

VII International Forum on Teacher Education

Agile in Digital Didactics in the Era of the VUCA World in Education

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Abstract

To consider the problematic field of digital didactics, we propose the use of Agile technology in modern educational conditions, since this technology is successfully used to manage cognitive activity in the digital space. This methodology seems to be one of the most effective in solving the problem of preparing students, increasing their employment opportunities, creating conditions for the formation of “soft skills” that are in demand in modern conditions of digitalization of education.

The study aims to analyse and explore the applicability of the Agile ideology in digital didactics in the era of the VUCA world in education; to determine the degree of teachers' readiness to build their digital educational process using the Agile tool; to determine the effectiveness of distance learning at university through the application of the Agile methodologies (Scrum, Kanban).

Research methods are collection and analysis of scientific publications devoted to the study of the features of Agile technologies, the possibilities of their application in the educational process; observing students' work according to the approaches of Agile methodology using the system of LMS MOODLE.

The Agile approach in education allows achieving goals with less effort and expense, in a shorter time, and the final product is of higher quality. We decided to open an Agile Center, which is aimed at developing the concept of reflective and research-oriented teacher education, designing and implementing a new structural and functional model of comprehensive teacher training in the university.

Keywords: Agile methodology, digital didactics, VUCA world, digitalization, Scrum, Kanban.

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Published by Kazan federal university and peer-reviewed under responsibility of IFTE-2021 (VII International Forum on Teacher Education)

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Introduction

The SPOD-world has transformed into the VUCA world. In the new reality, students learn rapidly, prefer individualized learning and study that is of interest to them. They are extremely fast to acquire new competencies, which is why the existing teaching methods are no longer suitable within the current educational process. Therefore, new technologies, approaches, and methods are required. In this regard, it is becoming necessary to create absolutely new programs, which allow taking a different view of development strategies for educational and government institutions. Nowadays many companies are also looking forward to employing new professionals which means that universities have to train people for the jobs of the future, the jobs that do not exist yet.

Students' lack of interest or motivation is a worldwide problem that directly affects the immediate need of organizations to hire qualified employees. In the light of the modern paradigm of lifelong education, the problem of introducing educational innovations aimed at the independent discovery of new knowledge by students in the digital age is gaining more and more practical and theoretical significance. Agile tools can revive interest in education and help students acquire skills that will actually help in their career and modern life.

One of the earliest to apply agility in school, John Miller (Agile Classrooms) began experimenting with Scrum in 2009. In 2011, Steve Peha shared a presentation at Yahoo called Agile Schools - How Technology Saves Education (Peha, 2011). In the presentation he rather correctly pointed out how initiatives like No Child Left Behind have failed in the US, and how agility, applied to education, may be a much more productive route. In 2012, Willy Wijnands of Ashram College in the Netherlands, along with his colleagues, began translating Scrum into eduScrum. Jeff Sutherland (2014), co-creator of Scrum and proponent for its application beyond the software world, referenced eduScrum in his book «Scrum: The Art of Doing Twice the Work in Half the Time». A number of scientists have examined in detail the case studies on teaching software engineering at the bachelor's level (Sureka et al., 2015). Other researchers have investigated the issues of training engineers in accordance with the requirements of stakeholders for the designed systems (Rupakheti et al., 2018). However, there are few studies devoted to the use of flexible methods in the training of specialists in the humanitarian field. Among the domestic authors who study the effectiveness of the Scrum method in teaching, it is worth highlighting the works of Afonin (2019) but most of his works are about school education. Scrum is an Agile software development methodology or framework used primarily for software development projects with the goal of delivering new software capability every 2-4 weeks.

It is known that project activities are integrated into the educational process from primary school to the completion of training, and this methodology allows it to be effectively implemented.

Kanban (visual map) is the simplest Agile project management methodology. The basic idea is to keep a Kanban board with a list of tasks to be completed and their status. The main difference from Scrum is that it does not define time intervals for work, allows the team to focus on a reduced number of tasks and identify bottlenecks before they become an element that prevents work from completing. Kanban can be a good approach for projects with a small team or for individual work.

