Bringing Agility to the Classroom: Integrating Professional Scrum Trainings to an Undergraduate IT Project Management Course

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***Abstract*—This Innovative Practice Full Paper examines the integration of Professional Scrum Trainings (PST) into an undergraduate class. The PST was integrated into the IT project management course in 2016. The course deals with challenges in IT projects, agile project management, intercultural project teams and IT project controlling. It is held in the Bachelor of Science programs Business Information Systems and Electronic Government, which is provided by the department of business computing at the University of Applied Sciences and Arts - Hochschule Hannover in Germany. We integrate PSTs into the course with the aim to provide the opportunity to our students of a deep dive into the most commonly used agile method Scrum. Also, we collaborated with visiting lecturers from the industry mainly to include practice-relevant problems, challenges, and examples to the students. We prepared, planned, and performed the integration of the PST since 2016 in every term, except the summer term in 2020 due to Covid-19 reasons. This paper presents our approach to integrate PSTs as Scrum seminars into an undergraduate course in higher education. We also analyzed how the students value the integration of PSTs into the IT project management course. Based on our experience and learnings including the quantitative evaluation data, which we conduct regularly, we describe that the students value attending a PST in their studies and benefit from specific experiences related to Scrum in practice. The results include both, classroom and virtual distance teaching during Covid-19. Furthermore, we give three recommendations for other lecturers, which are interested integrating PSTs into their teaching activities. The recommendations refer to the collaboration with professionals from practice, the importance of providing practical relevant knowledge to the students and the possibility of integrating certification providers to the integrated PST. Thus, the paper contributes to an understanding how to integrate agile methods and professional trainings into a higher education context both in the classroom and virtual distance teaching environments.**

***Index Terms*—Agile education, agile methods, scrum, scrum trainings, higher education, project management**

I. Introduction

Agile methods have been spreading rapidly in practice for two decades, since the agile manifesto was created in 2001 [2]. Nowadays, in software development, agile methods are worldwide well-known approaches for the implementation of product and project development projects [41]. Agile methods are characterized by their adaptability, the focus on social aspects and the iterative-incremental approach [1]. The motivation to use agile methods is often argued by the increased dynamic and fast pace in the markets, in which organizations operates. This situation leads, for example, to changing requirements for software products and the need for a better integration of customers and users [44]. In addition, the relevance of agile methods is also increasing in other industries, for instance, the area of government [6]. Today, the most used agile method in practice is Scrum. According to the State of Agile Report, more than half of respondents say they use Scrum or a Scrum hybrid approach (like ScrumBan) [41].

Due to the high relevance in practice, the question has increasingly arisen in recent years as to how the theory of agile methods should be taught in higher education. Also, we know, that the question of how agile methods can be integrated into specific didactical approaches in higher education to meet the need for agile specialists in practice getting more and more attention [17], [21], [28]. First and foremost, the integration of agile methods into higher education teaching provides the possibility to integrate problems and challenges from the real world. Also, the combination of agile methods and problem-/project-based learning is possible [7], [21]. Thus, we know several approaches to integrate agile methods into higher education. For instance, several lecturers adapt agile methods like Scrum for the context of education and integrate them in project-based didactic approaches and lab courses [13]. We also know specific agile methods, which are designed for the use in education [43] were adapted and successfully performed in higher education [25]. The advantages of integrating agile methods into higher education are described by several authors [22], [23], [25]. The students work in teams, so one may assume that specific social skills will be trained and improved [29]. In addition to presentation techniques, this includes in particular communication and collaboration between team members [16]. For the successful use of agile methods in practice, this facet is of high importance [4]. In addition, many of the students will work in teams settings and thus, social skills are important for their performance. Furthermore, there

is also a high probability that they will come into professional contact with agile methods in practice. Basic knowledge of well-known agile methods may be helpful for the students as their skills should make the onboarding on new companies or projects easier.

As shown in Section II, several studies are aiming to analyze how agile methods can be integrated in higher educational contexts. We also present an overview of literature, which is dealing with the integration of Scrum. We found that the integration of professional Scrum training's into higher education has not been extensively analyzed and discussed in research. Our study contributes to the community of lecturers by answering the following research questions:

- RQ1: How can we integrate professional Scrum trainings into an undergraduate IT project management course?
- RQ2: How do the students value the integration of professional Scrum trainings?
- RQ3: Which recommendations can we provide for other lecturers?

