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TEACHING BIOLOGY WITH STEM TECHNOLOGY

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It goes without saying that it is important for today's young people to pass on knowledge in close contact with life (R., July 2008). The pace of intensive development of the agrarian and industrial era subsided, and it was replaced in a short time by the era of new technology and information. Science and education have always served to improve the quality of human life, and as science develops, the quality of life increases, and the knowledge gained yesterday remains unrealized today (Савенков, 2008). And it is not surprising that the knowledge gained today will not be valid tomorrow. Behind any success lies great creativity, independent work. Therefore, the best lesson will be if the student works harder than the teacher in the lesson. (Barab S., 1997) getting students to work hard on their own is not an easy task, so every subject teacher should contribute to this by using the research and optimal methods developed in this direction.

The STEM (Science, Technology, Engineering, Maths) method of Education, which is the basis of our research, is one of the methods of teaching a child skills and research. The STEM method is aimed at developing universal skills of the XXI century (4K-critical thinking, creativity, communication, teamwork) in the process of solving subject and interdisciplinary problems, that is, solving in pairs or groups with a functional distribution of roles, helps to develop teamwork and communication skills. The proposed task and material allow you to develop skills in working with information, critical thinking. (Stebbins, M., 2019) in this study, we intend to demonstrate the role and path of development of this educational system in Kazakhstan by identifying the issues of importance in it by differentiating STEM and traditional methods of Education.

In addition, we will consider the features of the construction of educational tasks and teaching biology in primary, basic and general secondary education using the STEM education system within the walls of the school.

Keywords: *Stem, biology.*

STEM education and the structure of use in schools

In the past decade, there has been an increasing focus on education in the fields of science, technology, engineering, and mathematics (STEM), with calls for greater emphasis on these subjects and improvements in their curricula and teaching methods. STEM education, a term used collectively to refer to these subjects, has garnered attention in the political arena and among educators. Prominent reports from influential educational, political, and business organizations advocate for the expansion and enhancement of STEM education. The rationale behind these recommendations is multifaceted. One key argument is that STEM education can lead to gainful employment and is crucial for a country's potential for innovation. Furthermore, many employers and government officials believe that scientific and technological literacy is essential for all individuals, particularly the youth, regardless of whether they pursue STEM-related careers. In a society abundant in scientific and technological advancements, such literacy is important for individuals to be informed consumers, thoughtful participants in democratic decision-making processes, and to have a holistic understanding of the world. Thus, STEM education serves the purpose of training scientific and technical professionals, fostering integration in advanced research and development, and cultivating a scientifically and technologically literate and well-informed society. (А., Изучение естественных наук в логике STEMобразования: концепция и практика , 2018.)

STEM encompasses four primary disciplines. Science involves the study of the natural world, including the laws of physics, chemistry, and biology. It encompasses the interpretation and application of facts, principles, concepts, and conventions related to these disciplines. Science represents both a repository of accumulated knowledge and a process of scientific research that generates new knowledge.

Integrated STEM education encompasses various goals that developers of educational programs aim to achieve. Considering these goals is of utmost importance in the development of educational activities, as they serve as the driving force behind the iterative process of educational improvement. The project data revealed five primary goals for students and two goals for teachers:

Goals for students:

• STEM literacy: Fostering students' understanding and proficiency in STEM subjects.

• 21st-century competencies: Equipping students with the skills necessary to thrive in the modern world, such as critical thinking, problem-solving, collaboration, and communication.

• STEM workforce readiness: Preparing students for future careers in STEM fields.

• Interest and engagement: Cultivating students' curiosity, passion, and active involvement in STEM learning.

•Ability to establish connections between STEM disciplines: Developing students' capacity to recognize and utilize the interconnections among different STEM fields.

Goals for teachers:

• Advanced knowledge about STEM content: Enhancing teachers' understanding and expertise in STEM subject matter.

• Advanced knowledge of pedagogical content: Equipping teachers with effective instructional strategies and approaches for teaching STEM concepts.

When it comes to the structure of using STEM education in schools, there are a few key aspects to consider:

Curriculum Integration: In STEM education, the curriculum is designed to integrate the four disciplines (science, technology, engineering, and mathematics) rather than teaching them as separate subjects. This integration allows students to see the connections between these disciplines and understand how they relate to real-world applications.

Project-Based Learning: A central component of STEM education is project-based learning, where students engage in hands-on activities and projects that require them to apply their knowledge and skills to solve complex problems. These projects are often open-ended, allowing students to explore different solutions and develop their creativity and critical thinking abilities. (Гусейнов А.З., Турчин Г.Д. , 2015)

Authentic Context: STEM education emphasizes the use of authentic contexts and real-world problems to make learning more meaningful and relevant for students. By connecting classroom learning to real-life situations, students can see the practical applications of STEM concepts and develop a deeper understanding of their importance.

