# GETTING TO KNOW FUTURE SPECIALISTS WITH INNOVATION: THE CASE OF ŠIAULIAI STATE COLLEGE

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**Annotation**

*The article presents a study of future professionals' knowledge of innovation. Šiauliai State College I-IV-year students formed the research sample group. 103 respondents took part in the survey. Students usually get acquainted with innovations from the press, via the Internet, Youtube channel or social networks, as well as during college lectures. Research has shown that students are best acquainted with technological innovation and the stage of generating innovation ideas. The higher education institution should strengthen the studies of other stages of innovation development, especially commercialization.*

**Key words:** *Innovation, acquaintance with innovations, STEAM, Šiauliai State College.*

**Introduction**

Innovation is identified as a priority both in public life and in the state and inseparably in private business. Every entrepreneur strives to constantly improve the performance of his company in the market in order to take a leading position in the competitive struggle. Reducing costs alone is not enough to win, it is important to think about growth, added value, which can only be achieved through the use of knowledge and the development of innovation processes. There are many breakthrough inventions in Europe, but Lithuania unfortunately is not among the leaders in this regard and ranks only 40th in the global innovation index. The state needs to look for new solutions by supporting and promoting the development of innovations, strengthening the existing positions of business in those development processes that have a positive impact on the Lithuanian economy.

The European Innovation Scoreboard (2022) shows that Lithuania is one of the countries implementing the most innovations in the European Union in the last 7 years. Lithuania's aggregate innovation index has risen to 92% of the EU average in 2022. This compares with 72.1% in 2015 and 85.6% in 2021. But some indicators of this index, such as employment share knowledge-intensive services, high and medium high-tech knowledge sharing and use of information technologies, do not reach the average of EU countries and have not shown the necessary progress in recent years.

Innovation is based on the creativity of employees, knowledge of technologies in a specific field and entrepreneurship. At present, students of Lithuanian education and research institutions are taught these knowledges using innovative teaching methods, such as project activities, but the innovations themselves are often very fragmented for future professionals. It depends on the opportunity to visit the businesses that initiate, develop and implement those innovations. Also, from the environment in which they live and what sources of information about innovation they can access. The topics of innovation in curricula are usually not directly included in the subjects of secondary education schools, it all depends on the teaching methods used by teachers. However, students have the opportunity to participate in a variety of complementary activities, such as STEAM (Science, Technology, Engineering, Arts and Math), which contribute to a better understanding of innovation. Students' cognitive opportunities are further expanded when they choose to study subjects related to innovation through production practices and internships and engage in innovation-creating projects. However, their participation in these activities depends both on their personal goals and on the opportunities offered by the higher education or other educational institution.

In the research it was important to find out how high education institution students as future specialists get acquainted with innovations and get involved in innovation development activities.

**The goal of the research** is to find out how students get acquainted with innovations by interviewing students of the Faculty of Business and Technology of Šiauliai State College.

**Research objectives**. The article first reviews the concept of innovation and the possibilities of cognition of innovation from the theoretical point of view. The research methodology is discussed below and the research results are presented. It was determined how and which innovations students know best.

**Research methods** are the following: theoretical, empirical analysis, questionnaire, descriptive statistics, classification and generalization of data.

**The concept of innovation**

Innovation is a new or substantially improved product or process including production, construction or other processes, new marketing methods, new business, workplace organization or external communication methods introduced to the market, public administration, social, cultural field. It is important to know that the word “innovation” is derived from the Latin verb *Innovare*, meaning “to renew” (Strazdas, Bareika, 2010). In everyday communication, innovation is often referred to as “novelty“. Innovation means the updating, improvement and development of a process or product, which can also be a service. One of the most popular Hauschildt (1999) model in the scientific literature (Garcia, Calantone, 2002; Murswieck et al, 2017) distinguishes four levels of innovation:

- *Incremental innovations*. Improving an existing idea (goal) using existing methods. The degree of innovation is very low, because existing products, processes or business models are made with only minor changes.
- *Goal-driven innovation*. A new goal emerges which is achieved through unchanged or new measures. Activation of innovation is often driven by customer needs or market demand. The degree of innovation in this case is average.
- *Medium innovation*. New measures are proposed to meet existing or new targets. Medium-sized innovation is mainly based on the company's R&D activities, which often have a higher degree of innovation compared to the innovation brought about by the new goal.
- *Breakthrough innovations*. These innovations are particularly characterized by the fact that the unknown need of the customer is met by completely new means or by applying new technology. Breakthrough innovations show a very high level of innovativeness and are innovations that undermine established production (service provision) principles.