The paper at hand is structured as follows: In Section II, we give a brief overview of the theoretical background of Scrum and present the related work. We explain the research approach in Section III and introduce our approach to integrate professional Scrum training's to higher education in Section IV and present the results of our study in Section V. Our learnings outcomes and recommendations for other lecturers are described in Section VI. We describe the Limitations in Section VII before the paper closes with a summary in Section VIII.

II. Theoretical Background and Related work

In this Section we present a brief overview of the Scrum fundamentals and the history of the framework. We point to the theoretical background of the Scrum framework. Followed by the theoretical background we provide an overview of the literature related to the topic of the paper at hand.

A. Fundamentals of Scrum

From today's perspective, Scrum is defined as a framework for the development of complex products, which includes software development. Scrum is based on Takeuchi and Nonaka's New New Product Development Game. The model and the first experiences with it were made known to the general public by the two initiators at the OOPSLA conference in 1995 [36]. Ken Schwaber and Jeff Sutherland developed Scrum for software development, so it was initially classified as a software process [37].

Nowadays, the fundamentals of Scrum are described in the Scrum Guide [35]. The Scrum Guide is the official Scrum body of knowledge and was first published in 2009 and has undergone several revisions since then. The current version is dated November 2020 [38]. The guideline is available in various languages. The Scrum Guide defines the framework and its elements. From a software engineering perspective, various components of software process models are described (roles, activities, artifacts and the process model), which is why it can be understood as a software process. However, Scrum is explicitly defined not as a methodology but as a framework. In the following, we provide a brief overview of the fundamentals of Scrum based on the Scrum Guide [35]. We present an overview of the Scrum framework in Figure 1.

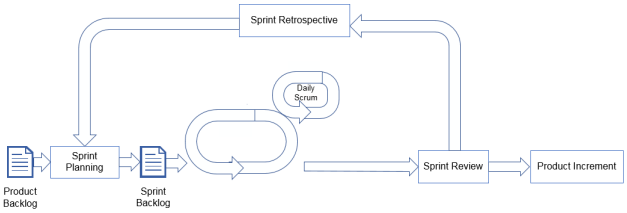

Fig. 1. Scrum Framework

Agile methods in general and specific methods like Scrum in particular are focusing on values and principles. The values and principles are defined in the agile manifesto [2] and for specific methods in their guidelines or bodies of knowledge [35]. Scrum is based on an empirical approach that takes continuous self-optimization into account. The aspect of continuous self-optimization is also known as the Kaizen approach. For this purpose, three pillars of empiricism are described: transparency, adaptation and inspection. When executed correctly, all elements of Scrum ensure the achievement of these three pillars and are the basis for gaining sustainable own experience and are of great importance in terms of constant learning and optimization. Scrum is an iterative-incremental approach. In Scrum, iterations are named as sprints and can have a maximum duration of one calendar month.

a) Artifacts: For Scrum, three artifacts are defined: Product Backlog, Sprint Backlog and the increment. The product backlog is a list of requirements and optimization tasks or measures for the product in type of product backlog items (PBI). The PBIs are ordered by their priority, e.g., business value. The product backlog is the only source of not finished work for the the Scrum Team. It is understood as a living artifact. Changes in terms of adding, changing or deleting of PBIs as well as the prioritized ordering are possible. The Sprint Backlog represents the work for a specific Sprint. It contains the requirements (what) and a specific plan for creating the product increment (how). Finally, the increment is defined as a stepstone for reaching the product goal. Product goals provide a vision in terms of why and what of the product for the Scrum Team. Each increment should offer added value for the product and be validated. In addition to technical quality assurance, the validation also includes checking whether the new increment is compatible with the ones already provided.

b) Roles: Scrum Teams are self-organized and cross-functional. The Scrum guide defines three roles for a Scrum Team: Scrum Master, Product Owner and Developer. The Scrum Master is responsible for establishing the Scrum process. The role is acting as an impediment remover, also for the team as well as the organization. Scrum Masters providing several services to the other roles in the Scrum team and the organization and thus, are known as servant leaders.

