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MODERN APPROACHES TO INNOVATIVE PROJECT MANAGEMENT IN ENTREPRENEURSHIP EDUCATION: A REVIEW OF METHODS AND APPLICATIONS IN EDUCATION

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ABSTRACT

The pace of business and technological progress becomes faster nowadays. This happens on the background of increased competition. Because of these trends, enterprises and organizations increasingly rely on project management methods and processes to achieve commercial goals. As a result, higher education organizations offer curricula and programs aimed at improving the education. The purpose of this research is to determine the relevance of knowledge of modern methodologies in the labor market and to analyze the organization-related features of the process of learning innovative project management methods in the leading universities of Kazan and Elabuga cities, Russian Federation. The study used statistical analysis, a survey and testing. The survey involved 630 students from 8 universities of Kazan and Elabuga. The employers that took part in the survey were found to be interested in those employees, who knew the Agile methodology (28%). The “Project Management” course program gives a general idea of the modern technology of project management and offers insights into the general principles of using knowledge and skills to solve problems at work. The efficiency analysis of education, carried out to evaluate the teaching of modern methodologies, showed that more than 60% of students were aware of the importance of learning project management methods for successful employment. The correlation analysis showed (Pearson coefficient $r=0.67$) that students understood which innovative project management methods are in demand in the labor market. The survey, however, revealed that only 30% of respondents had a sufficient level of knowledge. This reflects the need to teach modern methodologies, such as PRINCE2, Scrum, and Agile, as separate disciplines in higher education establishments. These steps can significantly affect the quality of teaching and learning modern project management methodologies. If so, universities will strengthen their position in the educational services market by rapidly adapting to changes in the external environment. This will lead to the production of more competitive graduates.

Keywords: Agile Methods, Entrepreneurship Education, Innovation Method, Project Management, Labor Market.

INTRODUCTION

In modern settings, innovative methodologies are essential to successful enterprise operations (Akhmetshin et al., 2018). Higher education establishments should promote student skills and focus on innovation (Celuch et al., 2017). Advances in entrepreneurship education have led to the creation of a student-oriented and experience-based learning environment that is part of academic courses and curricula (Byrne et al., 2014). As a result, a modern university permanently creates new educational products, improves their quality, and also conducts internal reengineering of educational processes in order to increase education efficiency (Bhat & Singh, 2018). A new goal of project management education is to teach students to handle a real project rather than to prepare trained technicians, who understand project management methodologies but have difficulties when adapting to a complex project environment (Wu, 2018).

Methodological and theoretical approaches to innovative project management in entrepreneurship were discussed by Svejvig & Andersen (2015), Vala et al. (2017). Innovation activities are usually organized as “*projects*” with a wide scope. A project may cover several business areas, practices and processes. They require different organizational capabilities in order to achieve positive results, be agile and effective. At each stage of project-related activities, from project selection to implementation and monitoring, several steps are necessary, such as the constant project monitoring and thorough resource distribution (Vala et al., 2017). If ideas or innovation capabilities are good enough after several attempts or processes made to reduce risk and enhance potential success, then innovations are prepared to be implemented in the context of a business project (Svejvig & Andersen, 2015).

Methods and tools for project management allow you to assuredly define the goals, the main stages, the necessary resources, and the timing of project implementation. They also allow making necessary adjustments promptly (Tebekin, 2017). A right strategy is selected to effectively achieve results using various tools and methods (Hornstein, 2015). A number of national and international standards, representing the Project Management Body of Knowledge (PMBOK), were developed and published (ISO 10006:1997).

Levina et al. (2017) and Cai et al. (2017) were developing an idea of global informatization as a necessary sign of progress, the idea of using information technologies to solve problems of optimization and increase the efficiency of education.

The functional structure includes nine sections (phases):

1. Project Integration Management.
2. Project Scope Management.
3. Project Time Management.
4. Project Cost Management.
5. Project Quality Management.
6. Project Human Resource Management.
7. Project Communication Management.
8. Project Risk Management.
9. Project Procurement Management.

All these functions are closely intertwined, and therefore, project management is an integrated process (Abramov et al., 2008). Let us consider the basic modern methodologies of project management.

