





Scrum LPC – A Value-Based Framework for Learning Process Coaching

Martina Müller-Amthor^(✉)  and Georg Hagel 

University of Applied Sciences Kempten, Bahnhofstr. 61, 87435 Kempten, Germany
{martina.mueller-amthor, georg.hagel}@hs-kempten.de

Abstract. To foster students' agile process of learning in team and to pervade their own self-regulated and self-reflecting thriving process by value-based Scrum Learning Process Coaching is the motivation of the authors as researcher and practitioner in both software engineering and other STEM-education. This article describes the introduction the most famous Framework Scrum as an agile methodology, particular with regard to increase awareness of values. As a first step, it appears relevant to find out whether there exists a positive effect on the learning outcomes of participants in value-based scrum and what are the impacts of value-based support. The research question is as follows: Do team values in the frame of value-based Scrum Learning Process Coaching influence the performance of the students' team? In order to answer the question an experimental study was conducted with students in German higher education of Software Engineering (N = 78). The research is qualified by using mixed methods. The authors use both questionnaires of the Team Climate Inventory for value education in teamwork and semi-structured interviews. Therefore, we research the impacts of using value-based Scrum Learning Process Coaching as a framework of agile self-regulated and more self-motivated learning. The results show that groups with dedicated values benefit from their intensive teamwork with higher performance and better grades. This study consider many articles describing the use of scrum teaching in Software Engineering establishing a virtual or real capstone project. However, there is no awareness yet, that Scrum Framework could be a sustainable self-development tool for an agile thriving mindset.

Keywords: Agile learning · Scrum Learning Process Coaching · Higher education

1 Introduction

The link between innovative ideas developed in software and engineering industries and the new possibilities for digitalization and virtualization around the delivery of agile teaching and learning will become a major area of interest for educators and engineers.

This article will inspire broadly the awareness for agile learning at the level of higher education through the structured adaptation of Scrum. Such an agile framework is important due to the fact, that future challenges are characterized by complexity,

interdisciplinary and holocracy. Currently, innovative research seems almost unsolvable, because an agile mindset is needed. In addition, valuable Scrum is based on profound values that team working considers to be central to value-driven behavior and action nowadays time [1, 2]. Since 2017, the establishment of the value-based version (commitment, focus, respect, openness and courage) was a remarkable improvement and the sentence of Jeff Sutherland, the inventor of Scrum: “Scrum is a tool to change the world” [1]. R. Chatley [3] describes how to bring agile methods from industry to the classroom and creates more opportunities to communicate with students and customers about their needs through adapted project-based teaching of software engineering. The framework *Valuable Scrum Learning Process Coaching* (LPC) could be the answer of helping students to plan and perform their work, especially by value-based teamwork in fulfilling project-, problem- or scenario-based curriculum. The introduction of *Scrum* into higher education is significant for the learning practice and specific to Science, Technology, Engineering, and Mathematics (STEM) in higher education. It could be an important contribution to acquiring self-responsible, self-regulated, self-organized and self-reflective processes preparing for lifelong learning and to achieving a holistic self-development and self-efficacy.

2 Valuable Scrum as Learning Process Coaching

The following section presents related work covering the elements of the concept.

2.1 What is Valuable?

Kluckhohn [4] describes a value that a person considers desirable for himself and others. In western societies, there have been discussions of a change in values since ca. 1980. This change in values must be taken into account in educational and leadership behaviour, if people are to be reached and motivated [5–7].

The values of a team influence behaviour and steer the perception et vice versa. In this way, they form an internal and thus also an external concept of compliance [8]. It is important to mention that the change in values considers more self-realization, more autonomy, more attention to feedback and appreciation - as well as the consideration of ethical issues such as sustainability. In the case of values from the domain of intellectual autonomy, on the other hand to affective autonomy on the other hand it is more favored that individuals develop and pursue their own ideas and thoughts. This includes Schwartz [9] curiosity, tolerance and creativity.

The order of modernity does not only rely on external observation, but also uses the self-observation of the team members to examine their values and conscience. The internalized values and expectations always motivate to critically examine and improve one’s own self-efficacy. This is an important aspect for the own learning and development of new task solutions. In this context of the learning process, self-efficacy is defined as a value in itself [10]. It is the expectation that one will be successful in a certain matter. It is essential to the way things are approached. A high level of self-efficacy means that one has the confidence to do many things and is willing to face challenges often and with pleasure. A low self-efficacy means on the other hand, that challenges cannot be solved, so they are avoided [11].

In particular, the self-efficacy of one’s own learning process can be promoted by continuous feedback and encouragement from the colleagues and teachers. A support of learning process coaches should always be designed to increase the self-efficacy of learners [12, 13].

2.2 Scrum as Practical Approach to Developing Agile Thrive Mindset

In the context of this value based agile concept for an agile teaching and learning arrangement called Scrum LPC, the most important roles, events and artifacts will be described here again in Fig. 1. The framework can support a holistic learning process for STEM in higher education. It shows the most important elements of Scrum LPC in the applied scenario of a value-based learning process coaching. This results from the analysis and key impacts of already published didactical approaches [14–19]. A detailed description is given in [16].