Product Owner are described as value maximizer's. The role is responsible for defining what the product´s vision is and thus, managing the product backlog. Scrum Teams consist of less than ten people in order to handle the effort of coordination and communication.

c) Activities: Activities are defined as events in Scrum. The Scrum Guide describes four specific events: Sprint Planning, Sprint Review, Sprint Retrospective and Daily Scrum. Also, the Sprint itself may interpreted as an activity as well. Every activity in Scrum is timeboxed in order to limit the workload of the team. Mostly, the timebox relates to the sprint length. The Sprint Planning aims to define a specific Sprint Goal. Thus, the Scrum Team discuss and evaluate the product backlog items (PBI) and select some high prioritized PBIs for the current Sprint. Furthermore, the developers are defining the specific work items and tasks, which are necessary for realizing the PBIs. Both, the selected PBIs and created work items and tasks representing the sprint backlog. The Daily Scrum aims to synchronize the development team. Every team member gives a short status on what the member did yesterday, what is planned for the current day and if there are any impediments concerning their current work. The daily scrum has a 15 minute timebox. Its the only activity in Scrum, which timebox is not related to the sprint length. When a sprint is coming to its end, the sprint review is held. This activity provides the opportunity for the product owner to validate the realized work (product increment). The last activity in each sprint is the retrospective, which aims to identify optimization measures.

As described above we know that Scrum is the most used agile method. However, the adaption of Scrum (and other agile methods) in practice is the normal case [26]. Ken Schwaber estimates that 75% of all companies that claim to use Scrum do not do it according to the Scrum Guide [31]. One may assume, that the empirical characteristic of Scrum and the Kaizen approach lead to an adaption over time. The adaption of agile methods include the integration of specific agile practices, activities, roles or artifacts to the approach in use. For instance, one of the well-known hybrid approaches is ScrumBan, which means the combination of Scrum and the lean approach Kanban [12].

B. Related Work

In order to get an overview of the literature related to our paper´s topic, we searched for surveys and studies using Scopus and Google Scholar.

The integration of agile perspectives and methods into higher education is getting more and more attention in the recent years [17], [21], [28], [32]. Several approaches for the integration of agile methods in the higher educational context are described. First and foremost, we found several studies (e.g., [19], [29]) and experience reports (e.g., [9], [11]) dealing with the integration of Scrum in higher education. In addition we also identified various adapted versions of the agile manifesto for the higher educational context (e.g., [8], [10], [18], [39]). The authors describe specific values and principles related to higher education.

Paasivara deal in her study with the integration of communities of practice supported by professionals from the industry in three terms [29]. She identified that the students background influences the performance of a Scrum Master, as students with non computer science backgrounds peformed better. She recommends to integrate professionals for Scrum Trainings and Coachings into higher education. Magana et al. investigate the advantages of the integration of Scrum in a systems development course. The authors point to the effects related to the guidance of students in the context of software systems analysis and design [19]. The integration of Scrum in a cooperative learning environment lead to positive influences. For instance, the use of specific agile practices such as retrospectives support the students in reflecting their learning strategies and time management. Furthermore, Magana et al. present two approaches of integrating Scrum into the classroom: The overlapped approach and the delayed approach [19]. Klopp et al. deal with the challenges of teaching software processes in higher educations in their experience report [9]. The authors present their learning outcomes from three different universities using various didactic settings while integrating Scrum into the classroom. The authors provide insights into specific adaptions of Scrum for the the integration into higher education. For instance related to the Scrum events like Sprint Reviews or roles. The adaptations of Scrum depend on the respective course organization and the didactic setting. Another experience report is presented by Kropp and Meier [11]. The authors used several agile methods like Scrum and XP for organizing and performing a software engineering course, in order to provide insights in the areas of knowledge management and project based work. The integration of Scrum with the aim to integrate IT professionals and real world situations in computer science and software engineering courses is described by Linos et al. [15]. The results of their study show, that the students value the integration of real world aspects into the class and the discussions with the IT professionals. Also other authors integrated Scrum or Scrum hybrid approaches in computer science related courses like software engineering ([20], [22], [33]. However, Schroeder et al. point to the opportunities when integrating Scrum into software development lab courses [34]. They emphasize a switched focus on creating a product and dealing with the Kaizen approach instead of planning, analyzing and completing the whole product. Furthermore, we found studies, which are dealing with the aim to integrate other aspects of agile methods like agile values. For instance, Matthies et al. investigate the effects of engaging students with self-organizing skills [22].