The Adaptive Project Framework (APF) refers to the use of regulated (adaptive) project frameworks. This methodology contributes to project improvement at each implementation step thanks to previous experience (Maneva et al., 2017). By setting project goals and continuously monitoring the operation, the manager ensures marginal success and creates value for the future client (Brown, 2016).

Agile project management methodology applies to a project, which is divided into several small parts that will be completed by a specific date. This is opposed to a lengthy implementation of the entire project. An important role here is assigned to human resources. This is why a manager must be able to organize an active project team, the relationship in which is based on flexibility, cooperation, and on the search for compromises (Schön et al., 2017).

The PRINCE 2 (PRojects IN Controlled Environment) methodology guarantees that any project is justified and aimed at creating special value. The planning begins with the setting of consumer desires and benefits, and with the proper assessment of costs and resources. The PRINCE2 Project Management has two parallel areas called themes and processes; there is seven of each, which derives from seven principles (Vaníčková, 2017). The PRINCE2 is a process approach to project management (Mousaei & Gandomani, 2018; Axinte et al., 2017).

The Scrum is built on the idea of prioritization. In other words, objectives are accomplished in accordance with the value assigned by the client, but his/her requirements may change (Machado et al., 2013). Likewise, this methodology is applicable where empirical control of the project is required. Once each iteration is completed, a result is obtained and showed to the client, so that it can be evaluated, decisions can be made related to any change, and the team can synchronize daily and make the necessary adaptations. Thus, there is always a collaborative alignment between the client and the development team (Ariza et al., 2018).

The Critical Path Method (CPM) is used to figure out the route or the longest path in the project (Zareei, 2018). The critical path determines the duration of the entire project. By setting the most important tasks, manager can determine the completion time and assess the main stages and final milestones of the project (Samayan & Sengottaiyan, 2017). Moreover, once the project duration is calculated and the main activities are planned, manager should check the schedule for logic correctness. The Gantt chart is commonly used in CPM scheduling. The chart shows critical stages and operations with red bars. This methodology facilitates the daily comparison of planned and actual parameters (Montazeri, 2017).

The Critical Chain Project Management (CCPM), derived from the Theory of Constraints, is a project planning system that embraces critical chain, scheduling, buffer management, and pipeline planning for multiple projects (Leach, 2014).

The Kanban is used to produce a slow but constant flow of results during a long period of work. These results are then visualized to identify problems on production. The awareness of reasons behind the downtime and the loss of time allows a manager to promptly improve performance (Walker, 2016).

The Waterfall model is a process flow planning method. Its principle is to break the working process into sequential tasks with specific objectives. A task or a chain of tasks usually ends with a milestone or a key project event (Mitsuyuki et al., 2017). Participants perform tasks one by one but do not move to a new task before completing the previous one. A detailed plan assumes the existence of a detailed graphic scheme and budget size. The types of graphs used in

a waterfall model are project calendar network diagrams and Gantt charts (Patanakul & Rufo-McCarron, 2018).

Today, flexible approaches like Scrum and Agil to project management gain popularity: 71% of organizations report the use of flexible approaches in their projects, while every fifth project uses a hybrid (flexible+non-flexible) approach (Kuhrmann et al., 2017, Sopykhanova, 2017). Flexible project management methodologies become popular among software companies that seek to create high-quality products in less time and with less related documentation (Serrador & Pinto, 2015). The benefits from using flexible methodologies include: a work environment that supports creativity and productivity, rapid adaptation to changes, and being valuable to the client thanks to improved ways of need identification and prioritizing (Hobbs & Petit, 2017). The classic project management methodology, such the waterfall model, is a linear design approach that significantly increases the project time (Ahimbisibwe et al., 2015; Sousa, 2018). The most popular Agile methodology has its own drawbacks, especially when used in large and complex projects. This is why it is combined with Scrum to deal with large-scale projects (Sulaiman & Mansor, 2018). After combining the strength of two methodologies, the proposed hybrid model has four phases, inception, elaboration, construction, transition and adapts seven principles. These principles are applied and utilized during those phases (Papadakis & Tsironis, 2018; Salhi & Jemmali, 2018). This methodology gives freedom of tailoring artefacts, roles according to project need, however project size, and team size should be kept in mind before applying it in any organization. A combination of different development approaches can be implemented regardless of the industry (Cooper, 2016).