Different types of innovation are possible:

- Improving processes by constantly developing new solutions and organizational innovations.
- Product development: the development of innovative products or product features.
- Service innovation: development and implementation of new services for customers and partners.

In research, innovations are classified according to the functional areas they affect (see Figure 1). However, a more general classification of innovations by content, user impact and visibility is also possible:

1) *a product innovation* is one that is characterized by a new product design, innovative performance or meets new customer needs and is usually visually recognizable. This innovation can vary in scope from a completely new product (service) to a small improvement that gives the product (service) new features.

2) *technological innovation* is components, component relationships, production or service delivery methods, processes, combinations of those methods or processes that are applied to the production of products or the provision of services, based on new knowledge in various fields (engineering, management, etc.). This type of innovation is often closely related to organizational innovation which according to S. Pogosian and I. Dzemyda (2012) is a change that can take place in marketing, purchasing and sales, administration and personnel management policies.

3) *social innovation* is defined very broadly and not unambiguously in the scientific literature, but Vveinhardt and Kuklytė (2016) perhaps best describe it stating that “It is the development of social and economic well-being, representing the principles of traditional entrepreneurship, economic profit, social needs (motives)”. These innovations range from new models of social service delivery to specialized online social networks, from new forms of student training or staff development to measures to encourage people to switch cars to bicycles or the creation of global fair-trade networks.

| ***Functional areas innovations affect*** | |
|---|---|
| *Content* | Organizational, social, technological |
| *Level of implementation* | Scientific, technological, engineering, industrial |
| *Extent of implementation* | Single, multiple |
| *Speed of innovation* | Fast deployment, incremental deployment, slow deployment |
| *Extent of innovation* | Local, regional, international |
| *Efficiency* | High, stable, low |
| *Impact* | Economic, social |

Fig. 1 Classification of innovations
Source: compiled by the authors based on A. Maziliauskas (2017), B.Čėsna (2011)

Researchers distinguish between 5 and 11 stages of innovation creation (Česna, 2011; Kogabayev and Maziliauskas, 2017; Banelienė et al., 2020), but the most frequently mentioned are:

- Generation of ideas and development of innovation concepts;
- Designing;
- Production of a test sample (prototype);
- Testing and improvement of the test sample (prototype);
- Presenting to users the manufactured, fully prepared innovative product, technology, system, method;
- Commercialization;
- Production start-up.

Providing the necessary resources, team collaboration, and good relationships with the end user have the greatest impact on innovation. Important are those details that turn the original idea into a completely attractive product for the end user. Innovation is very useful for companies to differentiate themselves from their competitors. In other words, value creation is an essential characteristic of innovation. Today's business is challenging to survive in the market because the supply covers a very wide range of the market, so companies need to innovate to create unique competitive product features. Such products usually have their starting point in a barely recognizable niche and initially appeal to only a small number of customers until they become a dominant market factor and push other previously developed products and often the companies that produce them out of the market. Innovation management and implementation models are developed in business enterprises or other organizations the result of which are new products and services for future markets or society. Innovative business models are emerging - start-ups, business transfer models that create added value by creating new knowledge and implementing innovations as well as implementing them in practice. In the future such business models should appear which are not even possible to imagine today. Small teams able to operate flexibly will develop innovative concepts from innovative product idea to its maturity in the market.

**Opportunities to learn about innovations**

The aspect of acquiring knowledge about innovations has not been sufficiently studied in the scientific literature (Donate, Guadamillas, 2011). As stated by Girnienė (2014), organizations often lack systematicity and expediency in managing knowledge, an open environment that promotes employee trust is not created, when employees willingly share knowledge and acquired experience. Sometimes, knowledge acquisition is still understood very narrowly, only as the learning of its members, ignoring the possibilities of organizational learning (Balvočiūtė, 2007). However, more scientific works are emerging in which innovation is analyzed in the context of knowledge sharing and management (Atkočiūnienė, Petronytė, 2018), but empirical studies are rarely carried out.