Besides the area of the integration and usage of agile methods in higher education, we searched for specific agile approaches, which are designed for the use in educational contexts. One well-known approach in higher education is eduScrum (e.g., [3], [27], [40]), which was created by Willy Wijnands et al. [42]. EduScrum is defined in the eduScrum

Guide [43] and was designed for the usage in schools. Several authors describe adaptions [5], [27] and present their experiences [3], [40]. Another approach is known as A.L.P.E.S. (AgiLe aPproaches in higher Education Studies) and is described by Laval et al. [14]. A.L.P.E.S. was introduced in 2013 and provides the opportunity to integrate specific agile practices into higher education. Furthermore, the integration of gamification elements into the teaching activities while using agile methods is a well-known approach. Paasivara et al. describe the opportunity to simulate Scrum while using LEGO blocks [30].

The literature related to our study provide specific insights into the integration of Scrum from both, a practical and a theoretical perspective. However, we could not identify related work, which deal with the integration of professional scrum trainings into higher education.

III. Research design

A. Course information

The Bachelor of Science programs *Business Information Systems* (BIS) and *Electronic Government* (EG) are organized by the Business Computing department. A student group comprises 60 persons for the BIS program and 40 for the EG program . The course *IT Project Management* is offered in summer and winter terms. We are an onsite university, so the courses are designed for classroom teaching in person. Due to the Covid-19 pandemic and the related containment measures in Germany, the submodule has been performed in a virtual distance learning setting since March 2020.

The course *IT project management* is a submodule of the *project management* module. In the submodule, the students should understand specific characteristics and challenges of IT project management. They should be able to handle them based on systematic approaches and methods. We present the learning objectives in Table I.

TABLE I
Learning objectives

Learning objectives
Understand the characteristics of specific software processes (agile, lean, phase-oriented and hybrid methods)
Agile IT project management using Scrum, Extreme Programming and Kanban
Management of intercultural project teams
Management and team coordination
Stakeholder analysis and management
Controlling and risk management of IT project

Each term is divided into three phases: the lecture period (16 weeks), an examination period (three weeks) and a lecture-free period (seven weeks). The submodule IT project management is planned with total effort of 60 hours (34 hours in attendance, 26 hours self study). The 68 hours are planned as lecture units.

B. Data Collection and Analysis

We collected the data based on course evaluations conducted by the students. The data collection was conducted with a standardized questionnaire for each Scrum seminar. The questionnaire consists of eight closed questions in which the students can answer them on the basis of a 5-point Likert scale (1 totally agree to 5 totally disagree). The data collection is anonymized. An overview of the five questions is given in the Table II.

In addition, two open questions are asked, to which the students can answer in free text. These open-ended questions include the evaluation of the course in general. The students are asked to name three aspects that they like and dislike. Before the Covid-19 pandemic, this questionnaire was filled out manually; digital data collection has been taking place since the 2020 summer term. The data collection were conducted about two to four weeks after the end of the Scrum seminar in the respective term. The exact time varied depending on the term considered due to organizational constraints in our university. The evaluations from the following terms were used for the data collection in this study: Summer terms 2017, 2018, 2021; Winter terms 2017/2018 and 2018/2019. The other Scrum seminars were not evaluated and thus, could not included in this study.

We analyzed the data on detail. First, we extracted the survey data to a Microsoft Excel Sheet to be able to analyze the answers related to specific closed questions from the survey. The qualitative data from the two open questions were clustered based on their content. We built two main categories based on the question type of likeness of the students concerning to the Scrum seminar. Based on this abstract categorization we identified specific clusters in which we organized the answers. The data extraction sheets are available in Appendix A.

IV. The Scrum Seminars

In this Section, we present our approach to integrate professional Scrum trainings into higher education and answer our first research question: *How can we integrate professional scrum trainings in higher education?*

A. Integrating Scrum Seminars into the Course

The attendance to the Scrum seminars are not mandatory for the students. The target group are students who aim for a deep dive in Scrum and are generally interested in the topic. The seminars usually take place over two days of seven hours each. Due to the timetable and the need for two groups (i.e. four dates), we have decided to plan one day of the event for each group on which the submodule is planned. The second day of the seminar takes place on the following Saturday, on which we usually do not plan any courses. From this setting it follows that two out of 16 lecture days are omitted, which must be taken into account when planning the term for the submodule.

