APPLICATION OF THE AGILE METHODOLOGY IN THE PRACTICE OF PROJECT-BASED LEARNING IN THE TRAINING OF IT SPECIALISTS

Theoretical and practical issues of the active learning methods application using the high-profile methodologies aimed at finding effective learning technologies have been considered. There have been analysed the educational methodologies based on the Agile methodology to solve educational problems, taking into account the values and principles of the Agile methodology formulated in the Agile Manifesto. The project-based learning practice introduction in the educational process with the adaptation of the Agile methodology for teaching the “Architecture and analysis of software requirements”, “Software quality and testing”, “IT projects management” disciplines has been suggested, and the results of this approach have been analyzed.

Keywords: flexible project management in education, Agile methodology, Agile methodology in education, design technologies of education, IT specialists, technologies of team software development.

Introduction

General Problem Statement. The modern world of global challenges: the acceleration of social and technological change, the economy and society digitalization, the VUCA environment emergence characterized by the instability, uncertainty, complexity and ambiguity of the modern world, requires radical changes in the higher education. Universities must see this environment as a challenge, and not a threat. In these circumstances, the adaptation to the prevailing conditions is vital. New conditions require new people.

Therefore, on the one hand, the task of a university is to prepare a popular candidate at the labor market. A modern university should focus on the formation of a graduate with such qualities as the ability to a non-standard, adaptive thinking, the ability to develop a project, to achieve any goal, to formulate tasks that will be clearly defined and understood by each performer, the ability to quickly process information and the mental perception of the processed information, the ability to virtual cooperation, social intelligence, transdisciplinarity, etc.

On the other hand, the customers of the educational service – students – have also been changed. Mastering new technologies from childhood, they are not ready to spend a lot of time on gaining new knowledge and competences. In addition, they prefer convenient ways to obtain information: at a convenient time using any multimedia device [1].

These factors indicate that traditional educational technologies have become ineffective.

A modern university should create an environment for students that would promote the development of relevant competencies. One the approaches is to develop a technology based on the practice-oriented learning, and many researchers consider the method of project-based learning as the most appropriate mindset of the practice-oriented, competency-based approach.

Another innovation of the modern education today is the Agile methodology introduction into the educational process.

The challenges facing a university today and the opportunities posed by the development of new collaboration technologies have led to the Agile methodology penetrating the education system, and a number of educational practices based on it are already in place today. The Agile methodology, as a project management technology, allows you to develop project work skills.

Analysis of the Recent Research and Publications. Due to a growing interest in innovative teaching methods, in particular to the ones of student-centered active learning technologies, the implementation of which results in students gaining interdisciplinary knowledge and skills, creating real workable products and systems, and applying the Agile approaches to education, there are more and more publications on this topic. These approaches are widely used in the field of training engineering skills as well as specialists in software development (Software) and processing technologies (IT). In addition, the use of the Agile design methods in the educational process occurs in different directions.

So, many authors raise these issues and explore the effectiveness of the Agile and Scrum approaches directly in organizing the learning process.

Manokin M.A., Ozhegova A.R., Shenkman E.A. authors, in their concept-based work, provide a detailed review and analysis of educational approaches combined using the Agile design methods [1]. A special attention has been paid to the two most studied approaches: Agile teaching-learning methodology (ATLM) and eXtremePedagogy (XP), and some rec-
ommendations have been made to create methods for the learning process.

A number of authors study the project approach use applying the Agile methodology to solve targeted educational, organizational, organizational and methodological problems related to the educational processes of higher education.

So, the work of Tronin V.G. [2] proves the possibility and feasibility of applying flexible project management methodologies. The efficiency of Scrum application by the graduating department is considered, where the Scrum team is a team of teachers.

Mołdychy N.A., Naguibina N.I. authors, in their work [3], offer a model of practice-oriented learning applying the Agile principles in the management of structural units of a university to increase the efficiency and competitiveness of higher education.

The author of the article [4] Nikonova Ye.Z. considers the Scrum features regarding the possibility of applying this methodology in higher education to train specialists in the development and implementation of software products.