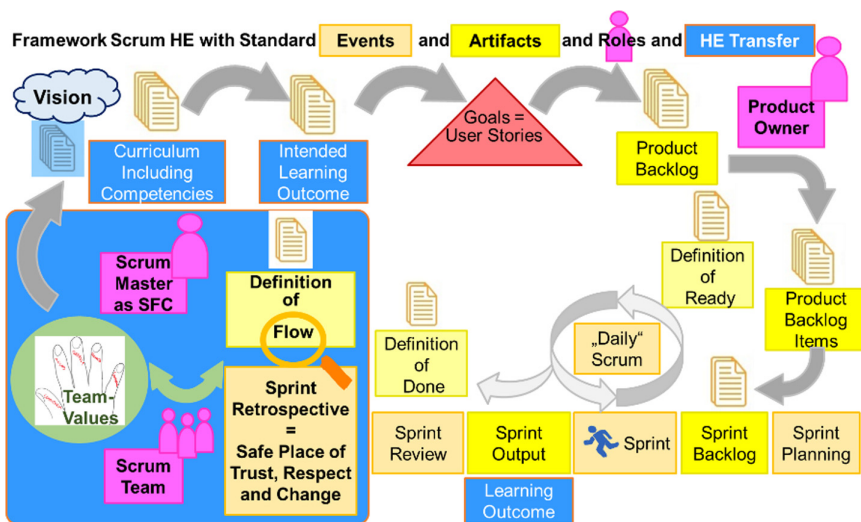


Fig. 1. Overview *Scrum-LPC* – process of learning with a Solution-Focused Coach [cf. 16]

As described in [1] and [16] in 2017, the five most important values are the following: Commitment, focus, respect, openness and courage. “Thus, these five values are obvious!” Therefore, we use the so-called five-finger feedback [21] as a reflection method. Each finger of a hand is supposed to stand for a value. In this way, each finger of a hand is given a specific meaning and represents therefore a concrete value. For this purpose, the students receive 140 value cards and can choose exactly five values from these cards, which are particularly important to themselves and which should also correspond to the size and significance of the finger, if possible. In this way, the student gets an overview of the values he or she wants to represent in the team from a wide range of values. Thinking about and discussing which values are important to him or her and how he or she will live them is an important cognitive and emotional process. The next important development

step is to work out and define five team values together. These are to be binding for the team during the period of the collaboration. In this way, the students create their own value system for future teamwork. To confirm the commitment and possibly facilitate later intervention, they sign the “Five Fingers” with their first name, as shown in Fig. 2.

This commitment is the fundamental prerequisite that in the retrospective phase of the SFC, students can take responsibility for reflecting on these values both for themselves and once again for the team with the following questions: “Have you lived within your possibilities during your learning process? What are you doing in order to achieve the best possible outcome? Were you able to advocate team values?”.

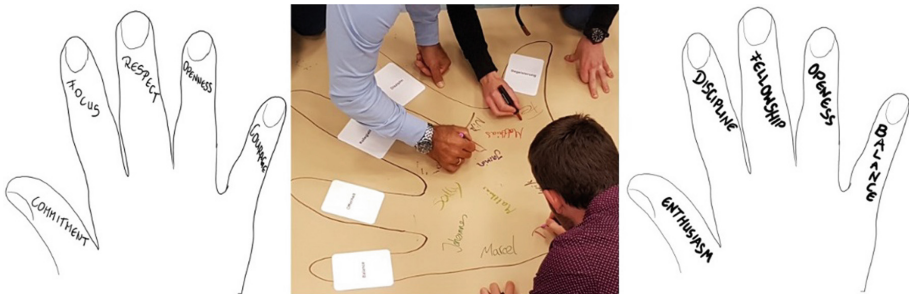


Fig. 2. Results of the Five-Finger-Method by transfer the Scrum values firstly to own values and secondly to team-values with the commitment by personal signature.

Considering the students’ point-of-view, the didactical approach with the methodology of value-based Scrum LPC allows to improve their own learning process reflecting the learning cycle: Plan, Do, Check and Learn (PDCL). This PDCL cycle promotes a holistic learning process, as the concepts of the different experimental and didactic approaches of Scrum in the educational context already show [14–19].

The following elements of the Scrum PDCL cycle, Müller-Amthor describes in [16]:

- Curriculum Including Competencies with Intended Learning Outcomes
- Goals of the learning process as User Stories
- Artifacts like Product Backlog, Sprint Backlog, Definitions of Ready, Definition of Done, Definition of Flow
- Roles of the *Product Owner*, the student group as *Scrum Team*, supported by of the *Scrum Master* and
- Events of Sprint Planning, “Daily” Scrum as Stand-up, virtually or in physical presence, Sprint Review, Sprint Retrospective (Retro).

The *Scrum Team* had a shared understanding of what it means for work to be complete and the Sprint goal is pervaded. The phases of the events reflect Plan, Do, Check and Learn. Essentially, the *Retro* is the most significant section for the value-based learning objectives. They are “to inspect, understand and adapt the interactions between learning skills, strategies and knowledge in cognitive performance” [16, p. 2].

This challenge encourages the *Scrum Team* and the individual to formulate a path to enhance themselves and the teamwork with increased collaboration. By responding

to the Quick Check of Flow questionnaire linked to the Team Climate Inventory Items, students acquire a mindset and a culture of agility. The agile methods of teamwork improve their collaborative skills. “Therefore, the definition of agility should be the ability to continuously adapt to their complex, future- and solution-focused needs” [16, p. 2]. A SFC that works in a value-based and sustainable way should power Scrum LPC. For both the lecturers themselves and support staff, it is necessary to have a sufficient understanding of basic psychological knowledge. Empathy is required for understanding interaction and attending to students’ needs. Only from this, the student develops his or her intrinsic motivation and well-being according to self-determination theory from Ryan and Deci [22]. In this way, better self-regulated, creative team solutions can emerge. Thus, it is necessary to succeed in deciphering the psychological needs for student action. Well-directed questions from the SFC to the student should raise student’s awareness of their own obstacles and challenges. Thus, it is necessary to succeed in deciphering the psychological needs for students’ actions. It takes encouragement to discover old dogmas in a solution-focused way, not just to mask them. This creates a terrain for future thriving.

2.3 What is Learning Process?

Now the question arises what we understand as to the process of learning and how we structure the phases of this process. First, the column headings are described in short form of Table 1 to get an overview of the holistic learning process supported by Scrum LPC.

This alignment and comparison should demonstrate the transferability of a methodology from industry to educational institutions. Thus, an agile and lean framework can be used to achieve high quality learning experiences as shown in Fig. 3.