The Scrum seminar basically prepares students for a Scrum Master certification from a well-known certification provider.

In addition to the two seminar days, another appointment (one to two hours) is offered for exam preparation. For this appointment, the students should prepare specific questions about Scrum, which we will then discuss together. Joint processing of examination questions is not offered.

B. Preparing Scrum Seminars

The preparation of the Scrum seminars requires some time due to our integration concept (see above). Every term, potential dates for conducting the seminars are discussed with the professionals at an early stage. This preliminary coordination usually takes place two to three months before the start of the term and is accompanied by the selection of the professionals. The selection is important for organizational reasons, since teaching assignments are usually given for the Scrum seminar. At the first event of the submodule in the respective term, reference is made to the Scrum seminar. The focus here is on the motivation and goals of the seminar. In particular, we point out the limited number of participants, as we do not offer the seminar for all students. When planning, we usually assume that around half of the students are very interested in the seminars and plan the number of groups and the necessary appointments on this basis.

Registration for the Scrum seminar is released for students three to four weeks after the start of the term. The communication to open the registration takes place within the framework of the weekly course. Registration takes place via our e-learning management software Moodle. The number of participants is limited by limiting the group size of the Moodle course. If a course is full, registration is no longer possible. Students who are unable to register will have the opportunity to register for the seminars in the coming terms.

The preparation is completed with the start of the seminar. Here the organizational aspects are briefly explained by the teachers and the possibilities for certification are presented.

C. Onsite Scrum Seminars

For the initial Scrum seminars in 2016, we have a basic didactic concept that is still valid today. In addition to the necessary theoretical transfer of Scrum basic knowledge, various simulations are planned. On the one hand, process simulations (iterative-incremental, lean, ...) are carried out in small groups. We did this in onsite format with the Ubongo Flow Game. Simulations are also carried out to document, prioritize and estimate requirements. These also take place in small groups. The aim here is, for example, to work out the difference between absolute and relative estimation techniques and to make it tangible for the students. The seminar is always supported by diverse and anonymous practical examples. Since the seminar prepares for a Scrum Master certification by a well-known certificate provider, exam-like questions are also repeatedly discussed in the plenum and answered together. There are also tasks for small groups that focus on the tasks and areas of responsibility of the Scrum Master role.

In the on-site format, we planned with a maximum group sizes of 50 students and reserved a room with the appropriate technical equipment (e.g., flip chart, whiteboard, beamer).

D. Virtual Distance Scrum Seminars

Due to the Covid-19 pandemic several countries worldwide took measures to contain the spread of the virus. One measure affected the universities in our country as they sent the higher education to virtual distance teaching [24]. Our university were closed for onsite teaching between March 2020 and September 2021. Also, the winter terms in 2021/2022 and the summer term in 2022 were affected by part time virtual distance teaching. Thus, we adapted the Scrum Seminars in the summer term in 2020, as our professionals were not be able to perform the seminar onsite. This adaption came with the first change of the professionals until we performed the Scrum Seminar in summer term 2016, because they were not able to rapidly adapt their didactical concept. In the summer term 2020, we decided to perform the Scrum Seminar by ourselves. We used the time up to the winter term 2020/2021 to expand our network of interested professionals for the implementation of the Scrum seminar. Since the winter term, it has again been carried out by professionals.

We used various tools to conduct the virtual distance seminar. Microsoft Teams was used for communication. We have specified a camera always on policy for the video calls, as this has positive effects on communication and collaboration during the seminar [24]. In addition, it is forbidden for the students to independently make recordings (image, sound, video) of the seminar. The documentation of the seminar was conducted with a virtual whiteboard. Both Miro and Mural were used for this. We have persisted the documentation of the seminars in our learning management system Moodle and made it available to the students. We have successfully transformed the simulations and collaborative content carried out in the onsite format into the virtual distance seminars. Various process simulations for Scrum are used here. In addition to a pizza bakery, the professionals have developed further case studies.

However, the content and the didactic concepts are the same as in onsite scrum seminars (see above). The materials were digitalized mainly using whiteboards and PowerPoint slides, in contrast to physical learning materials in the onsite setting. In order to optimize the integration of the students and the communication in the group, the trainer added more interactive exercises in small groups.

