice, taking into account agile values and principles; (4) students are able to plan and implement projects according to the agile approach, evaluate and present the results.

#### 4.1.2 Teaching Concepts and Didactic Methods

The module *Agile Project Management* is based on teamwork in small groups and its content is interlinked with the module project seminar marketing. Students work on projects from the project seminar marketing and apply methods of agile project management in the course.

The module consists of a *seminar class (SC)* and a *tutorial (T)* with integrated project work. The module is instructed by two lecturers, a professor from the *Berlin University of Applied Sciences (SC)* and a lecturer from the business world (T). The grade for the module is composed of three sub-grades. The A-grade is assigned to the SC and accounts for 40% of the final grade. The A-grade is determined based on the results of the eight online quizzes in terms of continuous learning assessments. The B-grade is assigned to the tutorial and also accounts for 40% of the final grade. The B-grade is determined based on team coaching sessions (8 sessions per team). In addition, students can earn 5 bonus points in team coaching. The C-grade is considered a common sub-grade in the SC and the T and accounts for 20% of the overall grade. The C-grade is based on the evaluation of the final video reflection (one video per team).

*Seminar class (SC)*: In the SC, the content on agile project management is taught and basic agile principles are learned, including project management in transition; characteristics and types of projects in

the digital economy; project leadership in the digital age; agile values, mindset and principles; agile frameworks such as Scrum, Kanban and DSDM. The instructional design from SC is based on the ARCS model, a motivational instructional design approach from (Keller et al., 1987) with four basic principles: attention, relevance, confidence, and satisfaction. Various didactic methods are used in teaching, including flipped classroom (i.e., preparation for SC with learning videos, application in SC, follow-up with learning scripts, weekly quizzes), game-based learning (e.g., games for applying agile frameworks), and collaborative learning in project teams. Various digital learning materials are used to best support students with different learning styles and preferences, including interactive presentation slides in Google Drive, scripts in PDF format in the Moodle LMS, and learning videos on LinkedIn Learning.

*Tutorial (T):* In addition to the SC, there is a weekly T for the students. The aim of the 90-minute T is to deepen the knowledge gained in the SC and supplement it with practical experience. Agile working is to be made experienceable. This is done by presenting and applying methods from the work with agile project teams in software companies, as well as creating a framework for agile collaboration of the students on the projects in the marketing seminar. The T is divided into five parts: warm-up, knowledge reinforcement, team time, Lean Coffee, and query of Return Of Time Invested (ROTI). The warm-up takes place at the beginning of each T and serves to activate the students. It includes an activity to promote group interaction at the beginning of each T (Przybyłek et al., 2017). This common warm-up creates a positive working atmosphere in the group. It also increases the receptivity of the participants (Mesquida et al., 2017). Typically, the warm-up lasts five to 15 minutes and includes a previously unfamiliar activity. This activity aims at a cognitive stimulation of the students. The knowledge deepening sub-section is about deepening the content learned in the SC, which is complemented by practical case studies. During team time, students work in their teams on their specific projects for the marketing project seminar. This gives students the opportunity to apply what they have learned directly to their project work. Lean Coffee is an agile practice that facilitates discussions with minimal planning. It uses innovative voting techniques such as dot voting to support collaboration and the decision-making process (Dalton, 2019). In Lean Coffee, students have the opportunity to raise issues relevant to them and discuss them with the lecturer and other students in the course. At the end of each T, a survey of ROTI

was conducted. This asked students to indicate their personal return on time invested in the T on a scale of one to five. A rating of five indicates a very high return on time invested. Students were also asked to indicate what they lacked for a better rating if they scored below five. This allows instructors to iteratively adjust and improve the structure of the T. Other methods include clarification of individual expectations and two team retrospectives.

#### 4.1.3 Learning Assessments and Digital Awards

In the SC, there are weekly quizzes in Moodle as continuous learning assessments to test the knowledge on the central topics in *Agile Project Management* week by week. The quizzes are created in the LMS Moodle. Different question formats are used, including multiple-choice, assignment, drag & drop. In the exercise, starting from the answer to the ROTI survey, the students' participation in the exercise will be checked. Students will receive 5 points for each participation. In addition, students can earn 5 bonus points by facilitating a team retrospective. The end-of-semester video reflection will be graded on a criterion-referenced basis. Each team will create a 10-minute video in which each team member reflects on the agile work in the team, including the use of agile methods and tools, according to the following criteria: (1) agile team (2) agile principles (3) agile methods and tools (4) takeaways.

In the *Agile Project Management* module, two additional digital awards based on Open Badges in the Moodle LMS are given to students who have met certain requirements. Students who have achieved the maximum score in the A-grade (knowledge-based learning assessment) will receive an agile expert digital badge. Students who have achieved the maximum score in the B-grade (team coaching) will receive an agile team digital badge. In addition, students will be guided on how to use the digital badges for profiling on social media, e.g. on LinkedIn.