Lukashenko M.A. and Tielieguina T.V. authors [5–6] conducted a study of the activities of domestic experts on the implementation of the Scrum method in the learning process and analyzed its results. From the authors point of view, the Scrum-method introduction in the educational process is complicated by the lack of relevant educational and methodological support. Therefore, the possibilities of Scrum as a method of managing the creation of educational products are considered. The attention is paid to the combination of a flexible control based on the Scrum and the classic “cascade” model based on the Gantt chart.

The authors also propose concepts for teaching bachelors and masters, which allow to gain sufficient experience and knowledge for successful work in the IT industry using the Agile methodology [7–8].

Some works [9–11] are devoted to the issues of project-based learning where the practice of talent management on the Scrum technology and the implementation of project-based learning in the format of an IT startup are considered. Students, when developing projects, can embody and realize in their ideas the potential that is very necessary for an innovative and technological development of Ukrainian enterprises. According to the authors [10–11], a startup can become an innovative tool for training future IT professionals, which will help students gain their first practical experience and develop the competencies needed for their future professional activities.

In the context of the practice of applying the project-based learning using the Agile methodology, the formation of a development team plays an important role. The authors analyze the typical problems faced by the management in forming a project team, the typical roles of team members, determine the main and optional roles of team members [12–13] and analyze the experience of forming student project teams, of creating conditions for the “soft skills” formation in demand under present-day conditions [14].

Aim of the Research. Given the challenges of today, and perceiving them as an impetus to find new opportunities in higher education in the training of IT professionals, the scientific community is exploring different approaches to training a specialist in demand in the labor market. The aim of this work is based on the analysis of educational approaches to the formation of the graduate's abilities that will allow him to quickly and thoroughly, easily and firmly master life activities; it is to offer the project-based learning approach with the Agile methodology adaptation, where students learn about the IT industry activities, gain practical experience, learn to manage IT projects.

Statement of basic materials

Prerequisites for the project-based learning implementation

New conditions mean new opportunities. They just need to be used, especially if the previous features are no longer available. Thus, opportunities lie in responding to challenges by changing the philosophy of learning.

Obviously, there are two sides to the learning process: a teacher and a student. The role of a teacher is to start from the role of a teacher who imparts ready-made knowledge, to become a qualified consultant who directs the learning process to solve practical problems, and through management consulting methods, to encourage students to make the right choice of a problem and to identify the ways to solve it. In this mindset, a student becomes an active participant in the learning process; he becomes a teacher's ally in solving problems.

The traditional approach to learning is a process aimed at the acquisition by a student of certain knowledge, skills and abilities. That is, a student must Know, be Able, Possess (a skill). Is it appropriate in nowadays conditions? Obviously, it is not. First, a long transition from Knowledge to Skills leads to the fact that no one needs them anymore. This is especially noticeable when training an IT specialist. Secondly, the process is time consuming: a person carries out many activities, and each type of activities requires its knowledge, skills and abilities [15].

It is therefore necessary to teach abilities. Abilities are the characteristics of an individual that arise from birth or develop over a lifetime based on the experience and practice. An ability is manifested in how quickly and thoroughly, easily and firmly an individual learns the activities.

Knowledge is acquired because a person has the ability to perceive, remember and connect new knowledge with the existing bundle of knowledge. Skills appear only when there is the ability to adapt the acquired
knowledge to practical activities. A habit appears in the presence of the ability to reproduce the skills to implement knowledge in different situations.

Sustainable human abilities underlie individual conditions and performance. Such innate abilities as imagination, empathy, curiosity, persistence, creativity, etc. can be cultivated and amplified in a right environment. And in an environment where activities do not encourage these abilities, they may be underdeveloped and inactive.

Abilities such as adaptive and critical thinking, emotional and social intelligence, teamwork and meaning-making can be formed and improved over time [15].

Based on this, it is obvious that abilities not only have the key to a long-term and permanent relevance, but they can be cultivated without large investments, taking into account that everybody has them, and in the case of their use, they are rapidly evolving and strengthening.

So, what should a modern graduate of a higher educational establishment with an IT specialty look like?

He must have professional training, which includes a basic academic core, a specialized professional training, project management highly specialized Hard skills, operating in a stable environment and within one profession. He must have Digital skills. This category arose in connection with the global digitalization of our world. And Soft skills. They are universal and help to achieve success in any profession, they provide with high communication skills and self-organization, long-term planning skills, teamwork. Scientists from Harvard and Stanford claim that 85% of success in professional life depends on Soft skills.