In detailed phases of lifelong learning phases, diverse profiling takes place. According to the retrospective phase, questions are designed in the subarea to stimulate the students to think about their versatile needs and the status of their self-efficacy. Finding suitable answers to these questions gives a good prerequisite for further growth. For this purpose, suggestions for methods and tools are available, which help to deepen and to document the thoughts on the questions posed. Finally, the elements of the Scrum Framework are assigned to demonstrate the holistic nature of the coaching learning process. Figure 3 describes the most important elements related to the *Scrum* events and artifacts and shows the core of the educational framework of Scrum LPC with the “PDCL-cycle as the real holistic process of learning” [16, p. 2].

In this publication, only the planning and the checking phase should be emphasized, because this is the entry into value-based Scrum. The analysis and the awareness of one’s own values is an important basis for the recognition of the motives that are rooted in them. So is quite clear, that as the word “motives” from the word root already says, this is the base of motivation. If students know and name their own values, they can communicate about these values with others in the team.

If the team values are fixed for a certain period of cooperation, the motives and motivation become visible to everyone in the team.

If a discussion happens about values and students ask questions to themselves, then this can lead to further reflection, as follows:

Table 1. Overview of the process of learning in Fig. 3

Headings	Description	Scrum LPC
<i>Learning-Cycle</i>	<i>Plan, Do, Check, Learn (PDCL)</i>	
<i>Process of Learning</i>	<i>PLAN: Planning as a kind of advanced organizing → “Ante” Learning</i>	Scrum Values <i>Sprint planning</i>
	<i>DO: Execute and Exercise → Learning in Action</i>	<i>Sprint with “Daily” Scrum</i>
	<i>CHECK: Evaluate and Reflect → Learning on Action</i>	<i>Sprint Review Sprint Retrospective, in particular to Scrum Values</i>
	<i>LEARN: Adapt and Thrive → Learning new Action → change and continuous improvement → Thrive Mindset</i>	Scrum Values
<i>LLL-Phases</i>	<i>Lifelong-Learning – Self-reflexive Profiling (generally) – Competence balancing (specific study programm or task-based) – Individual development planning (specific task-related) – Experimenting, Gaining experience, Implementing solutions, Getting task done, Achievement – Subject, Learning Behaviour, Learning Success, Learning Strategy, Learning Emotion, Learning Context (Setting and Environment) – Self-Determination, Self-Motivation, Autonomy, Participation, Well-Being, Self-awareness</i>	Scrum Values
<i>Catalogue</i>	<i>Questions for the respective lifelong learning phase</i>	Scrum Values
<i>Method/Tool</i>	<i>Appropriate and suitable coaching tools</i>	–
<i>Scrum LPC</i>	<i>Scrum Learning Process Coaching events, artifacts</i>	–

Learning-Cycle	Process of Learning	LLL-Phases	Catalogue of Questions	Method/Tool	SCRUM LPC	
P	- PLAN/Planning->"Ante" Learning					Transparency in a Sprint Planning
		Self-reflexive Profiling (generally)				
			- Am I clear about the <i>value-based goals</i> of my life?	Human Needs, Values, Attitudes -->Motives -->Motivation	Scrum Values >> Personal Values >>>(Scrum) Team Values	
			- In which areas of life do I want to contribute even more to my own well-being and thrive in my life?	Wheel of Life		
				Talent-Empowerment-Strengths Questionnaire	Dialog about strength-oriented fields of development and action	
				Personality Test in combination with Learning Style Test	Learning Strategy Development	
		Competence Balancing (specific study programm or task-based)				
			"Should" - What is the expectation that I should fulfill?	STEM-functional and attention to non-technical skills	- Curriculum Including Competencies - Intended Learning Outcome	
			Which specific, task-related vision could I formulate?	AS-IF-Frame	- Vision - Epics	
			"Actual" -Am I clear about the <i>value-based self-motivation</i> of learning? - What do I do particularly well? - What do I want to engage in a self-determined way?	collaboration, communication, self-directed exploration, etc. --> multi-complex competences with a catalogue of questions for self-reflecting	Definition of Flow	
			"Target-actual comparison" - What are my strengths and areas of development?	Competence balancing Strengthen strengths, weaken weaknesses	Product/Sprint Backlog with tasks for exercises and tests meeting the <i>Sprint Goal</i>	
		Individual development planning (specific task-related)				
			"Targets" - Which learning goals/focused learning outcomes do I set myself?	Coverdale, ILO, GROW, Circle of Influence, SMART, etc.	- User Stories - Product Backlog - Definition of Ready	
			What do I think, how clear are the value-based goals of my team?	Learning objectives agreement	- Sprint (>= one week or other fixed period of time) - Sprint Planning - Sprint Backlog	
			"One Way" - How do I achieve my learning goals?	Flow channel - Learning strategies - Learning Tasks with estimation	Sprint - Sprint Backlog Items with Scrum Board under consideration Definition of Flow	
D	- DO/Execute/Exercise->Learning in Action					Transparency in a Sprint
		Experimenting				
		Gaining experience				
		Implementing solutions				
			Area of tension	Collegiate learning, Learning partnership, Individual dialogue for a learning process coaching, Innovative learning landscapes and platforms	"Daily" Scrum or "Stand-up" with three questions, which help the Team meeting the <i>Sprint Goal</i> ? 1) What did I achieved yesterday? 2) What will I do today? 3) Do I see any impediment that prevents me?	
			Getting task done		Learning outcomes: using also social media by collaborative platform	
Achievement					Definition of Done	

Fig. 3. Holistic process of learning performed by Scrum LPC (proprietary description)