One of the ways of learning about innovations is STEAM activities carried out in preschool institutions, secondary, vocational schools, colleges and universities. STEAM education - integral education of students' abilities in the context of natural sciences, mathematics, technology and engineering which focuses on the complex knowledge of reality phenomena, application and problem solving (Šlekienė, 2018). Based on research related to the evaluation of STEAM activities (Hidi & Renninger, 2006; Hidi & Ainley, 2008; Dorph et al., 2017) it can be said that participation in STEAM activities is an important factor for young people to choose a professional career related to technical, engineering sciences. Creativity and technical creation as an interdisciplinary approach is emphasized in STEAM education, rationally combining it with the peculiarities of individual educational subjects. Many Lithuanian secondary and higher education institutions are involved in STEAM activities, but these activities do not always include innovation. Sometimes learners simply get acquainted with the basics of applying engineering sciences in practice or participate in some stage of innovation development. On the other hand, not all educational institutions have the opportunity to participate in these activities.

Cooperation between science and business is another activity that helps to get acquainted with innovations. These projects financed by the structural funds of the European Union and usually initiated by business enterprises are intended to involve scientific and study institutions in the creation of innovations. These activities aim to develop student training, research and business in the direction of innovation. However, this cooperation has a number of problems such as the small scope of activities of scientific and business entities, the small number of products created by new knowledge and commercialized. Joint projects usually involve only researchers, not students. Insufficient funds are allocated for student training or

they cannot fully engage in business and scientific cooperation activities due to a very intensive study process.

Another opportunity for students of vocational and higher education studies to get involved in the knowledge of innovations are production practices and internships. However, even here, students have very different opportunities, since internship companies have different experiences, opportunities and unequal conditions they can offer to get acquainted with innovations. Students who carry out semester or research summer internships while participating in projects initiated by the Research Council of Lithuania and other institutions supported by European Union funds and dedicated to these activities can be most actively involved in these activities. However, the funds allocated for the implementation of these projects are not large, and in addition, few students from one institution can join the projects. The quality of scientific research or practice also depends on the conditions created by the company and the extent to which a researcher or intern can directly engage in the creation or implementation of innovations in the company.

**Research methodology and results analysis**

**Methodology of research.** The research was conducted at the Šiauliai State College from March 23 to April 23, 2022. The research instrument - an anonymous survey questionnaire (https://apklausa.lt/f/ar-esu-susipazines-usi-su-inovacijomis-l3reql1/answers/new.fullpage) was composed of five closed type questions - two of them were demographic questions, the other three - related to knowledge of innovations according to their types, knowledge circumstances and stages of their development. In order to find out which innovations (according to their three types) were most remembered by the respondents, one open-ended question was presented. The questionnaire was placed and the link was sent to the respondents using the website www.apklausa.lt. Targeted selection was applied in the study - students of the Faculty of Business and Technology were chosen, who during their studies at least get acquainted with innovations from a theoretical point of view. 135 questionnaires were sent, 103 were returned. Questionnaire return rate - 76 percent. Data analysis was performed by calculating averages and comparing the opinions of students of individual study programs, distinguishing the main circumstances and methods of getting to know innovations, the types of innovations that students got to know best.

**Analysis of research results.** Almost half of the students are representatives of business and public management, almost a third – engineering, a fifth – social sciences and a tenth – informatics, it was determined after performing the analysis of the demographic data of the respondents who participated in the study (see Figure 2). Such a distribution of respondents corresponds to the structure of all students studying at the faculty according to study programs.