Innovations in project management that are based on hybrid technologies are also in focus (Tebekin, 2017a). The key to a successful approach is that an IT project with high and low risks must be regulated so that resources, technologies, and methods can be applied to each task. It should be noted that given approaches to innovation project management in educational organizations complement each other (Kalimullin et al., 2016).

Nabi et al. (2017) and Briz-Ponce et al. (2017) investigated modern teaching methods in higher education institutions. They indicated the interest of students in courses when mobile learning, interactive and distance learning technologies are in use.

An innovative approach to organizing an integrated study of project management in entrepreneurship was applied by Dayan et al. (2017), Yunis et al. (2017) and Secundo et al. (2017). They believe that innovative knowledge management is critical to the development and implementation of strategies for project organization and management. These authors studied the effect of business cooperation between entrepreneurs and university students on a negotiated systematic approach to the generation, selection and implementation of entrepreneurial projects in operating companies. This includes the call for proposals from creative students and entrepreneurs.

The analysis of literature shows an open issue of innovative management methodologies in education. It happens that the role of education in project manager training still has something in it to study. Consequently, the purpose of this study is to analyze project management methodologies that are in demand in the labor market and to evaluate the way in which innovation methods are taught during the course of project management in higher education establishments.

METHODOLOGY

Research Design

This research uses a hybrid (qualitative+quantitative) method. Based on the goals set, an empirical study was developed, organized and conducted. This study had two blocks: block 1 analyzes the labor market in Kazan (Russian Federation), block 2 implies survey and testing. The objective of the first block is to find out what innovation project management methodologies are most in demand among employers. The objective of the second block is to determine the level of knowledge of modern project management methodologies, as well as to determine the interest of students in their study. Such an approach to research allows determining the relevance of using “*Project Management*” programs in higher educational establishments in Kazan.

Initial Data: Block I

The most popular in Kazan job search websites (<http://kazan.rabota.ru>, <http://job.ws/kazan>, <http://ru.jooble.org>, <http://kazan.hh.ru/>) underwent statistical analysis to determine project management methodologies which are in demand among the employers. The search for vacant jobs was carried out by the keyword: project management. The total amount of processed items (vacancies) is 1020 from all websites. The vacancies were sorted by modern project management methodologies, the knowledge of which is required by employers.

Participants

The survey involved 630 students from 7 universities of Kazan, 3 state universities and 4 private universities, and from one university of Elabuga, aged 20 to 23 years, pursuing a bachelor’s degree. The number of students from each university is presented in Table 1. Students were going through the “*Project Management*” course or “*Project Management in Logistics*” course in each of the given universities.

Higher Educational Establishment	Institute, Department, Specialization	Number of students
Kazan Federal University	Elabuga Institute (branch) of KFU, Economics and Management Department. Bachelors training direction: “ <i>Management</i> ” (specialization: “ <i>Logistics and Supply Chain Management</i> ”).	85
Kazan State Energy University	Institute of Power Engineering and Electronics. Bachelors training direction: “ <i>Electrical Engineering and Nanoelectronics</i> ”. (specialization: “ <i>Industrial Electronics</i> ”, “ <i>Illuminating Engineering and Lights</i> ”).	86
Kazan State Academy of Architecture and Construction	Institute of Economics and Management in Construction. Bachelors training direction: “ <i>Building and Construction</i> ”. (specialization: “ <i>Real Estate Examination and Management</i> ”, “ <i>Urban Construction and Economy</i> ”, “ <i>Maintenance of Housing and Utilities Sector and Urban Infrastructure</i> ”, “ <i>Production Management</i> ”).	68
Kazan Branch of the International Institute of Economics and Law	Institute of Economics and Management. Bachelors training direction: “ <i>Management</i> ” (specialization: “ <i>Marketing</i> ”, “ <i>Project Management</i> ”, “ <i>Financial and Management Accounting</i> ”, “ <i>Financial Management</i> ”).	82