Learning-Cycle	Process of Learning	LLL-Phases	Catalogue of Questions	Method/Tool	SCRUM LPC
C - CHECK/Evaluate/Reflect >> Learning on Action					Inspect
	Subject		"What did I want to consider/try out in the concrete situation/...store in the brain in the long term?"	Task: practical, functional,...	Daily personal <i>Flow Check Review</i> after the Sprint
	Learning Behaviour		"What did I do and how?"	Quick-Check: Learning Behaviour (time scheduling, workload, effective learning methods)	<i>Retrospective</i> - Impediments - Learning requirements
	Learning Success		"What have I achieved?"	Learning outcomes related to - Tasks (test questions, exercises) - Competences - Values	<i>Review and Retrospective Evaluation</i>
	Learning Strategy		"What strategy worked/ What didn't work? Why?"	Success diary of key topics	Review and Retrospective
	Learning Emotion		"What was I thinking and feeling?" (values, emotions, impressions)	Quick-Check: Learning Emotion	<i>Review and Retrospective</i> Daily personal <i>Flow Check</i> incl. Impediments Backlog
	Learning Context (Setting and Environment)		"What place and context worked?/ What didn't work? Why?"	Success diary of key topics, Checklist of Yes/ButNotYet	Review and Retrospective
L - LEARN/Adapt/Thrive>>Learning new Action>>Change, Continuous Improvement>>Thrive Mindset					Adapt
	Self-Determination		"What will I do differently next time?"		<i>Product/Sprint Backlog Refinement</i>
	Self-Motivation		What are my really motives? Am I intrinsically motivated? What can motivate me extrinsically?	Motivation - Cards, Videos or other Apps, etc.	Iteration with <i>value-based Scrum</i> or <i>Dialog about strength-oriented fields of development and action</i>
	Autonomy		"What does this mean to me?"	competence balancing and transfer to other competence areas	Iteration with <i>new Sprint Backlog Items</i>
	Participation		"Which values have I experienced as fostering?"	Five-Finger-Method	Iteration with <i>value-based Scrum</i>
	Well-Being		Do I really live joyfully and harmoniously?	Success diary of key topics	
	Self-awareness		"What's left to do?" "What do I want to document and what can I record / pass on as 'knowledge management' for myself or for others?"	Learning Diary/WIKI Preparation "Planning New" and transfer	<i>Product/Sprint Backlog Refinement</i> <i>Iteration with new Sprint Backlog Items</i>

Fig. 3. (continued)

- What was the purpose of my values selected from the list that I have so far “appreciated” through experience?
- What opportunities are there to try to experience the negotiated team values in the here and now?
- Which values are so important to me that I want to live them in the near future?
- When the analysis of the team values in relation to the team goals can provide us with information about what is important in our cooperation?
- How effective a values-based relationship can be with each other?

It is possible that better common understanding will result in improved cooperation. The analysis of the team values in relation to the team goals could provide an indication of the relationship and the effectiveness of working together.

2.4 What Are the Tasks of a Learning Process Coach?

The next important question is how we can support the learning process and manage the continuous improvement with an agile coach.

The *Scrum Master* advises as a service- and solution-focused coach, who clarifies the students' needs and works attentively on the change potential of each individual "Problem talk creates problems; solution talk creates solutions" [23]. This is the key sentence, which S. de Shazer used in 1985 to establish his special solution-oriented short therapy, which is now frequently practiced by school counselors. Through purposeful questioning techniques, empathy, emotional intelligence, and use of encouragement, students are nurtured in their needs and values. One of the most important tasks of the SFC is to facilitate the learner's search and discovery process for his or her own solution to the challenge and to create aspirations for a positive transformation in his or her own learning process. The SFC asks clear, direct, primarily open-ended questions, one at a time, at a pace that allows for thinking and reflection by the student. He or she allows the learner to complete speaking without interrupting unless there is a stated coaching purpose to do so. The SFC shares observations, intuitions, comments, thoughts and feelings to serve the student's learning and forward movement. The SFC assists students to identify their beliefs that they need to address or resolve in order to achieve what they want to reach. The approach of this methodology supports students to discover their resources themselves and to use them actively as well as beneficially. The main goal is to create and stimulate self-awareness and to train this ability. Another critical competency of the SFC is both attentive, mindful as well as active listening. This requires a high degree of self-control and a correspondingly reflective focus on value-oriented activities.

"The *Scrum Master* is the key actor who shapes the project and therefore the learning environment and whose main task includes motivating students to learn by using autonomy-supportive strategies instead of final controlling behaviors" [16, p. 2]. She or he is a professional who is called a facilitator. They primarily manage teamwork in an active and structured way by fostering collaboration, coordination, communication and collegiality. In addition, these people enjoy excellent moderation, visualization, and presentation skills. The distinctive value-based and solution-oriented coaching with simultaneous high conflict ability, in order to overcome or mitigate through obstacles and resistances, is their daily of life. He or she is responsible for the implementation and facilitation of lean and agile task as best practices of the students and methodologies across *Scrum Teams*.

More sustainable, effective and efficient is the joint development of possible solutions. It triggers valuable and esteemed processes of reflection and promotes the development of individually tailored strategies. Important learning processes can be triggered in this way, both in terms of teamwork and with regard to change management. The development of collegial relationships and open discussions about possible alternative development approaches are the result. By stopping to whine and to complain, a broad scope of expectation is created so that change is not only possible, but also inevitable [24, 25]. This allows the *Scrum Team* to achieve their shared learning goals sprint by sprint because they have a trusted leader as an SFC to call on when needed, who is committed to the spirit of agile teaching, and who exemplifies agility to the students through his or her own life [cf. 16, S. 2].

2.5 What Should Be the Effect of Learning Process-Coaching?

LPC should foster self-efficacy in a balance of four challenges to strengthen self-esteem or self-worth for an agile, sustainable and thrive mindset as the Fig. 4 shows.



Fig. 4. Self-Efficacy in a balance of four challenges to strengthen Self-esteem/Self-worth (proprietary description)

Based on the PCDL-cycle with the phases of Plan, Do, Check and Learn four perspectives are described. There are “I am”, “I should”, “I can” and “I will” as described by Fig. 4. The model involves four main components of self-efficacy thriving an agile mindset by fostering both self-esteem and self-worth.

Primarily, self-responsibility including awareness of values, needs, and attitudes is at the beginning of the cycle. This is the factor that the given research question answers: “Do team values in the context of values-based Scrum LPC influence student team performance?” Because if each team member knows what is a meaningful experience of self-responsibility, team responsibility will also emerge and vice versa. In this process, each individual in the team has the opportunity to present his/her motives and plan his/her learning objects that are specific, measurable, achievable, meaningful, and time-bound. This is also performed depending on her/his personality and learning type. The SFC must create opportunities to have these type specifics analyzed.