## 4.2 Case Study 2 - HAW Hamburg

In the following, a description of the didactic goals, the teaching concept and methods, and the learning assessments are provided. In addition, it is explained how agile practices and agile values were implemented.

### 4.2.1 Didactic Goals

The learning objectives of the course have been formulated as learning outcomes within the framework of competency-based teaching. For the presentation, a user story (Cohn, 2004) has been created and presented by means of a sketchnote (see Figure 1). For the formulation of the acceptance criteria, the taxonomy levels according to (Bloom et al., 1956) have been used. The goal is for students to be able to apply as many agile practices and agile values as possible during the course.

#### LEARNING OBJECTIVES AGILE PROJECT MANAGEMENT

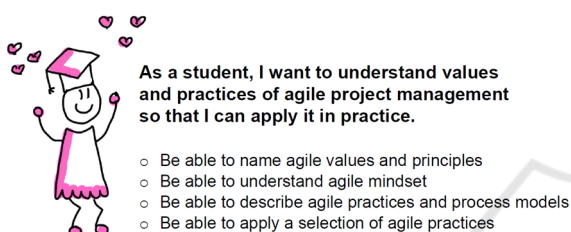


Figure 1: Learning objectives in the user story format.

### 4.2.2 Teaching Concepts and Didactic Methods

The optional module *Agile Project Management* is divided into 2 SWS *seminar classes (SC)* and 2 SWS *tutorials (T)*. The module is taught by a professor from HAW Hamburg. The professor brings both the expertise and the application knowledge from corporate practice. In addition, there are guest lectures by well-known personalities of the agile community from industry and science within the framework of the SC.

*Seminar class (SC)*: In the SC, the theoretical basics of agile project management are provided. The following topics are covered: agile mindset, state of agile in practice, product discovery and product execution, agile estimation and planning, agile process models, scaling agile, and agile leadership. Theoretical concepts are introduced and content is supplemented with videos and interactive discussions to implement activating teaching. In summer semester 21, there were two guest contributions from people in industry and academia who reported on agility in practice and current research on the agile way of working during the corona pandemic.

*Tutorial (T)*: The tutorial consists of three exercise units which are assessed with a pre-requisite for the exam. The tutorial has been implemented by means of a sprint logic. The duration of a sprint is

three weeks. During the SC, the new tasks are presented (*planning*). The students then work on the tasks in self-organized teams (*doing*). A shared exercise date is then used for the teams to present the results to each other and receive feedback (*review*). At the end of the exercise, a *retrospective* takes place in which the participants reflect together on what went well, what can be optimized and what was learned. The lecturer takes on the role of the product owner in the T and presents the tasks to be worked on and accepts the solutions at the end. During the first T, the students conduct a product discovery and apply the agile practices personas, story maps, and user stories. During the second T, students perform agile estimation and release planning. Here, the agile practices magic estimation, release planning using a story map and minimum viable product (MVP) are applied. In the third T, a release retrospective is conducted with the entire course in order to reflect on learning outcomes and thus consolidate the content in the long-term memory.

### 4.2.3 Learning Assessments

Different methods are used to assess the learning progress. On the one hand, interactive quizzes are regularly included in the SC; these can be group discussions as well as smaller surveys or quizzes. On the other hand, the students apply the contents of the SC in the T. Another aspect is the exam of the semester. The form of exam used is a presentation. The students independently choose a topic from the SC and create a scientific poster. The scientific poster is presented in an audio presentation.

The course *Agile Project Management* was conducted completely digitally due to the pandemic regulations valid in the summer semester of 2020. The following tools were used to conduct the digital teaching: Miro, Trello, Retromat, MS Teams, Zoom, Whiteboard, and Mentimeter.

## 5 DISCUSSION

In this section, we discuss the implications of our findings and answer our research question of how agility can be implemented in higher education.

### 5.1 How Can Agility Be Implemented in Higher Education?

The analysis of the case studies (cf. section 4) has shown how agile practices can be used in higher education. We have conducted a comparison of the

agile practices and agile values used in the two case studies. Table 1 shows an overview of the implemented agile practices and agile values in case study 1 (*Berlin University of Applied Sciences*) and Table 2 shows the results for case study 2 (HAW Hamburg).

Table 1: Overview of agile values and agile practices in case study 1.