The use of Agile in a digital learning environment presents a number of challenges, nevertheless, this methodology seems to be one of the most effective in solving the problem of preparing students for lifelong learning, increasing their employment opportunities, creating conditions for the formation of “soft skills” in digital education (Masood, Hoda & Blincoe, 2018; Noguera, Guerrero-Roldan & Maso, 2018).

Nowadays one of the most popular forms of organizing the educational process is distance learning. Distance form of the implementation of educational programs in a higher educational space should not be a limiting factor in the formation of modern graduates of competencies, skills, and work styles that correspond to the labor market. Agile technologies can also be used in the organization of distance learning.

In the SPOD-world, where people used to live, all algorithms were clear and familiar, communication was well-established and results could be realistically expected. However, everything has changed with the shift towards the VUCA world: our reality is no longer convenient, familiar and predictable; we are left with the feeling of frustration and being ineffectual and cannot find the new and the rational that could establish the framework of the new reality, set new goals, formulate new objectives, and build new algorithms.

Nevertheless, there is a VUCA response to the VUCA challenge, which involves:

- Vision: communication and belief in oneself and one’s partners; the ability to direct the team’s efforts into productive activity;
- Understanding: empathy, natural curiosity, the desire to respond to new challenges in a nonstandard, creative way, open-mindedness that allows thinking outside the box and seizing new opportunities;

- Clarity: the ability to intuitively follow a new path; the old knowledge is an obstacle that stands in the path to the new; system thinking and dynamic vision of a situation;
- Agility: eagerness to provide new opportunities for employees, openness to new, non-standard, innovative approaches to processes and projects at the university.

This investigation is organized in the following way. First, we give a brief overview of the emergence of Agile in software development as an alternative to traditional approaches to team collaboration. Second, the paper reveals the Agile Manifesto for teaching and learning, which is designed to guide innovation in higher education. Third, the study describes and assesses our own experience in adapting the Agile approach for use in the educational space of the university. Fourth, the study presents the results of a survey about the experience of students using Agile teams and methods in the educational process. The study concludes with a brief overview of our study, with the aim that it may serve as a guide for other educators wishing to explore how the Agile approach can be of practical use in their own work. This study leads to the following research questions: How can Agile digital technologies be used with real and practical problems in higher education? How do the students value the work with Agile in the digital environment of university?

Purpose and objectives of the study

The purpose of the study is to present an approach to the implementation of the Agile methodology' ideas in the educational process of a future teacher in the context of distance learning, comparing the possibilities of implementing two popular technologies of Agile methodology - Scrum and Kanban using the example of the Moodle distance learning system.

Research objectives are:

- to study how it would be correct to transfer the Agile principles to the higher education system and what changes these transformations will bring;
- to determine the basic principles that can be guided by the administration of higher educational institutions when introducing Agile technologies into the educational space of the university;
- to identify the main problems and difficulties standing in the way of reforming the educational system of the university in the realities of the VUCA world;
- to identify the main trends of Agile methodologies for distance learning of future teachers.

Literature review

While Agile was initially conceived as a tool for software developers, its broadly applicable ideas about collaboration – as well as its essential similarities with other management approaches, for instance, Total Quality Management (TQM) and Lean that have migrated beyond their originating environments – made Agile a likely candidate for adaptation by educational organizations (Emiliani, 2015).

Such has been the case with the use of Agile teaching, also referred to as Agile instruction, which is a student-centered approach where learners work in teams and respond to rapid feedback. Teachers using this approach intentionally eschew adherence to rigid syllabi or lesson plans in favor of flexible classroom interactions and ongoing student-teacher collaboration (Briggs, 2014; Stewart, et al., 2009; Tan, 2012).