The next phase of “DO” uses the “to do,” “doing,” and “done” sections to formulate the competencies that students should develop in order to succeed in realizing, implementing, and accomplishing their target tasks. “I should” is the challenge and accomplishing it requires resilience, perseverance, self-control, and awareness.

The third phase of the “check” follows with the self-reflection of “I can”. This includes knowledge of curriculum topics on the one hand and learning strategies, learning emotions, and learning context on the other. This “I can” perspective is described by the already mentioned Review and Retro in the Scrum Framework and explored with the design of the quantitative method of the questionnaire as well as the qualitative method of the semi-structured interview or the results and analysis of the Mixed Methods, discussed in the following Sect. 3 and 4.

The last phase includes volition, the “I will” perspective. It corresponds with the definition of Ryan and Deci [22], who characterize self-determination as a complicated and complex process for human development. The will to shape as a positive energy with self-motivation creates the best condition for the decision between autonomy and participation. Well-being arises only when it is accompanied by self-awareness, knowing what serves self-worth. This is the essence of human existence and creates the energy for the next, new PDCL cycle in a higher level of an agile, thriving mindset with healthy self-awareness and the appropriate self-esteem to expect and live improved self-efficacy.

3 Experimental Study

We aim to answer the following research question: Do the team values in the frame of value-based Scrum LPC influence the performance of the student-teams?

We conducted the research in the Bachelor degree program of computer sciences, business informatics and game engineering at the University of Applied Sciences Kempten in Germany during the academic year 2017–2019. It is important to provide the undergraduates with agile methods and their implementation in Software Engineering. Therefore, it is an obligatory module of five Credit Points. The 78 Bachelor’s students originate from different study-programs and completed three or four semesters of their studies and should have developed a solid knowledge of programming and process models like *Scrum*.

In next section, the research methodology is presented followed in this study. The design of the quantitative method of the questionnaire and the qualitative method of the semi-structured interview, respectively the results and analysis of the mixed methods is then discussed.

3.1 Methodology - Quantitative Design

Müller-Amthor [16, pp. 9–13] investigated that the Team Climate Inventory (TCI) published by Anderson and West [26] can be used to gain validated insights into the metacognitive perception and reflection of teamwork [27]. This basic reference of the British original was adapted to cultural and linguistic needs [28].

In this respect, the results of the acceptance research conducted are certainly a significant part of this study. However, what will be decisive, it is the adaptation in relation to the presented research question: Does the didactical-agile approach of Scrum learning process coaching generate stronger teamwork when a *Scrum Master* intervenes as a value-oriented and solution-focused learning process coach?

This study now presents the findings of the two most significant and most frequently used factors, *Vision* and *Task Orientation*, with a total of seven detailed factors, but only four of them are contextualized to value-based interventions. Nevertheless and for completeness, the seven factor details shall be mentioned and are presented below. It is crucially important to highlight that for the most important phase of the retrospective, which serves for reflection on a meta-level, only four so-called factor components (*) are considered relevant.

- **Vision** with Clarity*, Value of team objective*, Sharedness and Attainability. Table 2 shows only the results in the *Vision* factor, which is defined as an idea of a valued outcome representing a higher goal and involve clarity (easy to understand), value of team objectives (valued outcome, visible to individuals in the group), because they are relevant for the value-oriented perspective. The sharedness (extension of the *Vision*) and attainability (achievable widespread acceptance) are published in [16].
- **Task-Orientation** with High Standards*, Reflection* and Synergy
The so-called output orientation was included as an additional factor in the study by [27] of the German version. Apparently, this factor design shows a special affinity to solution-oriented approaches, the formulation and comprehensibility of common values and quality-related characteristics. Reflection could be actively cultivated, if this phase is continuously executed with high mindfulness as an attribute. Despite uncertainty, ambiguity and dissent in factual and technical questions, the team members nevertheless can find out their individual competences. The goal is to work with increasing transparency for their shared expert knowledge and to cultivate themselves in mindful reflection. For the next sprint, employees consequently plan the next steps on the path to more mindfulness, higher awareness, and improved autonomy. This development opportunity illustrates Table 3.

The quantitative evaluation is based on a questionnaire at the end of each semester. As described in [16], the scale was constructed as follows: The total sample size of 78 students was distributed among 14 teams that agreed to participate. This resulted in between four and seven members per participating group. The optimal size of the development team is small enough to stay agile and large enough to do significant work in a sprint. According to the Scrum Framework, a typical team includes both a learning assistant *Scrum Master* and an assistant *Product Owner*, as well as the learning *Scrum Team* members.

3.2 Result of the TCI-Evaluation of the Retrospective

In order to prepare the learning or adaptation phase of the PDCL cycle, as shown in Fig. 4 as self-determination, a structured *Sprint-Retrospective* is required in the check phase. The learning success is initiated by a real situation to solve a challenge and the team performance is measured by the evaluation of the TCI items. Only a minimal change in the *Scrum Master's* behavior results that all employees of the *Scrum Team* are able to perceive their common team goals in the appropriate depth and just in time. The *SFC* as *Scrum Master* follows the motto: “You should not force a team to follow assumed rules. Help them discover and adopt better ways of doing things their way - step by step

- implementing the next right thing during each iteration.” The consequence is that it leads to better design results as planned, because profound and far-reaching behavioral changes of all people involved are the result. “Inversely, it seems that the higher the goal or the desired change, the harder it will be to establish a cooperative relationship between all roles, and the more likely that the team will fail. The students’ action after PDCL represents the real learning process.” [cf. 16, p. 3].

Thus, Table 3 describes how the cycle of repeating *Retro* as a formal framework condition creates opportunities - again and again - to recognize the improvements in a specific way and actually makes them available in a structured way for the new implementation phase, namely the next sprint. This is the actual main goal: Perceive the peak of the learning event! It helps to make participants aware of their reflective capacity based on their values, which is a necessary condition to customize and individualize the learning process.