Kazan State Agrarian University	Institute for Economics. Bachelors training direction: “ <i>Management</i> ” (specialization: “ <i>Production Management</i> ”, “ <i>Production System Organization</i> ”).	78
Kazan Institute of Finance, Economics and Informatics	Institute of Economics and Management. Bachelors training direction: “ <i>Economics</i> ” (specialization: “ <i>The Economics of Enterprises and Organizations</i> ”).	75
Kazan Institute of Social and Humanitarian Knowledge	Institute of Economics, Management and Law. Bachelors training direction: “ <i>Economics</i> ” (specialization: “ <i>Business Accounting, Analysis and Examination</i> ”, “ <i>Banking and Finance</i> ”).	69
Kazan Institute of Economics, Management and Law	Institute of Economics, Management and Law. Bachelors training direction: “ <i>Management</i> ” (specialization: “ <i>Organization Management</i> ”).	87

The survey was conducted among students of third and fourth years of study because senior students are potential workers, who are ready to enter the labor market. They also have the best theoretical and practical experience.

Survey and Testing

The survey consisted of four 3-point Likert scale questions, where “1” means “yes”, “2” means “no”, and “3” means “not sure” (Kitsantas et al., 2009). The questions and their objectives are presented in Table 2. The test consisted of 10 questions, which implied one correct answer out of three that were offered. The maximum score is 10, where “8-10” is excellent, “6-7” is good, “3-5” is satisfactory, and “1-2” is “fail”. The survey was made thanks to the collaboration with chancellors, deans, and academic advisors.

Question	Answer	Academic Objective
(A) Do you think “ <i>Project Management</i> ” is a necessary course to take in a university?	1-yes 2-no 3-not sure	Determining the general attitude and interest of students in learning “ <i>Project Management</i> ”.
(B) Do you have a full access to contemporary academic literature containing information on the subject?	1-yes 2-no 3-not sure	Determining the appropriateness of literature used to teach “ <i>Project Management</i> ”.
(C) Do you think the knowledge of modern project management methods increases the likelihood of getting a good job?	1-yes 2-no 3-not sure	Determining student awareness of benefits that the study of modern project management methodologies brings with it.
(D) What modern project management methodologies would you like to study intensively during your time in the university? (underline the relevant)	Agile Scrum Waterfall PRINCE2 CPM Don't know	Determining modern project management methodologies that are most demanded.

Statistical Analysis

Data analysis was performed using STATISTICA software. For convenience, part of data was presented as histograms made in Origin 9.1. The responses of respondents were assessed using a 95% confidence interval. To calculate the confidence interval, Student’s t-distribution

was used with a significance of $p \leq 0.05$ and a standard deviation (σ). The null hypothesis was decided to be $M > 1.20$, where M is the mean value. A t-test was performed to test the hypothesis for each question. The survey error was $6 \pm 2\%$ because not all questionnaires were filled out correctly.

The vacancy error was $6 \pm 2\%$ because not all employers indicated on their websites the knowledge of specific management methodologies in requirements.

In order to check the student's knowledge of modern project management methodologies for the compliance with the requirements of employers, a correlation analysis was performed. This correlation analysis was between the answers to question (D) and the results of the labor market analysis.

Pearson's correlation coefficient (r) was chosen as a measure of the strength of a linear association between two variables because it is best suited for the ranked series (Zhou et al., 2016).

The survey validity was measured by calculating the average score in testing to determine the quality of project management education.

Research Limitations and Implications

The labor market analysis was performed on one city, but the sample can be stretched to cover the entire Russian Federation for higher accuracy. The study involved third- and fourth-year students. That is why a number of problems and difficulties that were identified in the study, as well as recommendations for solving them, can be applied only to groups of third- and fourth-year students and programs that were designed in senior courses. Note that universities that took part in this research were of different types: agrarian, architectural, energy, economic and federal.

RESULTS

The analysis of the job search websites revealed that Agile, Prince2, CPM, Scrum, and Waterfall methodologies are the most popular among employers (Figure 1).