Given specific disciplinary origins of Agile, it is hardly surprising that the majority of applications of Agile techniques in higher education to date have focused on computer science, engineering and similarly technical fields. A discoverer was Chun, whose Agile-Teaching/Learning Methodology (ATLM) centered on three essential elements: agility, XP, and independence (Chun, 2004). ATLM frequently involves the extensive use of blogging, wikis, instant messaging and other technologies to support collaboration, knowledge sharing, and quick feedback. Chun (2004) reported considerable success in using this Agile-based methodology in several technical courses taught at the City University of Hong Kong. Other scientists have found similar success in adapting Agile to their teaching in computer science courses at other institutions as well (Anderson & Romney, 2014).

Other scientists have developed at least two additional education-focused application of Agile ideas and methods. One is Agile Problem-Driven Teaching (APDT), which borrows from Problem-Based Learning (PBL) the use of iterative student work on complex problems while also calling for greater teacher flexibility and application to different learning environments (Dey et al., 2009; Romney, 2009). The study by Dey and colleagues provides several examples of the use of APDT in various STEAM-oriented curricula including mathematics, database development, information technology, and programming languages. The other is Extreme Pedagogy, recently introduced by D'Souza and Rodrigues (2015), which adapts the principles of eXtreme Programming and the Agile mindset to teaching and learning in engineering. As D'Souza and Rodrigues see it, students should be viewed as the primary 'customers' of education, while other stakeholders – including parents, sponsors and

the government – are best understood as secondary customers. As such, Extreme Pedagogy calls for teachers to emphasize three elements of Agile in their teaching: A) learning by continuous doing; B) learning by continuous collaboration; C) and learning by continuous testing.

Nowadays educational applications of Agile beyond science and engineering are still uncommon, although some educators have found success in this regard. Rebecca Pope-Ruark of Elon College, for instance, has used Scrum in her English courses to facilitate collaboration in student-group writing assignments, particularly large writing projects concerning complex real-world situations (Pope-Ruark, 2012). Similar examples of faculty use of Agile project management techniques for facilitating student teams can be found in chemistry and in digital media studies (Wilson, Brown & Burke, 2013) as well.

Agile methodology is exploited for its useful tools. An example is the Kanban board, especially in project-based learning (Bacea, Ciupe & Meza, 2017). Widely used in industry, Kanban boards are a physical or electronic visualization tool for the management of work in teams, to improve their delivery of products and services in terms of predictability, quality and just-in-time performance.

Methodology

The research is based on the experience of practical work in teaching a number of disciplines to students enrolled in the direction of «Pedagogical education (with two training profiles)» at Kazan (Volga region) Federal University.

At the first stage, the literature on the research topic was studied, the features of Agile methodologies for organizing project work Scrum and Kanban were identified, and the possibilities of their application in the educational process of the university were analyzed.

Taking into account the information received in the distance learning system, a course “Upbringing in the educational space” was developed in which teamwork of students in a number of disciplines was organized. The students were divided into teams, one part of which worked according to the Agile methodology of Scrum, the other part - Kanban.

At the final stage of the study, the educational process was observed.

The generalization of the data obtained made it possible to formulate recommendations for the design of a distance learning course, the study of which will allow introducing the ideas of the Agile methodology in the educational process for the acquisition by students in practice of skills and styles of work associated with the use of modern technologies for the development of software products.

Results

In our study we examined two popular technologies of Agile methodology - Scrum and Kanban, which can be used in the preparation of future teachers using the Moodle distance learning system as an example. Both Scrum and Kanban are flexible and iterative. The iterative approach is to divide the work process into short iterations or sprints. The team can independently set goals and objectives, choose methods to achieve them. The team regularly plans its work and monitors progress its execution within the time intervals - sprints. The main differences between the considered methodologies are sprint length and multitasking capabilities.

By the way, distance learning will not only not negatively affect the educational result, but will also contribute to the greater realism of these approaches. A modern platform for organizing distance learning will take on the role of a project management system and communication tools, creating a virtual space for joint learning of teamwork. Let's consider the features of the implementation of each approach in the Moodle distance learning system.