It was believed for a long time that Hard skills should dominate; and therefore, the whole system of the world higher professional education was focused on the formation of Hard skills. But the consciousness of the importance of first soft and then digital competencies over the past 20 years has changed the Western education system. As for domestic higher educational establishments, most of them leave the focus on the formation of basic (hard) competencies in graduates, despite the fact that the lion’s share of professional achievements is provided by soft competencies.

A lack of IT specialists with developed relevant skills encourages the IT business to look for ways to solve the problem: they open their own universities, training centers, etc., where they prefer to teach such technologies and training methods as the method of business games, the case method, the project-based learning method, the gamification, the online platforms.

On the other hand, an IT student knows the requirements of a potential employer, assesses the chances of obtaining the necessary competencies in the higher educational establishment where he is studying, decides on the place of further acquisition of the necessary competencies.

### Practice of implementing the project-based learning using the Agile methodology

Taking into account the starting positions of today, higher educational establishments, to solve these challenges of today, are experimenting with different teaching methods and technologies, starting with the inclusion in the educational process of communicative trainings and ending with a complete restructuring of the educational process where the project-based learning dominates.

In the context of the project-based learning implementation, a motivating environment for cognition and development is created, in which the student learns to learn, which motivates him to act, to be through research, projects, communication, collaborations.

When introducing the practice of project-based learning, it is advisable to use an interdisciplinary approach, which aims to form students’ interdisciplinary thinking: a student learns to synthesize knowledge of different disciplines, to analyze this knowledge and to apply it to comprehensively understand a problem and to find solutions to it.

The search for new ways of learning encourages the use of effective methods and practices from other areas. So, it is natural to turn to the Agile philosophy, which has proven itself in the best way in software development and in the training of IT professionals. The philosophy of flexible work allows higher educational establishments to quickly adapt to changes and requirements of employers, and the Agile technology, as the one of project management, allows students to develop skills for project work.

The Agile methodology use in the practice of project-based learning is due to the fact that the Agile methodology is a much broader concept than methods and practices; it is a way of behavior, a culture and a way of thinking. It is not just a methodology, it is a common name of different methods and approaches to learning management, which focus team members on working together, teach to develop a strategy and tactics, to work in short cycles, they actively use feedback, they determine the choice by each participant of his area of responsibility, they have basically a personality-oriented approach. Therefore, the educational approach – a project-based learning is based on values borrowed from the Agile Manifesto.

The practice of implementing a project-based learning using the Agile methodology was applied in order to:

- help students get acquainted with different areas of IT, learn to work in a team, as well as understand their preferences for the type of activities;
- students receive an assessment of their activities;
- help the student to deliberately choose a master's specialty direction, or to make sure that his available
knowledge is enough for a successful work in the field.

The practical implementation of a project-based learning with the Agile methodology adaptation at the Computer Technology and Mechatronics Academic Department (CTM) as an experiment is as follows. The “Architecture and analysis of software requirements”, “Software quality and testing”, “IT projects management” disciplines, which are taught by the work’s author, from the second year to the fourth, are combined into a kind of educational module. Within this module of disciplines, students must go through the main stages of the software development life cycle: a project concept development, the requirements writing, the architecture planning, the code development, the testing. To create a holistic picture of the educational process and to qualitatively implement certain stages of the project, because, for example, the code development requires competencies that are formed within the other disciplines, this module is integrated with the other disciplines.

In contrast to a traditional educational process, where the unit of time is a semester, and students and teachers receive learning outcomes every 4 months, the Agile sprints introduction reduces the feedback cycle, allows to respond quickly to any changes.

Therefore, in practice, a semester is divided into sprints, and the duration of a sprint is 1 week (according to the schedule). Each sprint begins with a planning meeting, where students think about future work and assess the efforts that will be needed during the next week. The sprint ends with a retrospective (additional lesson-consultation): students analyze the work done, identify achievements and areas for improvement. Short feedback cycles also allow teachers to quickly identify problems and to take appropriate action.

Different approaches have been used to form teams, and the Agile methodology involves teamwork and collaboration, putting people and their interactions above processes and tools. The most interesting result was obtained when the motivating factor for the formation of a team was the project idea.