By creating an environment for the best feasible team development, *Scrum Teams* can be pushed to peak performance. Through a structured agenda and the so-called “golden rules of *Retro*” as well as the tool-based “Quick Check of Flow” [29, 30], the *Scrum Master* supports both the learners themselves and the team in recognizing the need to adjust their behavior in the next sprint and to promote a continuous improvement process [16, p. 3]. The proof of a better team climate is provided by the measurement result. It shows the high total number of points and the percentage increase of the evaluation points after a *Retro* session in Table 2 and 3. This allows the conclusion that the *Scrum Master* as SFC has a significant influence, whereby the evaluation points of the so-called factor details give an impression of the distribution and frequency of the evaluated aspects.

Table 2. Results in the Factor “Vision” [cf. 16, p. 3]

Factor elements	Influence (I) of <i>Scrum Master</i> before/after <i>Retrospective(Retro)</i>			
	<i>Question</i>	<i>Points^a before Retro</i>	<i>Points^a after Retro</i>	<i>(I) in%</i>
Clarity	How clear are you about what your team objectives are?	504	561	11.3
Value of team objectives	To what extent do you think they are useful and appropriate objectives?	508	556	9.4
	How worthwhile do you think these objectives are to your team?	471	498	5.7

^a Evaluation Points Sum of 78 students with a 9 point response ranging from 1 = not at all to 9 = completely.

This also suggests that the SFC ensured that the group keeps focusing on their shared value-based vision and thus individuals are more motivated to work together to explore new solution-oriented ways of working.

The author describes the results of the study [16]. Only the very important highlights should show the consequences for agile learning events:

- The analysis shows that the team goals were assessed 11.3% more clearly, after the *Scrum Team* has interacted with the *Scrum Master*, who moderates the *Retro*. In this case, the SFC motivates the team in the *Retro* to talk about the team goals again. In this way, the team is consciously committed and focused on the team objectives in its current situation and shapes its activities appropriately.
- The value of the team goals is 9.4% higher than before the retro. Thus, the participating students describe the fixed goals as “useful and appropriate”.
- The question of how valuable the agreed goals are for your *Scrum Team* according to your personal opinion increases by 5.7%.

Target tasks are successively completed in a timelier manner when the students become aware of the relevant resources in the important retro phase. Thus, they achieve better progress with a high level of responsibility and experience the self-efficacy that is so crucially important. In the new Sprint Planning process, they trust themselves to do more than they previously expected. The members influence each other interactively and the small groups work with a high level of commitment without having to work overtime.

Furthermore, the output orientation factor of the TCI correlates with the Scrum Framework even in the two sub-areas. “Highest standards” realize the *Definition of Ready*, the *Definition of Done* and the *Definition of Flow*. These recommendations enable each team to receive relevant and specific support at the time they need it. Thus, the solution-focused coaching model plays a role especially for students in STEM courses when designing skills are required.

- The factor detail “High Standards” increased by 9.6%. This improvement is certainly assigned to the flexible but however binding and committing application of the Scrum Framework. The team is encouraged to self-check continuously. Nevertheless, this can also trigger a certain psychological pressure and negative scenarios can arise. This is where the role of the experienced SFC, who provides valuable guidance for the further design process, becomes to be extremely important. In particular, the trainer’s persuasiveness and willingness to design, help to eliminate the crises in the team in order to achieve the optimum as a whole team. An improvement of 6.8% is seen here as well. The question of what the optimum means has to be clarified for all members of the *Scrum Team* sufficiently.
- The factor detail “Reflection” is permuted twice in the phase “Self-Check”. This most important phase in the process of learning includes the *Review* and the *Retro* event in the Scrum Framework. First, the *Review* concerns the correct assessment of the

Table 3. Results in the Factor “Output-Orientation” [cf. 16, p. 4]

Factor details	Influence (I) of <i>Scrum Master</i> before/after <i>Retro</i>			
	<i>Question</i>	<i>Points^b before Retro</i>	<i>Points^b after Retro</i>	<i>(I) in %</i>
High standards	Is it really important to the team members that the team achieves the highest standards of planned performance?	558	612	9.6
	Are there clear criteria in the team, which are sought by the members in order to achieve the optimum as an entire team?	435	465	6.8
Reflection	Does the team continually monitor its own performance in order to achieve the highest standards?	486	511	5.1
	Are team members prepared to question the basis of what the team is doing?	531	546	2.8
	Does the team critically appraise potential weaknesses in what it is doing in order to achieve the best possible outcome?	549	612	11.4

^b Evaluation Points Sum of 78 students with a 9 point response ranging from 1 = strongly disagree 9 = strongly agree.

expertise. In addition, there is also the question whether the self-regulated as well as self-organized approach is suitable and appropriate for the individual learning process of the functional tasks. Secondly, a very important point for the development of students' reflective ability is the framework-specific time of an event called *Retro-spective*. This reserved time allows not only feedback but also another level of mindful reflection for the team and for each participant as a human being, trustworthy and just in time, as well as organized by the spirit of *Scrum Master* as SFC. [16, p. 4]

- As already mentioned in the factor detail “High Standards”, some team members find the constant control between them uncomfortable. “Students frequently quoted the phrase from [1] that Scrum is easy and simple to understand, but difficult to master” [cf. 16, p. 5]. Developing self-discipline in the process of learning is the great challenge for

both the students themselves and the self-organized team, which requires resilience, perseverance, self-control and consciousness, as shown by the improvement of 5.1% and 2.8%, respectively. Analysing the survey scores per group, the conclusion is, “that teams who really explore their common values in the beginning of their teamwork and use the five-finger-feedback method as a guide for the *Retro* are more willing to critically appraise their potential weaknesses. This is shown by the high level increase of 11.4% after a moderated *Retro*” [cf. 16, p. 5].