From the point of view of the course structure, the conformity to the approaches of Scrum and Kanban is determined by the presence of the Product Backlog block (a list of all project tasks) and several Sprint blocks aimed at solving part of the tasks (Sprint Backlog). At the top of the course, it is advisable to place a project description or other document listing the requirements for the software product being developed, such as a requirement specification. To organize the interaction of the customer representative (teacher) and the development team (students), you can use various means of communication Moodle: forum, chat, webinars. You can also use third-party resources, such as Zoom, Microsoft Teams for video communication. In the latter case, you can select the "Hyperlink" item to easily connect students to the Zoom conference. The Product Backlog can be composed of various items available in the Moodle distance learning system, in our example we use "Task". This element allows the teacher to set tasks that require students to respond in electronic form. The system provides students with the opportunity to upload files with completed assignments directly to the server, which avoids the use of e-mail, social networks or other, not so reliable means of communication.

The following course topics (Sprint_1, Sprint_2, Sprint_N) contain the tools necessary for team members during the sprint: Checklist, Forum and Chat. Chat is used to organize daily short meetings lasting 10-15 minutes. During these sessions, team members share their successes over the past day of work, celebrate the fulfillment of sprint tasks. The rest of the time, students work independently or in small groups, exchanging tips and advice in a specially created forum.

Let's take a special look at the checklist. This module allows the teacher, and concurrently and the leader of the student team, to form a list of sprint tasks (Sprint Backlog). Tasks are selected from a general block containing a list of all the tasks of the course. Here you can also change the priority of a task by moving it up or down the list, delete an existing task, or add a new one. The instructor creates this list together with the students, communicating via video link, or delegates this prerogative to a representative from each team, assigning them an appropriate role in the course.

Having coped with the next task of the sprint, students mark it as completed, and the teacher, in the same checklist, can view the number of tasks completed by the whole group and by each student individually.

When all sprint tasks are completed (in Kanban methodology) or the stage time ends (in Scrum methodology), a new checklist is created for the next sprint and work continues. The main differences in the implementation of the Scrum and Kanban methodologies are shown in Table 1. Moving from one approach to another does not require a restructuring of the course structure, but involves small settings in the course topics. For the Scrum methodology, time access is configured for each topic (i.e. students will be able to access sprint tasks only at a certain, pre-configured time period). In the Kanban methodology, there is no time limit, but all sprint problems must be solved, respectively, you can set up access to the new sprint (topic) according to the condition - completion of the course element (checklist from the previous sprint).

Before starting training, the teacher must select the group mode – “Isolated Groups” in the course settings, enroll the students in the course and distribute them to the teams.

Table 1. Features of Scrum and Kanban approaches

Criterion	Scrum	Kanban
Sprint length	Determined beforehand, 1-4 weeks	Depends on the achievement of the sprint goal. Sprint ends when all are resolved tasks
Priority of tasks	Priorities are defined at the beginning sprint	The team can quickly redistribute task priorities
Multitasking	Backlog is formed at the beginning of the sprint and does not change until its end	Backlog can change continuously, including during the sprint
Project team	Product owner, team leader, specialist (specialists can share by roles)	Product owner, team leader, expert
Interaction between team members	Daily to discuss the results of the current sprint	

Table 2. Application Results

№	Efficiency indicators	Data before implementation Agile tools (Scrum, Kanban)	Data after implementation Agile tools (Scrum, Kanban)
1	Percentage of students, who successfully (4 or 5 points on a 5-point scale) passed the exams in specialized classes	70%	82%
2	Student satisfaction level according to the 100-point scale measured through the questionnaire in the section of classes	65%	80%
3	Number of enterprises (potential employers) in base for device for practice	10%	42%
4	Percentage of students, who during the period of study at the university begin to work	15%	35%
5	Number of employers per year dealing with a request to select a student for employment	5%	13%

All indicators of Table 2 demonstrate three classic key positive effects received from the introduction of Agile technologies: improving quality, acceleration of processes, cost reduction. Most indicators combine two or three positive effects in themselves. The presented statistical data with positive dynamics prove successful implementation of the Agile approach to the educational process of higher education and demonstrate a significant increase in quality and speed parameters training of students.

