2. Болотнова Н.С. Ассоциативное поле поэтического текста как отражение когнитивной деятельности читателя // Вестник Томского государственного педагогического университета. 2019. Выпуск 2 (199). С. 41–47.

3. Болотнова Н.С. Поэтическая картина мира и ее изучение в коммуникативной стилистике текста // Сибирский филологический журнал. 2003. № 3–4. С. 198–207.

4. Даль В.И. Толковый словарь живого великорусского языка: в 4 т. М.: Терра, 1994. Т. 2. С. 27.

5. Ефремова Т.Ф. Новый словарь русского языка. Толково-образовательный. М.: Русский язык. 2000. Режим доступа: http://www.rudict.ru›slovar-efremovoy.html (дата обращения: 22.10.2020).

6. Кубрякова Е.С., Демьянков В.З., Панкрац Ю.Г., Лузина Л.Г. Краткий словарь когнитивных терминов. М.: МГУ, 1996. 245 с.

7. Маслова В.А. Поэт и культура: концептосфера Марины Цветаевой: учебное пособие. М.: Флинта, 2004. 256 с.

8. Рубина Д.И. Окна. М.: Эксмо, 2012. 276 с.

9. Тарасова И.А. Идиостиль Георгия Иванова: когнитивный аспект: монография. Саратов: Изд-во Саратовского университета, 2003. 280 с.

10. Толковый словарь русского языка / Под ред. Д.Н. Ушакова. М.: «Советская энциклопедия»; ОГИЗ, 1935–1940. (4 т.) Режим доступа: http://wwwenc.biblioclub.ru›Encyclopedia/117 (дата обращения: 22.10.2020).

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Inventive activity as the main component of engineering education: historical insight

The article provides a historical overview of engineering inventions that have a tremendous role in the development of modern engineering. It emphasizes the importance of inventive activity in the education of engineers. Thus, it is considered to be involved in educational process as an integral part in forms of different inventive tasks.

Key words: invention; inventive activity; engineering education; development; technology.

The core component of the engineering profession is invention as the ability to solve technical problems by introducing something new using different approaches. Current trends in engineering education emphasize the ability to experiment, research, analyze and solve.

Engineering does not mean only the ability to put into practice already known solutions, but to a greater extent to employ something that has not existed before. Considering the current state of inventive activity in engineering, it is better to refer to the historical stages of its formation.

Technical progress depends on the development of civilization just as well as evolution of civilization is impossible without progress [1, p. 5]. It is known that human civilization is based on the transformation of the natural world with the help of tools, and the creation of various technical means. The history of creation at the same time is the history of engineering.

The development of engineering activity could be divided into three main stages:

The first stage is the Ancient World. The technique was based on symbols (calculations, numbers, drawings) and technical experience. It was understood not rationally, but as the joint efforts of man, spirits and gods.

At an early stage of development, a scientist often needed only to observe natural phenomena. Many of the discoveries were accidental or presented a by-product of a major experiment. The objective world became diverse, along with this a person wanted to know more. Curiosity, thirst for new knowledge became the driving force of progress. The discovery of the first elements is the starting point of modern industrial invention.

Let us look at some ancient inventions and their relationship to modern engineering advances.

Concrete has been known for a long time, in Ancient Mesopotamia, its production was simple and inexpensive, but the use of the broadest construction time was short. It was ideal for the rapid growth of Empires, but there were also disadvantages, compared to stones, for example, it was much less durable. Roman engineers found a solution. Instead of sand, they used «pozzolan» – a mixture of volcanic ash, pumice, etc. Seawater was used as a liquid to make the mixture stronger. As a result, concrete of increased properties was obtained: waterproof and wear-resistant. Monuments and buildings made of it, have not been destroyed up to these days.

For the huge city of Rome with a population of about a million people, the issue of water supply was acute. Water was delivered directly from the mountains through man-made canals that passed inside the hills and was delivered clean to the city.

Engineering invention was an opportunity to create the new future. The main task was the application of achievements, the use of laws and natural

resources to solve specific problems, goals and objectives of mankind.

The most important engineering inventions belong to such scientists as:

– Archimedes is a scientist who laid the foundations of mechanics, hydrostatics. He organized the mass production of military equipment [2, p. 80].

– Sostratus of Cnidus is the architect of the Pharos Lighthouse in Alexandria, one of the 7 wonders of the world, the height of which, according to various sources, ranged from 111 to 180 m, and which light was visible at a distance of 50 km.

– Heron of Alexandria is a famous engineer of the past, who made significant discoveries in the field of mathematics, physics and engineering. The founder of Technical School in Alexandria, the author of the first book on geometry, geodesy, mechanics and optics.

Ancient engineering inventions made a great contribution to the development and formation of technical progress at various stages. Technologies were modified, improved and new ones were developed on their basis.

Instruments and approaches have changed but scientific and technical creativity remains an important, distinctive feature both for ancient and modern engineers [3, p. 38].

Creating something, an engineer with his imagination may see the final product of his intellectual work. This ability is always in demand in the labor market.

As you know, the creative abilities of a person could mostly be reflected in activities. So, inventive tasks should become an integral part of engineering education. There are a lot of them:

– engineering projects,

– summer industrial practice,

– scientific conferences,

– participation in grants,

– academic mobility.

It is impossible to imagine modern engineering without experience accumulation of our predecessors. No one could invent anything without the knowledge gained from the great minds of the past. Thus, every engineer must know the past of his field and value it.

Литература

1. Акимова К.С. Краткая история развития инженерной деятельности // Электронный научно-методический журнал Омского ГАУ. Вып. №2. 2016. С. 1–5.

2. Бондаренко С.Б. Жизнь и смерть Архимеда Сиракузского // Философия науки. 2013. № 2. С. 78–81.

3. Лопатухина И.Е. Очерки по истории механики и физики. Санкт Петербург: ББМ, 2016. 204 с.

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Case-study technology and flipped classroom approach to teaching engineering students

The paper gives an overview on the implementation of the case-study technology integrated into the flipped classroom and investigates its potential for both teachers and learners. The authors present the outcomes gained from the experience of the case-study technology implementation in physics. The research shows that the use of the described technology enhances students' motivation and improves their academic achievements.

Keywords: flipped classroom approach; case-study technology; learning environment; student's motivation; academic achievements; involvement.

Nowadays the «flipped» approach to teaching has become particularly attractive because of availability of vast internet resources among which video and audio that can easily adopt to any discipline. The integration of ICTs empowers teachers and learners, transforming teaching and learning process from being highly teacher-dominated to student-centered and offers them many opportunities to study anytime and anywhere.

According to the flipped classroom approach, what is usually done in class and what is usually done at home is shifted or flipped. Instead of learners listening to lectures on, say, Physics in class and then going home to work on a set assigned problems, they read materials and watch videos on physics before attending class and then involve in class in active learning using labs, case-studies, or experiments. A main principal of the flipped classroom is that work usually done as homework (e.g. synthesizing, problem solving, analyzing, essay writing) is better undertaking in class with the guidance of the teacher. Watching videos or listening to lecture is better carried out at home. Thus, the term flipped or inverted classroom [2, p. 54].

A literature review helps us observe the benefits of using the flipped classroom approach to the teaching and learning process as follows: learner goes at his or her own pace; doing «home assignment» in class gives teachers deeper