Figure 1 shows that the general knowledge of the theory of project management is most demanded in the labor market. This field of knowledge involves the ability to plan work and organize the process; the ability to set goals and to prioritize; and the fixation on achieving a quality result. In entrepreneurship, practical application of knowledge of modern methodologies is relatively new and a priority path. The list of requirements for a specialist working with Agile is only 2% shorter. This can be explained by the benefits that Agile brings (improved quality of results, adaptation to changes, fast and efficient performance, controlled project implementation schedule). Almost one third of enterprises are interested in specialists, who can operate with Scrum and PRINCE2. These enterprises are mainly those related to IT and consulting, but specialists as such are also required in other public and private organizations. The knowledge of the traditional Waterfall methodology was requested by 15% of employers. The knowledge of the CPM is the least demanded because it is less efficient in services and software businesses, and does not take into account dependencies between resources. Projects with a critical path can often be not finished when necessary. The remaining 4% of employment ads did not have relevant information.

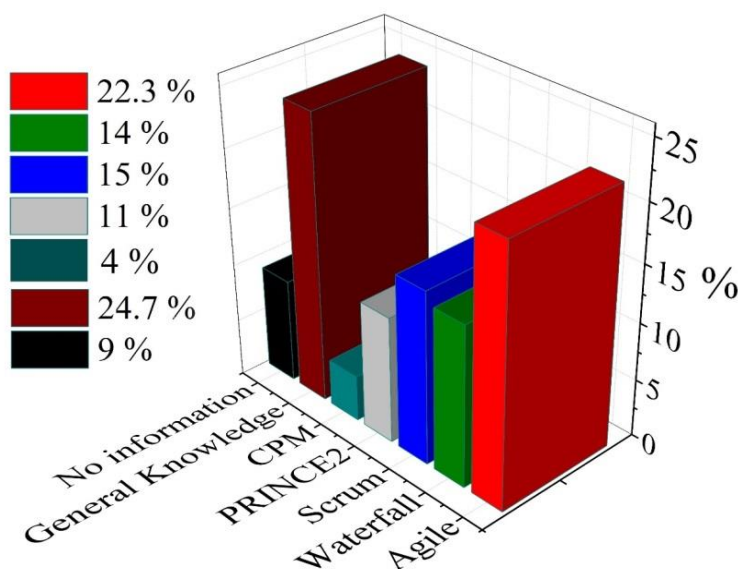


FIGURE 1
KAZAN LABOR MARKET DEMAND FOR KNOWLEDGE OF MODERN PROJECT MANAGEMENT METHODOLOGIES

Information is essential to any education. Respondents are interested in exploring innovation project management methods, as they believe that this contributes to their future employment (84%) (Figure 2).

The survey shows that students are interested in high-quality future-proof education, but there were also those who did not know about innovative methodologies (6%) (Figure 2).

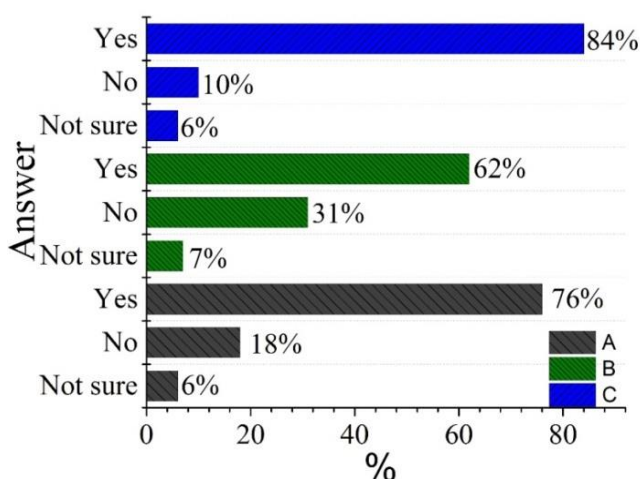


FIGURE 2
STUDENT INTEREST IN THE STUDY OF MODERN PROJECT MANAGEMENT METHODOLOGIES

In Figure 2 the following designations are used:

A: Student awareness of the importance of studying “*Project Management*”.

B: Is recent literature on innovation project management methodologies available to students?

C: Does the knowledge of modern project management methods increase the likelihood of getting a good job?