Value-Based Factor Vision

While in the previous two sections we presented the most significant factors of vision and output orientation out of a total of four factor statements, the next section describes the values-based research on how students really engage to live their chosen values as well. Thus, the research questions are as follows (Fig. 5):

1. Am I clear about the value-based goals of the project?
2. What do I think, how clear are the value-based goals of my team?

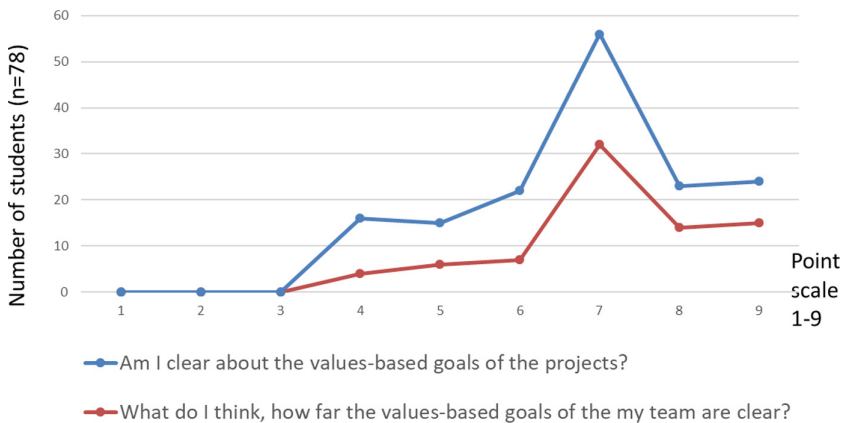


Fig. 5. Results in the Success Factor of value-based Scrum: “Clarity”, Evaluation Points Sum of 78 students with a 9 point response ranging from 1 = not at all to 9 = completely.

78 students express the clarity of the value-based objectives quite clearly between 6 and 8 points, and no one gave less than three points. However, the next statement shows that the agreement with the other values of the team members is on average lower. The following qualitative factors could be designed based on this evaluation. Do the commitment and the trust of each individual in the group and the lived courageous exchange of the team members about their values play an important role? The identification rate with the group values is significantly lower. Could this be due to the fact that the tasks in the group were not formulated clearly enough? Was there not enough communication time provided in the limited online event? Should we offer more time in breakout sessions

to give more space for the discussion of values? It was remarkable in the observation of group processes that those with a shared values-based vision were more motivated to develop new solution-oriented working methods. Within this experimental study, a variety of effects could be identified that had an impact on the learning process and the learning success of the students. As described above, the quality of team performance is strongly related to strength-oriented relationship work, appreciative communication in the four phases of the PDCL cycle of the success-oriented learning process, and in the value-based actions of the *Scrum Master*. Becoming aware of one's own team performance as a team and seeing it as a product and not just as the sum of individual results is an important prerequisite not only for the success of the *Scrum Team*, but also for the learning process of the individual *Scrum Team* member.

3.3 Methodology - Qualitative Design

In the summer-semester 2020, we decided to interview the participants of the *Scrum Teams* for the efficacy of the new course design, after using the value-based Scrum LPC as the methodology with semi-structured interviews of five teams after the end of course and after the examination in August 2020. The interviews were semi-structured and a catalogue of possible supported interview questions, so that the researcher can refer to them when the questions arise in the individual interview session, thus enabling a deeper reflection on the learners personal learning behavior, learning strategy, learning emotion and learning context. Altogether 23 undergraduates participated in the course and 21 in the interviews. Each interview took 20 min. The author of this article conducted the interviews. She was not in a responsible teaching position in the course but as the *Scrum Master's* support; she could ensure that the students could reflect their experiences during the course openly and trustfully. So for example we were able to find out for example, when a student says that he or she has not improved the learning process, whether there is a reason for an learning obstacle or another impact factor that exists in addition to value-based trust.

3.4 Result of the Interviews

In the beginning of the teamwork, we could document the result of the second Scrum Retrospective fixing the values with the Five-Finger-Method per group. Figure 6 shows the overview of the agreed team-values and the transparency of some team performance indicator. First, this summary served as orientation for the interview in each group, and each team member discussed how they realized the values personally.

After the course and after obtaining the results of the written examination, we ask the students the following questions concerning the value-based strategy of the didactical approach in semi-structured interviews. Table 4 shows as we have received answers with of the same tenor and get meaningful insights by a response rate of 91% of the student participants. That is good enough to get started with the next step running the analysis.

3.5 Discussion

Following the evaluation, metacognitive awareness and reflection on teamwork using the Team Climate Inventory will be discussed and the qualitative answers given by the

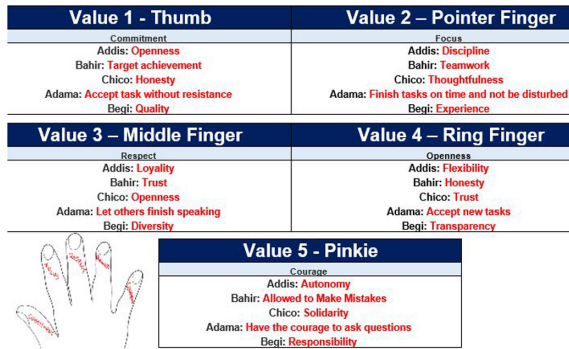


Fig. 6. Scrum Team values sorted by Five-Finger-Method per group

Table 4. Value-based Questions and Responses of the Semi-structured Students’ Interviews

Questions	Responses
Which competence could you intensify through value based Scrum LPC?	<ul style="list-style-type: none"> • Self-discipline (you had to complete a task by a fixed deadline so that you or the team members could complete tasks based on the solution of this task), but also generally working according to Scrum • Task distribution • My ability to communicate • Trust and confidence • Responsibility for the team performance increase my self-motivation • Perseverance with Sisyphus tasks
Which team competence did the project team jointly develop on a value-based approach?	<ul style="list-style-type: none"> • Focus on essentials • Working and solution finding together in a team • Sharing tasks • Helping each other when I did not know how to solve a task on my own
Were the jointly agreed team values decisive for your joint behavior?	<ul style="list-style-type: none"> • Sometimes we looked at our “Five-Finger-Hand” • Less fear to ask my mates, <i>Scrum Master</i> and <i>Product Owner</i> • “All for each and each for all”

students, which were used to find explanations of what was observed in the data of the TCI. This can prove the aggregation of the collected data by team name.