At the first stage, the students of an academic group are invited to choose a project topic without restrictions: any idea has a right to exist. As the experience has shown, at this stage, a team of like-minded people is being formed. The student leaders (first group) are immediately involved in the process; they are actively generating immediately discussed ideas. The students who fail to go beyond the specific tasks (second group) need time to adapt to a format unusual for them. In the process of discussing the ideas of the student leaders, some students from the second group begin to join the process of discussing the suggested ideas, which eventually leads to the formation of project teams. Then, the formation of project teams continues with the students of the second group who were not included in the already formed teams, by offering them to carry out projects in a particular area, and if necessary, by formulating a specific project theme, i.e. by creating the conditions familiar for such students. Thus, all the students of the academic group receive assignments and start working on projects.

In each project team before starting work, the roles are agreed, which in the process of work can be changed if necessary; the project teams can also change their composition. This develops the ability to adapt, which helps to maintain team spirit at the level of the whole group, not just at the team level.

One of the Agile methodology key principles is to build projects with motivated people. Students are motivated by success, by recognition of work results, by a high degree of responsibility, by the ability to realize their creative potential. If something went wrong, then according to the Agile methodology, the leader's task is to explain what mistake the performers made, and not to punish.

Motivators for students were at least a certification in subject module disciplines, and at most, a participation in competitions and contests of students of different levels, a bachelor's thesis defense, a creation of a meaningful portfolio in contrast to the traditional educational process, where a success is motivated by marks. In addition, students enjoy working on a real project, the topic of which is interesting for all the team members.

It should be noted about the “IT projects management” discipline taught last in the educational module. Given that students have gained practical experience working in a team, and some of them have tried themselves in the role of a Scrum master, the task of teaching the discipline for this category of students is to structure the already gained knowledge, and it is focused on finding and applying the latest advances in this field. In the future, it is planned to involve fourth-year students, within the “IT projects management” discipline, in the role of project managers of the junior project teams.

Results of the project-based learning implementation using the Agile methodology

Thus, the introduction of the practice of project-based learning with the adaptation of the Agile methodology has achieved its goal.

This practice clearly helps students get acquainted with different areas of IT and determine the priority of their future activities. The result of teamwork is very important. The application of the described approach made it possible to form the motivated project groups, where the ability to analyze and to think critically was acquired, non-standard solutions and innovative ideas were generated, where the students learned to interact, to create an atmosphere of cooperation, where everyone worked for results.

In addition, the interdisciplinary approach application plays an important role when students have a conscious demand for knowledge to develop and acquire professional competencies. The ability to constantly
learn is the ability of both the present and the future.

The students received their work evaluation in various formats. Most often, the completed projects ended with the defense of complex bachelor's theses with the development up to the master's theses, with a participation in scientific conferences of various levels, with a publication of the outcomes of their achievements in professional publications [17–18] and with a victory in an all-Ukrainian competition of student works.

The CTM Academic Department Graduates, who studied applying the project-based learning using the Agile methodology, are employed in various positions of IT companies.

But, even with the positive result of this approach implementation, there are a number of problems related to the management of its practical implementation on a larger scale involving the other teachers of the institution. These problems require a detailed analysis and they are the subject of a further research.

Conclusions

As a result, the theoretical and practical issues of the application of active learning methods using the high-profile methodologies aimed at finding effective learning technologies were considered. An analysis of the educational methodologies based on the Agile methodology to solve educational problems, taking into account the values and principles of the Agile methodology formulated in the Agile Manifesto, was carried out. The project-based learning practice introduction in the educational process with the Agile methodology adaptation for teaching the “Architecture and analysis of software requirements”, “Software quality and testing”, “IT projects management” disciplines has been suggested, and the results of this approach have been analyzed.

The obtained results have been analyzed and the conclusions have been made, where both the positive experience of implementing this approach and the problems that need a further research have been identified.