The survey shows that $\geq 50\%$ of students are motivated to study innovation project management methodologies because they believe that this contributes to their future employment (84%). However, students report on a limited range of related literature provided in universities. The literature that is available covers only 62% of issues. These data indicate a lack of educational materials. Thus, there are universities with traditional education programs, and this is a problem when the objective is to teach familiarize students with project management methodologies.

The majority of students (>60%) are interested in studying Agile, Scrum, Waterfall and CPM (Figure 3). This suggests that students are aware of the demand for these methodologies in the labor market. Despite this positive result, only 9% of students consider the PRINCE2 methodology necessary for studying, and this is when it is rather popular among employers (Figure 1). The reason behind this phenomenon may be the lack of available information on this methodology.

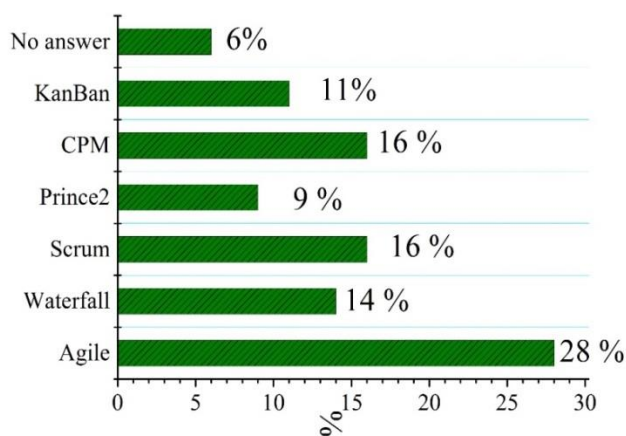


FIGURE 3
SURVEY RESULTS ON STUDENT AWARENESS OF THE EXISTENCE OF
INNOVATION PROJECT MANAGEMENT METHODOLOGIES

An interesting fact is that between the answers of students about them knowing about the existence of innovative project management methodologies (Figure 3) and the results of the labor market analysis (Figure 1), there is a small but positive correlation ($r=0.67$). This means that students have an idea of what requirements are imposed by the employers.

Figure 4 shows a rather low level of knowledge of modern project management methodologies (Appendix), 30% to 33%. This suggests that teaching of modern management methodologies is not a common practice in universities. Students learn the basics and tools of project management together, and the innovation project management methodology is not a separate discipline. Testing revealed the mean score higher by $6 \pm 0.45\%$ in respondents from state universities than in respondents from private establishments (Table 3). This may indicate that in state universities, innovation methodologies are delivered earlier than in private ones.

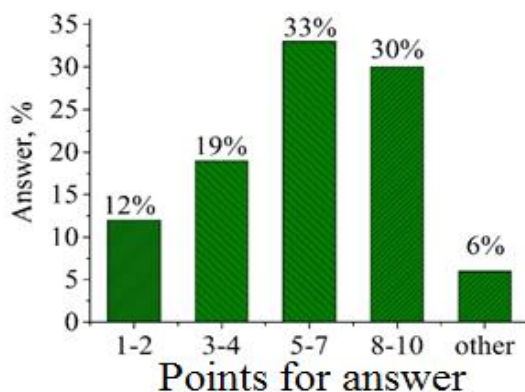


FIGURE 4
MODERN PROJECT MANAGEMENT METHODOLOGY TEST RESULTS

Higher Educational Establishment, type of ownership	Total respondents	Mean	Significance (1-tailed) P-value	σ	Normal Deviation
State	317	6.32	≤ 0.05	6.30	2.06
Private	313	5.23	≤ 0.05	6.20	2.08

Note: Test value was considered to be 1.20.

A statistical analysis of knowledge that students had on innovation project management methodologies showed that, on average, all respondents scored 5.82 ± 2.07 points. This means that, on average, students possess only a superficial knowledge of innovation methods. Thus, innovation project management methodologies are only in the middle of the introduction stage.

DISCUSSION

Presently, there is no one opinion on the most effective method of teaching entrepreneurship (Bhat & Singh, 2018). Universities around the world conduct student surveys to formulate current problems and trends in national innovation-driven education (Nabi et al., 2018a). By contrast to this research, authors often compare the use of project management methods in different industries, such as IT, medicine, manufacturing, building and construction, and entrepreneurship. Aside from that, they also often consider project management effectiveness (Walker, 2016; Azanha et al., 2017; Sulaiman & Mansor, 2018).