Discussions

A new approach to using the capabilities of the Moodle distance learning system makes it possible to turn a regular distance course into some kind of project management system. In order for the teams to work on the project, taking into account the flexible methodology, it is necessary to create a course in the distance learning system, the construction of which and the work schedule in which must meet certain requirements.

Students enroll in the course, while dividing into teams. The course structure includes a Product Backlog block that lists all project tasks and several Sprint blocks, each containing a batch of tasks. Inside each sprint, the entire set of tools necessary for in-team interaction of students is located: checklist, forum, chat; distribution of access rights to a certain sprint for team members is organized.

The result of solving problems in the current sprint determines the set of tasks for the next sprint, which is a feature of the flexible methodology, the selection of tasks is carried out from the Product Backlog block. In the Scrum methodology, the transition to the next sprint occurs in a certain period of time and does not depend on the readiness to solve problems, while in Kanban the transition is carried out when the condition is fulfilled - solving the tasks of the checklist of the current sprint. In either case, the instructor is required to make settings for each sprint in the distance learning system.

Assessment of student work is also possible using the tools of the distance learning system. In the Scrum methodology, the main assessed parameter is the number of tasks solved in a sprint; in Kanban, it is the time taken to complete one sprint. In addition, when using event monitoring tools in the distance learning system, the teacher can assess the contribution of each specific student to the solution of the project's tasks.

The experience of organizing the training of students in a distance format studying in the direction «Pedagogical education (with two training profiles)» at Kazan (Volga) Federal University, according to the proposed course recommendations, showed not only the assimilation of subject knowledge by students, but also the acquisition of experience in participating in project activities corresponding to modern flexible methodologies.

Conclusion

This study has analysed the possible implementation of the Agile Manifesto in digital didactics and the VUCA response to the challenges of the VUCA world. The technical aspects and methods of integrating Agile in education have been discussed. Agile principles can be implemented in transforming universities, the directions for the professional transformation of a teacher of the future have been identified. The described Scrum and Kanban approaches, which are typical for the Agile methodology can be successfully applied in new educational environments. Generally, it can be claimed that the educational model is becoming student-oriented. Teachers will offer new educational courses, while the Agile approach will allow to quickly integrate them into training courses and educational programs, just as the VUCA world requires.

Agile can be effective, especially where active and project-based learning can be applied. According to Agile, teachers become facilitators, coaches for students that are self-directed learners. The focus is not on rigid plans, rather flexibility is required to take into account students' feedback and their different abilities, interests, difficulties, and experiences, aiming at unlocking their hidden strengths and passions. The emphasis is on delivering the highest value, in terms of both course-specific learning outcomes and soft skills such as organization, planning, collaboration, and teamwork.

Agile is an important approach in building a holistic methodological basis for the digital educational process and it determines the essential aspects of managing the cognitive activity of students in a digital environment. The experience of conducting Scrum and Kanban lessons has shown that the use of Agile for organizing the educational process in the study of various lessons makes it possible to make meaningful learning possible for all participants of the process, contributes to the development of motivation in students and individualization of the educational process.

After the study, we are going to open the Center for Designing Multi-Level Teacher Education (Agile Center).

This project aims to develop new trajectories for teaching future teachers who can be flexible and mobile in a digital educational environment, able to navigate a rapidly changing world, interact with a transforming student and work in a transforming school. The model developed at the Agile Center undoubtedly takes into account the international experience of teacher training in the UK, Holland, Germany, Finland and the USA. The purpose of this center is to provide a new quality of training for competitive teachers and to form a holistic position in the educational process: "student - subject of learning: personality - personality - personality" by intensifying the educational process due to the technological renewal of an open, flexible, individualized continuous education throughout life. The results of the study can be used in different educational institutions, higher educational institutions, institutions of additional education after preliminary training of personnel by transforming traditional lessons using the Scrum-methodology of Agile project management.

Acknowledgements

This paper has been supported by the Kazan Federal University Strategic Academic Leadership Program.

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