The Virtual Distance Scrum Seminar also prepares for the PSM I certification, and we have continued our cooperation with a well-known certification provider. The demand for the Scrum seminar is consistently as high as before the pandemic in the on-site format. We are currently planning seminars for 50 to 60 students each term. The groups are always fully booked shortly after the registration has been announced.

V. Results

A. Overview of the results

For data collection and analysis, we used the evaluation survey from five terms (see Section III-B). The overview of the count of respondents per term is shown in Figure 2:

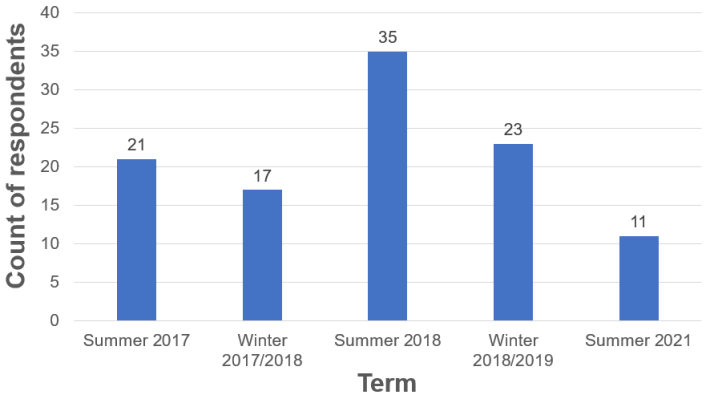

Fig. 2. Overview of the respondents per term

The distribution of response rates shows heterogeneity over the years. While the peak of 35 answers was reached in the summer of 2018, the values for the terms summer 2017 and winter 2017/2018 are around 20 answers per term. In the summer of 2021, only 11 students evaluated the Scrum seminar and completed the survey. We attribute this in particular to the virtual evaluation of the seminar. Since the switch to virtual evaluation of courses caused by Covid-19, we have observed a general decline in response rates across many courses.

B. How do students value the integration of professional Scrum training's?

In this subsection, we answer our second research question: *How can we integrate professional scrum trainings in higher education?* To answer our second research question, we first discuss the results from the five closed questions of the evaluation survey. In order to increase readability, we provide an overview of the eight closed questions of the survey in the following Tabel II:

TABLE II
Overview of the closed questions

Question	
Q1	For me, the course has a clearly recognizable structure (red thread).
Q2	I had the opportunity to actively participate.
Q3	The lecturer explains in a way that is easy to understand.
Q4	The lecturer has a varied presentation style.
Q5	The students actively contributed to the success of the course.
Q6	There is an undisturbed working atmosphere in the course.
Q7	There is a pleasant atmosphere between students and lecturers.
Q8	I was encouraged to think for myself.

The data of the closed questions in the survey show a high agreement of the quality of our Scrum seminars (see Figure 3). In most terms, the students rate the seminars with top course near by 1 (totally agree). However, in the winter term of 2017/2018 the values are around 1.5. However, also 1.5 is a very good rating for the professionals from industry and show a satisfaction by the students, which participating to the Scrum seminar. We also see a drop in the evaluation of the Scrum seminar for the summer term 2021. It is the only available evaluation of a term in virtual distance teaching. Depending on the question, the rating is more than one point on the Likert scale worse than on-site Scrum seminars. Due to the data situation, this circumstance cannot be clearly attributed to the change to virtual distance learning, since the professionals in the summer term 2021 were different than in the previous terms. It is therefore also quite conceivable that several facets come together here, which may have influenced the evaluation by the students.

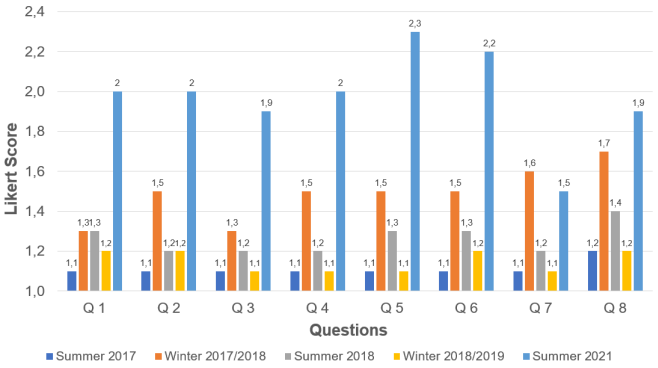

Fig. 3. Overview of the survey answers per closed question

Basically, we see a high level of student satisfaction and a consistently positive evaluation of the Scrum seminars. The average value across all questions with the same weighting is no evaluation with a Likert value of 2 or worse. This shows that the students are basically satisfied or very satisfied with the offer of the Scrum seminar and also rate the implementation positively.