Didactic element	Agile values	Agile practices
Seminar class (SC)	individuals and interactions over processes and tools, customer collaboration over contract negotiation, responding to change over following a plan	scrum team, scrum events, product backlog, team board, timebox, user story, estimation, querying expectations, gathering feedback, iteratively responding to student needs and feedback
Tutorial (T)	individuals and interactions over processes and tools, customer collaboration over contract negotiation, responding to change over following a plan, working software over comprehensive documentation	team building, team phases, scrum events, Lean Coffee, retrospective, asking for expectations, collecting feedback, iteratively responding to student needs and feedback, timebox, project slicing, story mapping, team time to work on the marketing project
Exam	individuals and interactions over processes and tools	collaborative reflection

With the introduction of agility into higher education, the role of lecturers, students and the interaction between these group changes. Lecturers are seen as coaches who provide students with a roadmap (e.g., didactic goals and course material) for acquiring knowledge and skills. They accompanied the students' learning process and are available as advisors.

In addition, they motivated the students and supported them in self-organized learning. In agile process models, this role is also known as team coach (Hawkins, 2021). The role of the learner also changes, as a change in values takes place with the introduction of agility and teaching evolves into a student-centered approach, in which the students with their prior knowledge and attitudes regarding learning are the

Table 2: Overview of agile values and agile practices in case study 2.

Didactic element	Agile values	Agile practices
Seminar class (SC)	individuals and interactions over processes and tools, responding to change over following a plan	product backlog, kanban board, timebox, user story, informal documentation, sketchnotes, storytelling
Tutorial (T)	individuals and interactions over processes and tools, working software over comprehensive documentation, openness, respect, courage	product owner, timebox, sprint logic, planning meeting, review meeting, retrospective, user story, product discovery, personas, story maps, agile estimation and planning, magic estimation, story points, release plan-ning, minimum viable product, release retrospective
Exam	individuals and interactions over processes and tools, autonomy, mastery and purpose	timebox

focus. In both case studies (see chapters 4.1 and 4.2), regular feedback was obtained from the students in order to adapt the subsequent learning units to the needs of the learners during the semester. Care is always taken to ensure that the changes in the teaching concept meet the requirements of the *Agile Project Management* module in terms of content and do not blur it. The regular collection of feedback from the students serves as quality control of the iteration process. Furthermore, the lecturers try to promote the intrinsic motivation of the students and use didactic concepts, e.g. growth mindset (Claro et al., 2016), so that agile values such as autonomy, mastery, and purpose (Pink, 2009) come into focus. This shift in values towards value-based learning supports competency-based teaching, as the focus is less on teaching subject knowledge and more on teaching competencies.

In addition, the linking of the *Agile Project Management* module with other modules in case study 1 makes it possible to apply and deepen the teaching content across modules. In this way, students benefit in several ways from what they have learned. They experience the value-creating character of agile

working through the theory, as well as through personal successes, e.g. positive feedback from the customer in the marketing project seminar and/or through a better grade.

## 5.2 Critical Review and Limitations

When using the taxonomies of cognitive learning objectives, the affective level, (e.g. attitudes and motivation), is currently missing in the learning objective description. However, this level of learning objectives is important if we want to develop attitudes in orientation to values more strongly and integrate them into the curricula. In future courses, we, therefore, want to expand the learning objectives descriptions by using other taxonomies that deal specifically with attitudes and motivation. Thus, the student-centered approach can be further improved.

The results are currently based on an analysis of the authors' course material, as well as an evaluation of learning assessments carried out. The agile practices and agile values used (see Table 1 and Table 2) might have been perceived differently by the students. We have increased the objectivity of the analysis by having a discussion of the results in the authors' group.

This research has so far been limited to the context of higher education, as we have conducted the case studies in higher education institutions. Value-based learning is also suitable for other teaching and learning contexts, such as adult education and also other types of schools. However, this needs to be evaluated in future studies. In addition, the authors have already gained experience in how agile practices and agile values can be incorporated into teaching in other modules like programming, and information systems. This is not part of the scope of this work as the comparable data have not yet been evaluated.

## 6 CONCLUSIONS

This paper provides insights into how agility can be implemented in higher education. For this purpose, two case studies in Germany at *Berlin University of Applied Sciences* and *HAW Hamburg* were investigated. In both case studies, the *Agile Project Management* module was analyzed in relation to the respective context. We highlighted new ways to support knowledge and skills acquisition that enable rapid response to changing contexts through the use of agile practices and agile values. Our results present a student-centered approach to competency development.

The implementation of agile working methods in higher education leads to a change in values and thus also to changes in the roles of lecturers and students. In the future, lecturers will be seen as coaches who accompany the learning process of students and support them in their self-organized learning. In comparison, teaching will evolve towards a student-centered approach, where students with their prior knowledge and attitudes towards learning will be the focus. To this end, the learning process is adapted with the help of continuous feedback. Thus, the role of the learner also changes.

In future research, we want to collect further empirical data on these two case studies in order to gain more in-depth knowledge regarding the change in values. In addition, we want to expand our learning objectives for the modules so that the affective level, including attitudes and motivation, is more strongly considered in the description of the learning objectives.

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