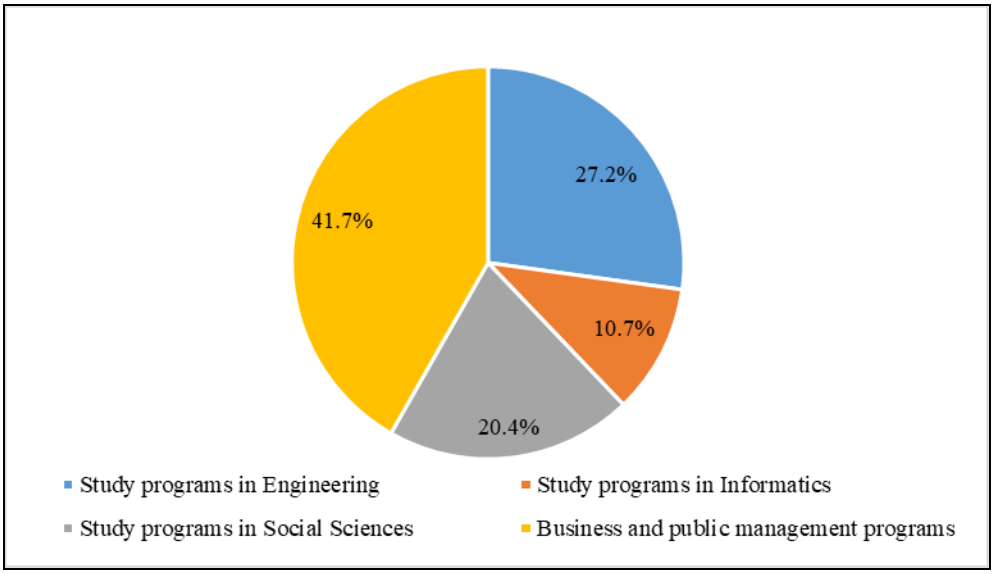


Fig. 2 The study program in which the respondents are studying.

Most of the interviewed students are studying in higher courses (about 75 percent) and only a quarter are in the first year. Internships start in college in the II year and continue in the III and IV years, so it can be said that most of the respondents already had the opportunity to get acquainted with innovations during the internship.

It can be assumed that nowadays it is not difficult to get acquainted with innovations, because they are found in many areas of our activity: at home, at work, in the science, etc. However, after analyzing the students' answers to the question of which innovations they are familiar with, it was found that only a little more than a third (36.6 percent) of the students had already gotten to know technological innovations, 24.2 percent of respondents answered that they already know about product innovations, a fifth - about social innovations, and 18.6 percent. respondents answered that they do not know what innovations are and did not have the opportunity to get acquainted with them. (see Figure 3)

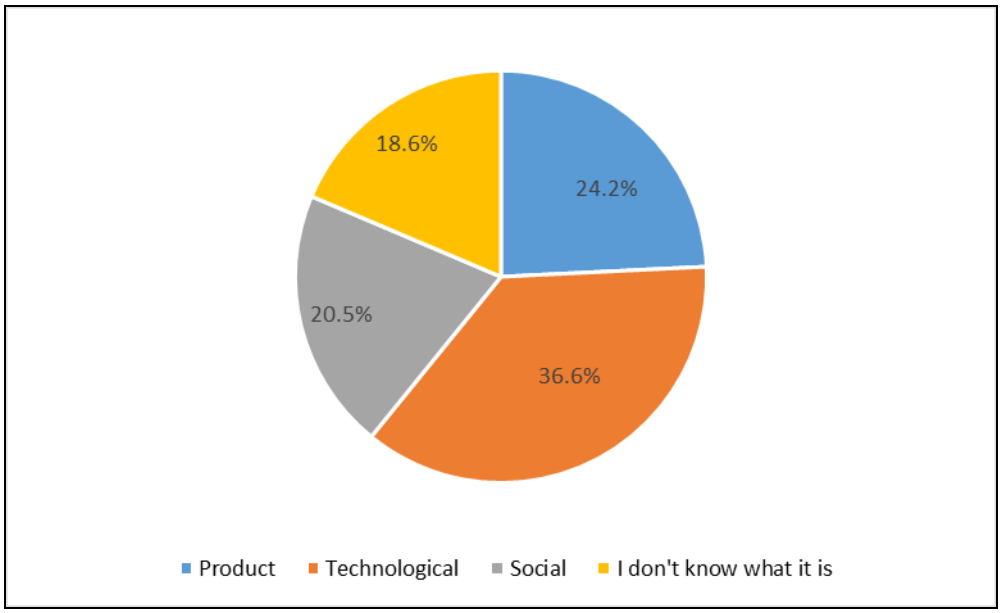


Fig. 3 Students' acquaintance with innovations according to the type of innovation

The respondents got acquainted with innovations in different ways and under different circumstances. 10.6 percent met some of them while studying at school, during field trips to companies. Less than a tenth (8.4 percent) got to know about it from the stories of relatives or friends. Another smaller part got to know innovations while working in companies before studying. Almost a fifth of the respondents - in the press, Internet, YouTube channels, social networks. The same number of respondents got acquainted with innovations during lectures at college, slightly more than a tenth - during practice, the smallest part (3.1 percent) of students got to know innovations when they started working during their studies. A tenth of the respondents (12.8 percent) did not have the opportunity to familiarize themselves with innovations at all (see Figure 4). This shows that students usually get to know innovations not by directly observing or participating in innovation creation activities, but virtually, or knowledge about innovations is transmitted by other people, in the case of the study, teachers.