They found out that flexible methodologies are the most popular ones among employers. The effectiveness of flexible Scrum was found to be higher than, for example, the strict Waterfall methodology (Takpuie & Tanner, 2016).

In order to follow the economic trends and needs, the US universities actively implement curricula and certified programs to study innovation project management methodologies (Valle & O'Mara, 2015). Studies on the implementation of Agile in the US universities have scientific value. According to the pilot modules for Agile project management, trainees will acquire leadership, analytical, and communication skills. The basics of working in a virtual team using

modern web-based tools for collaboration and communication are essential for students to learn. The same applies to communication skills (Uskov et al., 2016).

Some scholars stress that education programs based on PMBoK methodology are developed with a real up-to-date value for students (Winkler et al., 2018). Another important aspect is to admit project, program and portfolio managers to the training of educators and staff working in the field of education (Angelov & de Beer, 2017). In this context, a critical technique is to provide a teacher with feedback from students so they could learn from their own actions (Gonçalves et al., 2017).

The teacher must monitor the behavior of each student during the learning process, analyze his/her actions, and bring the analysis results to students so that those who have no experience could acquire practical skills at a level that allows applying those skills in real situations (Lang, 2017).

Since 2004, Tokyo University of Technology has been using role-based training as part of project management education to systematically increase the knowledge, which was gained in-class, to the level suitable for practical use (Tachikawa & Nakamura, 2013).

The university that delivers knowledge of innovation project management methodologies faces great risks due to the specifics of project teams. Risk management, in turn, is a separate area of knowledge that requires qualifications and experience to apply it in practice. However, project executors in a higher educational institution are scientists, who usually do not possess special skills (Lugovoy & Lysenko, 2013).

CONCLUSION

The labor market seeks for project managers with the knowledge of PMBoK, PRINCE2, CPM, and other equally important innovation project management methodologies. It was found out that students are interested in learning them. The “Project Management” discipline is studied in all universities that were considered in this research, but this course covers only the basic tools of project management. It does not provide an in-depth study of a particular methodology. The specific features of considered management methodologies do not allow using them in the teaching and learning process straight away. First, they must be adapted to an educational institution. There is also a lack of access to recent literature on the subject. Testing revealed an average level of knowledge of modern project management methodologies, 5.82 ± 2.07 points out of 10. Research results indicate that innovative methodologies should be further developed and introduced into higher education of the Russian Federation, so that graduates could meet high requirements of the rapidly developing field of project management.

APPENDIX

Modern Project Management Methodology Test

Choose the correct answer from a, b or c.

1. What is the name of the Japanese project methodology?
 - a) Kanban.
 - b) Agile.
 - c) Waterfall.
2. What element is not part of the PRINCE2 methodology?

- a) Planning.
 - b) Control.
 - c) Integration.
3. What is the type of a model structurally representing the relationship between the elements in a system?
- a) Functional model.
 - b) Information model.
 - c) Behavioral.
4. In project management methodology, what is a project?
- a) Financial records.
 - b) Working papers.
 - c) Interrelated activities aimed at accomplishing an objective within a given period of time and with an established budget.
5. List software packages that you know are for project management.
- a) Maple, Matcad.
 - b) Integra, MS Office, OnLine, SPSS, Time EX.
 - c) Open Plan, MS Project, Primavera Project Planner, Spider Project, Time Line.
6. In project implementation, by whom are taken the most risks?
- a) all participants.
 - b) investors and ordering parties.
 - c) vendors.
7. What methodology is used both in software development and in the real sector?
- a) PRINCE2.
 - b) CPM.
 - c). SCRUM.
8. What does “project implementation” mean?
- a) Creation of conditions that are needed to accomplish a project in a required time.
 - b) Monitoring, regulating and analyzing project progress.
 - c) A series of actions from the project plan that are carried out to achieve a project goal.
9. How do you call the distance between the start and the finish of a project?
- a) Phase.
 - b) Cycle.
 - c) Result.
10. The PMBoK is a:
- a) Project Management Body of Knowledge.
 - b) Project Life Cycle.
 - c) Project Structure.

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