The advantages of a value-based Scrum LPC are that the approach provide an insight into the learning process of students. We succeeded in supporting the self-reflection process about their own functional competence and their soft skills. This is an important

prerequisite for lifelong learning, because reflectiveness “includes the ability to deal with change, to learn from experience and to think and act critically” [cf. 29] as the German Qualification Guide defines. The documents of Retrospective reflect a special role in dealing with change and learning from experience. This emphasizes that students were not only guided by the SFC to reflect, but also became aware of their own self-reflection and learning processes. This is a central competence for experience-based learning, for further development and thus especially for innovative learning. Scrum LPC seems to offer the possibility to create a high level of trust. An increasing self-efficacy and a positive attitude could be a motivating factor leading to a good successful exam.

Sometimes it develops really a trustful talk about the missing motivation and even about the fear and human failure. The SFC states that the latter have to be analyzed for assessing one’s abilities and interest in her or his obstacles. The question should be allowed, why students have this kind of learning and whether this inner beliefs prevents them from applying new learning strategies. Through Scrum LPC students get the opportunity to reflect on their own prerequisites and attitudes in comparison with other team members. This is of interest when it comes to designing their own learning process more effectively and efficiently. Self-determined learning to its greatest extent is a process in which the student can decide and influence significantly whether, when, for what, what and how he or she learns. Each *Sprint* after the appreciative *Retrospective* gives the student a new chance to thrive with an agile mindset.

4 Conclusion and Perspective

An evaluation of the most important TCI factors and conclusion at the end summarizes the research outcomes. We must put even more emphasis on value-based *Scrum Team* working as an instrument of integrated student advisory service by solution-focused coaching. We use the German words for “educational biplane”, when we use the subject of study as a vehicle of a holistic self-development. It enables the increase of self-esteem and the implementation of self-effective learning arrangements for an agile mindset of students’ thriving. They intensified their learning strategy, which is suited for the own personality. Furthermore, it produces a higher success rate as to pass examination for software engineers. A long-term study will determine, discuss and qualify how the value-based Framework Scrum LPC supports the value-aware SFC in noticing the difficulties and challenges related to the intended learning outcome and the missing motivation in students’ learning procedures. The study proves that the use of values and their reflection by the Scrum LPC increase the team performance. This was diagnosed with the allocation of the TCI as a certain inventory of measuring the better capacity for teamwork. The evaluation also confirms that Scrum LPC with the specific procedure of asking and answering questions in the *Retro* improves the self-learning competencies in connection with self-regulated learning behavior in an agile and success-oriented way, self-emotion and self-motivation for the process of learning. Hence, based on the semi-structured interviews, this approach is expected to deliver valuable results on students’ self-reflectiveness learning and its facilitation in the context Software Engineering education. However, Scrum LPC could also be an approach for preparing students for a successful career in the other fields of STEM-Engineering.

In summary, it is worth to mention that the self-determination and the focus of the mated values effect the students' workload, which does not seem to have increased, however functional results have improved and even we led to better grades. This is due to their shift in esteemed behavior towards the team during lectures, means "Daily" Scrum or rather *Stand-up* meetings, *Reviews*, *Retrospectives*. The responsibility of the Scrum roles causes more activity, e.g. discussing ideas and asking questions. Individual solution-focused coaching enables teams to adopt themselves appropriate tools and techniques for their specific context and to gain more nontechnical, social skills. A. Dehlii et al. [14] describe, "Incremental deliveries of 'Done' learning results ensure that a potentially good result towards the learning goals is always achievable." and checks the learning process by using the *Definition of Fun* [14], which describes the "Definition of Happiness". The future concept of Scrum LPC substantiates a *Definition of Flow* for the *Retro*. In this model, students seem to experience flow because the requirements of the tasks in the present sprints correspond well with the abilities of the individuals, i.e., when the estimated possibilities for action offered by the Sprint tasks match the students' own abilities and there is an high expectation of self-efficacy. Thus, the *Scrum Master* as a solution-focused coach concentrates on the perceived competence as a central element of intrinsically motivated actions - the best prerequisite for the actual learning process. The verification of optimal challenges by a value-based and success-oriented SFC requires a concept of flow [30] and value-oriented communication in an atmosphere of trust. This provides the best basis for the individual's behavior to change during the next sprint. It seemed as if the curiosity would be motivated, because they ask many questions and discuss new multivariate solution ideas.

A *Scrum Master* could use a catalogue of dedicated questions and devoted methods for *Retrospectives* [31] in order to lead oneself, to lead students and to lead changes in higher education, so-called Transformative Leadership [32]. Some further guiding principles and useful approaches explore [20]: "It requires critical reflection on questions about for whom the system is working ...calls for critical analysis of beliefs, values..." As already mentioned, evidence through this study shows that excellent qualified SFC knowing tools of value-based orientation could be autonomy-supportive. It is important to remember that no team is ever the same. If there is something which has been useful to the SFC, in most cases it has been a curious, playful, experimental and agile approach in helping teams to learn to take ownership of the Daily Scrum means also ownership of their individual daily life.

Moreover, this study gives further impacts for research with future perspectives developing value-based team working and self-learning competence in higher education. It is a thriving way of experiencing oneself when one is fully engaged and uses one's abilities to the utmost to achieve something that one has previously consciously valued as personal values [33]. Scrum LPC is the process of experiencing self-efficacy [33].

This contribution analyses the relevant references in IEEE-papers between 2014 and 2018 and we could compare other relevant literature for papers of engineers in ACM, Web of Sciences, etc. The value-based guidance of students in their development into holistic personalities is the prerequisite for science to make a significant contribution to social responsibility based on deeply rooted ethical principles. Some open research

questions foster success factors, which deserves didactical principles by future design-based research.

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