This is also confirmed in the analysis of the open questions in the evaluation survey. The students value the structure of the seminar by the several professionals. A student from summer term 2017 noticed in the survey: "*Well structured, lots of illustrative material.*" Another student from winter term 2018/2019 said: "*Good balance of practice and theory.*" Also the integration of group based exercises is valued by the students. Several students commented that aspect in the survey over the five terms under evaluation. Furthermore, the simulation of Scrum and other approaches were valued by the students. The gamification approach in use (e.g., Ubongo Flow Game) was commented several times. Also, the integration of several agile practices like Kanban Boards and Burndown Charts were rated positive. For instance, one student noticed: "*Burndown chart motivates to go through with the rest of the*

Scrum seminars content." Another states, that the transparency made available through the Kanban Board was very helpful.

Interestingly, various students recommend the participation of Scrum seminars to other students. One student from the virtual distance term of summer 2021 answered: "*Was fun, very well prepared, was definitely something different than a normal lecture. I would recommend to everyone.*" Also, in the virtual distance setting, the use of Miro was valued by three students. One student commented: "*Miro Board was impressive*". Another student said: "*Really well done online. I liked the interactive MIRO boards.*". However, there were several comments mentioned by the students concerning possible improvements of the virtual distance Scrum seminar. Also related to the virtual distance setting. Some students mentioned, that the Miro board was too complex.

VI. Learning outcomes and recommendations

In this Section, we will give the answer for our third research question: Which recommendations can we provide for other lecturers? To answer the question, we analyzed our experiences and the professional Scrum training's evaluation in order to identify specific recommendations.

a) Collaborate with professionals from the industry: First of all, we believe, that the collaboration with professionals from the industry provide several positive aspects to all sides, the students, companies and our department at the university. The professionals are able to give specific and actual examples from practice for the students. Also, training and coaching of Scrum Masters, Product Owners, Agile Coaches or other roles is their daily business. We did not have any problems or challenges concerning didactical methods or approaches. However, the quality of the professional Scrum training's for students in an undergraduate course is of high importance for the success of the integration. Thus, we selected the professionals from companies of our research network. We highly recommend to perform test runs of the professional Scrum training's for a lower group size of students or observe professional Scrum training's in the professionals daily business, if other lecturers do not have the possibility for selecting professionals of their own networks. Nowadays, we work together with three companies and are in regular collaboration with them, also besides the professional Scrum training's. The regular exchange of current problems and challenges was particularly important during the first months of the Covid-19 pandemic, e.g. to work together on solutions related to virtual distance teaching. Also, both the companies and lecturers have benefited from the exchange in terms of practical relevance.

b) Provide practical relevant knowledge to the students: The involvement of professionals from practice ensures that concrete and up-to-date examples with practical relevance are used in knowledge transfer. We therefore recommend in particular the involvement of professionals for the implementation of the seminars.

The high proportion of collaboration and communication elements is also an advantage. The students do not only learn theory about Scrum, but experience various facets (see above) with the help of simulations and tasks that they have to solve in groups. Even if the Scrum seminar cannot be compared to a problem or project-based learning approach, we have made sure to convey practical content and give the students the opportunity to benefit from it.

c) Analyze the possibilities for certification: A motivating factor for the students that should not be underestimated is the possibility of certification. With certification taking place so early in the course, we always point out the risks. After all, by providing the certificate in later applications, the students show that they have profound knowledge of Scrum. If this is then brought up and tested in a job interview, this can be problematic if the seminar was three years or more ago and the graduates are not aware of this risk. Another risk now lies in the variety of agile certification providers in general and for Scrum in particular.

Apart from that, in our opinion, the advantages clearly outweigh the disadvantages. Fraud is not easily possible when examining the certificate, and the threshold of correct answers to be reached is comparatively high. Even if it is only a Level 1 certification, it must be noted that the vast majority of graduates in our country do not have such a certification. In addition to the students, the university also benefits here, as it is listed as a partner with the certification provider and can derive marketing measures from this, for example to advertise for the acquisition of potential new students. Another advantage is that the certification forces us to regularly question our content and concept. We do this at least when the content of the Scrum Guide is revised and adjusted.