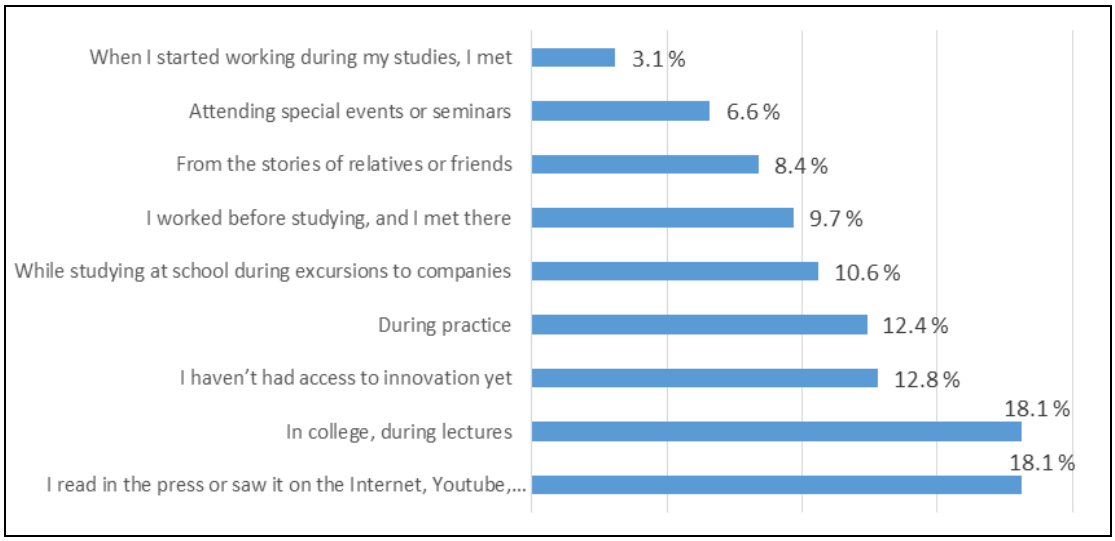


Fig. 4 Circumstances of students' acquaintance with innovations

Based on the results of the research, it can be stated that the stages of idea generation and concept development were indicated as the best known by 16 percent of the respondents. A similar share went to innovation design - 14.3 percent. 12 percent of the respondents were familiar with the production, testing and improvement of a test sample (prototype). The same part of the respondents was familiar with the presentation of the innovation as a fully manufactured product to consumers. The production start-up stage is familiar to a tenth of the respondents, and the commercialization stage - only 4 percent respondents. It is important to note that the largest share - as much as 18.9 percent of all respondents indicated that they are not yet familiar with the stages of innovation development (see Figure 5). The last choice correlates with the answer to the question about the known type of innovation, so it can be said that if the respondents are not familiar with the stages of innovation development, in this case they do not know what innovation is and do not recognize different types of innovation. It is also important to note that respondents are most familiar with the first two stages of innovation development, which are usually characterized by non-standard, creative solutions. The least known is commercialization, which is indicated in other studies (Leichteris E., 2011; Giriūnienė, Benetytė, 2012) as the most risky and complicated process of transferring the economic benefits of an innovation.