References

12. Bocharova, O.O. and Mnushka, O.V. (2020), “Rol' mol'ni grupi v komandi fahivciv pri roboti nad programnym proektom” [The role of a small group in a team of specialists in a software project], Proceedings of the II International scientific-

bezpechnyta” [Formation and management of a team of software developers], Bulletin of the National Technical University

ional'nogo standarta pedagoga” [Formation of flexible skills among students in the context of the implementation of the profes-
sional standard of a teacher], Bulletin of Tyumen State University, No. (4), pp. 222-234.

might be more important than reskilling in the future of work, available at: https://www2.deloitte.com/us/en/insights/fo-

VUCA-mira” [Strategies for Developing Universal Skills for the VUCA World], Forornezh University of Engineering

opment of a mobile application “City Parking”], Bulletin of Kharkiv National Automobile and Road University, No. 87, pp. 59-66.

vannya” [Architecture of the application for finding parking spaces], Bulletin of Kharkiv National Automobile and Road
University, No. 89, pp. 7-15.
Відомості про авторів:

Шапошникова Олена Павлівна
кандидат технічних наук доцент
doçent кафедри
Харківського національного
автомобільно-дорожнього університету,
Харків, Україна
https://orcid.org/0000-0002-0405-8205

Кірvas Валерія Вікторівна
науковий співробітник
Харківського національного
університету
Повітряних Сил ім. І. Кожедуба,
Харків, Україна
https://orcid.org/0000-0001-5310-6587

Інформація про авторів:

Olena Shaposhnikova
Candidate of Technical Sciences Associate Professor
Senior Lecturer
of Kharkiv National Automobile
and Road University,
Kharkiv, Ukraine
https://orcid.org/0000-0002-0405-8205

Valeriya Kirvas
Research Associate
of Ivan Kozhedub Kharkiv National
Air Force University,
Kharkiv, Ukraine
https://orcid.org/0000-0001-5310-6587

ЗАСТОСУВАННЯ МЕТОДОЛОГІЇ AGILE
В ПРАКТИКІ ПРОЕКТНОГО НАВЧАННЯ ПРИ ПІДГОТОВЦІ ІТ СПЕЦІАЛІСТІВ

О.П. Шапошникова, В.В. Кірvas

Сучасні виклики глобального світу – прискорення соціальних та технологічних змін, цифровізація економіки та суспільства, виникнення середовища VUCA, яке характеризує нестабільність, невизначеність, слизкість і неоднозначність сучасного світу вносять суттєві корективи в ринок праці: нові умови вимагають нових людей. Враховуючи висувані сучасності, як поштовх до пошуку нових можливостей у системі вищої освіти при підготовці IT спеціалістів, наукове спіттєвістю досліджує різні підходи для підготовки затребуваного ринком праці спеціаліста. Як показав аналіз публікацій, перспективною є концепція, де у центрі системи освіти стоять студенти, його запит на розвиток, враховуючи його особистості і можливості, навчальна, соціальна і усмішківна, де створюється освітнє середовище, в якому студент стає активним учасником процесу навчання, стає союзником викладача у вирішенні проблем. Метою цієї роботи є аналіз основних підходів для формування у випускника здатностей, які дозволяють йому швидко і грамотно спостерігати за динамічно змінюваними умовами ринку праці.

Інформація про авторів:

Olena Shaposhnikova
Candidate of Technical Sciences Associate Professor
Senior Lecturer
of Kharkiv National Automobile
and Road University,
Kharkiv, Ukraine
https://orcid.org/0000-0002-0405-8205

Valeriya Kirvas
Research Associate
of Ivan Kozhedub Kharkiv National
Air Force University,
Kharkiv, Ukraine
https://orcid.org/0000-0001-5310-6587

ІСПОЛЬЗОВАНИЕ МЕТОДОЛОГИИ AGILE
В ПРАКТИКЕ ПРОЕКТНОГО ОБУЧЕНИЯ ПРИ ПОДГОТОВКЕ ИТ СПЕЦИАЛИСТОВ

Е.П. Шапошникова, В.В. Кирвас

Рассмотрены теоретические и практические вопросы применения методов активного обучения с использованием гибких методологий, которые имеют целью поиск эффективных методик обучения. Проведен анализ образовательных методологий, основанных на Agile для решения образовательных проблем с учетом ценностей и принципов Agile методологии, сформулированных в манифесте. Предложено внедрение в учебный процесс практику проектного обучения с адаптацией Agile методологии для превращения дисциплин "Архитектура и анализ требований к программному обеспечению", "Качество программного обеспечения и тестирование", "Управление ИТ проектами" и "Программное обеспечение" результаты такого подхода.

Ключевые слова: гибкое управление проектами в образовании, Agile-методология, Agile в образовании, проектные технологии образования, ИТ-специалисты, технологии командной разработки программного обеспечения.