We therefore recommend checking carefully whether the combination with Scrum Master certificates makes sense. Becoming a university partner can be time-consuming and involve special requirements. These requirements can mean, for example, that certain professionals are not allowed to conduct the seminar because they do not have any trainer licenses or similar.

VII. Limitations and Threats

We need to take some limitations into accounts for our study. First and foremost, we address that we do not have evaluation survey data from all conducted Scrum seminars. Especially the data from the virtual distance setting is limited, as we only could considered the data from summer term 2021. Furthermore, the respondent rate from all Scrum seminars could be higher. Only one evaluation reached a ¿ 50 % rate. Here, the evaluation data from the virtual distance setting shows the lowest rate.

Also, the evaluation survey was conducted before the exam period of the submodule. This may lead to an increased positive feedback or less critical evaluations by the students, even if the lecturer of the Scrum seminar come from the industry and that the Scrum seminar is not examined by the university.

Although the evaluation survey consists of a standardized questionnaire and is validated over the years, we point to the

limitation of the survey design. The questionnaire consists of open and closed questions, however, control questions are missing. The questions may lead to misunderstandings by the respondents and thus, the answers may deal with other aspects, which the researchers aimed to ask and wanted to know.

VIII. Conclusion and Future work

Our study aimed to present an approach to integrate professional Scrum training's as Scrum seminars into an undergraduate course. We also point at how students accept and value this integration. Furthermore we present three recommendations for other lecturers, which are interested in integrating professional Scrum training's into higher education.

When integrating professional Scrum training's into higher education, it is important to prepare the seminars well and in an organized approach. We decided to not define the attendance to the Scrum seminars as mandatory for the students. Participation in the Scrum seminars is aimed at interested students who want to gain a deep understanding of Scrum and are generally interested in agile methods. We have also decided to collaborate with a Scrum certification provider to give students the opportunity to present their knowledge in an exam-based way. In addition, we have planned the integration of professionals from practice for our professional Scrum training's integration approach. On the one hand, this offers the students the opportunity to work with experienced trainers and to benefit from their experience. On the other hand, this results in the practical teaching of Scrum. For the integration into the term planning, a lead time is therefore necessary for the preparation, e.g. for scheduling appointments. Although we are again offering more onsite teaching for the students, the Scrum seminar will also run in the virtual distance setting in the summer term 2022.

For the evaluation of the Scrum seminars we analyzed the evaluation data of five terms. The students rate the Scrum seminars as positive. The positive evaluation refers to all the indicators surveyed, such as the structure of the seminar, the active involvement of the students or the atmosphere during the seminar. In particular, the simulations and gamification content are highlighted by the students in the evaluations. The strong interactive character and the integration of specific agile practices by the professionals are also rated very positively. However, we would also like to point out that the evaluation of the implementation in the summer term 2022 was on average worse than that of the on-site seminars.

Our three recommendations for other lecturers relate to the collaboration with practice partners, the provision of practice-relevant knowledge for the students and the analysis of potential certification offers. All recommendations are based on our experiences since the first Scrum seminar was held in summer term 2016.

Based on our evaluation results, we have already carried out analyzes to optimize the virtual implementation of the Scrum seminars and defined concrete measures. One of these measures includes the integration of several professionals to conduct the seminar. As a result, we expect an optimization in relation to video call fatigue and a greater variety of practical examples. We also discussed with several professionals how the simulations of Scrum and other agile methods or process models can be improved in virtual distance teaching. We have also decided to evaluate every Scrum seminar in order to improve the database. In addition, we plan regular community of practice events with the professionals to ensure a closer exchange. In this context, retrospectives are also planned in order to jointly develop further optimization measures for the Scrum seminars.

For the winter term 2022/2023 we are planning Scrum seminars both in onsite and virtual settings. The aim is to carry out a specific comparison of the two settings. The same professionals will conduct the seminars for this purpose. We have already prepared a dedicated survey for this. Semi-structured interviews with professionals and students are also planned. The corresponding guide is in preparation. We plan to report the results of this study in a timely manner in 2023.

Appendix A

The survey is available at the academic cloud: https://sync.academiccloud.de/index.php/s/5g9amQMfQo6mLAw

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