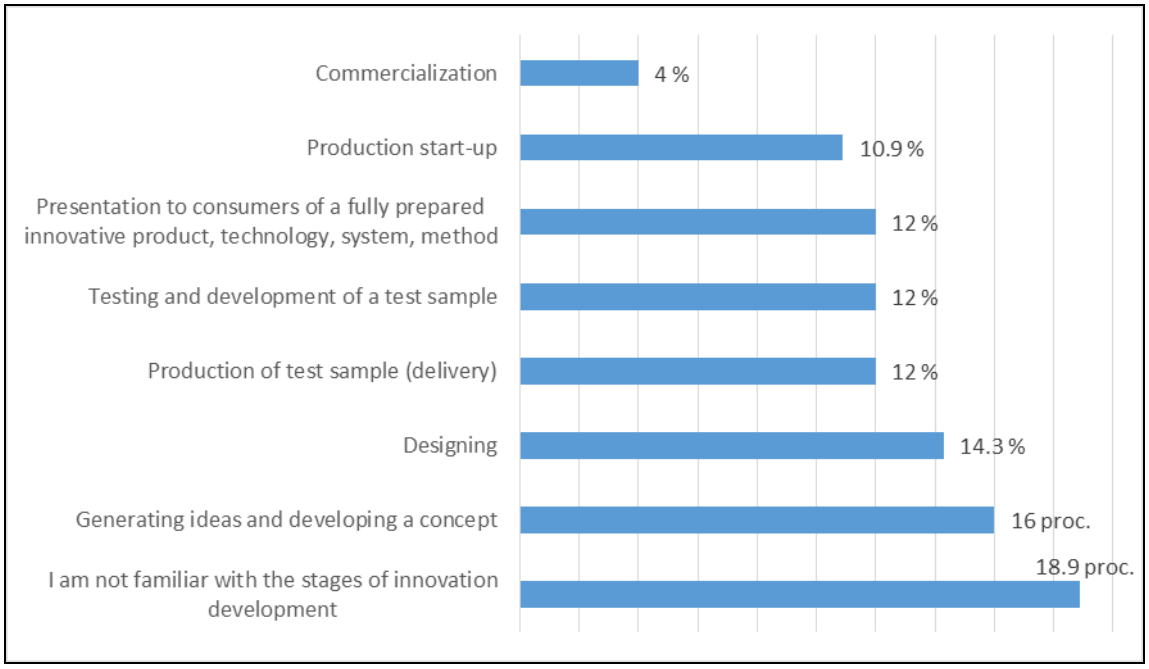


**Fig. 5** Acquaintance of students with innovations according to their development stages

Innovation thrives when people are motivated to work and the organization supports their creativity. However, it is necessary to constantly assess the possible obstacles that can prevent the emergence and development of innovations. Despite the fact that a relatively large part of the respondents have not yet come across innovations, the rest are already familiar with the most diverse innovations. Products, technologies, systems, methods, etc. innovations with which the respondents are familiar are presented in Table 1:

Table 1

**Innovations known to students**

| | |
|---|---|
| **Product innovation** | Mobile phone, robot-pump, drones, etc., "Agrifac, "Agronutrition", "Knauf", ceramic acoustic and EKO blocks, spray vitamins "Smart way", MD panels, lasers. |
| **Technological innovation** | LECTRA cutting machine, 4.0 industry, abandoning gluing of frames with sintepon and foam rubber and switching to sticking sintepon to the frame, innovative and integrated business management system Lean (2), Kanban, Poka Yoke, meat processing technologies, Nvidia DLSS (Deep Learning Super Sampling), improvement of car technologies, improvement of tractor technologies, improvement of computer technology, Autocad, Trumph Trupunch, Inventor, Photoshop, Solidworks, Revit100, Adobe Indesign, Corel draw, production of Mdp panels, fireproofing of metal structures, new Graco painting equipment. Belzona products for pipeline repair, automatic production lines, new generation glass carving machines HEGLA galactic, laminated glass cutting machines HEGLA prolam 37 and 46, glass tempering glaston VC500, glass processing (bending, grinding, polishing) trout machines, installation and commissioning of automated packaging lines , equipment maintenance. |
| **Social innovation** | Innovations in museums (Palace of Rulers, Basketball Museum, etc.), libraries (e.g. Povilas Višinskis Public Library of Šiauliai County) employment app, digitized cemeteries, opportunity passport, integrated criminal process information system, marketing innovations. |

The examples of the best remembered innovations provided by the respondents show that product and social innovations are less familiar compared to technological innovations. The most examples of technological innovations were presented by students of engineering study programs, who had more opportunities to get acquainted with the latest technological equipment, programs and process management systems.

**Conclusions**

According to the study, students are most familiar with technological innovations. Product and social technology innovations are familiar to almost the same number of students - about a fifth. A similar number of students did not have the opportunity to get acquainted with any innovations and innovations at all.

The circumstances in which students get to know innovations are very diverse, but they usually learn about them in higher education institution during lectures or find them on the Internet, social networks, YouTube channels or read about them in the press. A little less gets to know them during practice. A similar proportion of students did not yet have the opportunity to familiarize themselves with innovations. Before studying in higher education institution, only a tenth of the students got acquainted with innovations while studying or working.

The analysis shows that the students know the generation of ideas and concept development the best, and the commercialization of an innovative product the least. Other stages, such as: production start-up, design, presentation of the manufactured and fully developed innovative product to consumers, etc. are less familiar to students. According to the presented examples of innovations, it was established that technological innovations, various equipment, new programs, innovative management systems are best remembered. This shows that students pay more attention not to the final innovative products themselves, but to the innovative product development processes. This aspect of the study is important to encourage higher education students to engage in innovation studies. Also, the higher education institution should look for teaching methods that would help students better understand the commercialization of innovations and encourage their greater involvement in the development of innovations both during studies and in further professional activities.

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