Collaboration and Teamwork: STEM education encourages collaboration and teamwork among students. It recognizes that solving complex problems often requires a collective effort, and students learn to work together, share ideas, and communicate effectively. Collaboration also reflects the collaborative nature of many STEM careers, where professionals from different disciplines work together to innovate and solve challenges.

Career Exploration: STEM education aims to expose students to a wide range of STEM-related careers and opportunities. It helps them understand the relevance and potential pathways in these fields, fostering their interest and motivation to pursue STEM-related studies and careers.

Professional Development: Implementing STEM education effectively requires ongoing professional development for teachers. Educators need to acquire the knowledge and skills necessary to integrate the different disciplines, design engaging projects, and facilitate collaborative learning experiences.

It is important to note that the structure of using STEM education in schools can vary depending on the educational institution, resources, and specific curriculum guidelines. Schools may adopt different models or frameworks, such as STEM academies, STEM-focused schools, or integrating STEM principles into existing subject areas. STEM education offers a unique structure for teaching and learning that integrates science, technology, engineering, and mathematics to develop students' critical thinking, problem-solving, and collaboration skills. By using project-based learning, authentic contexts, and technology integration, STEM education provides students with opportunities to engage with real-world challenges and prepares them for future careers in STEM fields.

STEM education has been gaining popularity in schools worldwide due to its emphasis on integrating science, technology, engineering, and biology into the curriculum. The structure of use of STEM education in schools varies depending on the educational system and individual school's goals and resources. However, there are some common ways in which STEM education is implemented in schools:

Dedicated STEM programs: Some schools have dedicated STEM programs or academies that focus specifically on STEM subjects. These programs often offer specialized courses and activities that integrate the four disciplines and provide students with in-depth STEM experiences.

Cross-curricular integration: Many schools choose to integrate STEM principles across multiple subjects and grade levels. Teachers collaborate to design interdisciplinary projects and lessons that incorporate STEM concepts, allowing students to see the connections between different subject areas and apply their knowledge in real-world contexts.

Project-based learning: Project-based learning is a common instructional approach in STEM education. Students work on hands-on projects that require them to apply STEM knowledge and skills to solve authentic problems. These projects often involve research, design, prototyping, and testing, fostering creativity, critical thinking, and collaboration among students.

Use of technology and digital resources: STEM education encourages the use of technology as a tool for learning. Schools may provide students with access to computers, software, and other digital resources that support STEM learning. This includes using simulation software, coding platforms, data analysis tools, and online resources for research and exploration.

Partnerships with external organizations: Schools often collaborate with external organizations, such as universities, research institutions, and industry professionals, to enhance STEM education. These partnerships can provide students with access to experts, mentorship opportunities, internships, and real-world experiences that bridge the gap between classroom learning and the professional STEM world.

Professional development for teachers: Effective implementation of STEM education requires well-trained teachers who have a strong understanding of the STEM disciplines and how to integrate them into their teaching. Schools may provide professional development opportunities, workshops, and resources to support teachers in developing their STEM instructional practices.

STEM-focused schools: Some educational institutions are entirely dedicated to STEM education. These schools often have a specific mission and curriculum that revolve around STEM subjects. They may have specialized facilities, equipment, and partnerships with STEM-related organizations to provide students with a comprehensive STEM learning experience.

STEM clubs and extracurricular activities: Many schools offer STEM clubs or extracurricular activities to supplement classroom learning. These clubs allow students to explore their interests in specific STEM areas, engage in hands-on projects, participate in competitions, and collaborate with like-minded peers. Examples of STEM clubs include robotics clubs, coding clubs, and science fairs.

Questionnaire for teachers of different schools about STEM education and the traditional education system

The result of the resulting survey can be summarized as follows:

General conclusion:

1. 61.1 % of the teachers participating in the survey are women, and the remaining 38.9 % are men;

2. The vast majority of teachers participating in the survey work in secondary education institutions (44.4 %). There are also teachers who provide education in schools and institutions of additional training for gifted children and in universities;

3. The vast majority of teachers teach students in grades 7-11;

4. The vast majority of teachers are teachers who provide education in the field of Natural Sciences. However, there are also teachers who provide education in the humanities;

5. 88.9 % of Teachers said that the tasks in the textbook should be improved, and 61.1 % concluded that the tasks were suitable for the age of the students themselves;

6. When compiling tasks, only 50 % of teachers said that they use special methods. In particular, they showed that they work with the method "differentiated method from easy to difficult;

7. A number of Teachers showed that when drawing up tasks, there are fewer difficulties and what they consider important;

8. In STEM education, 38.9 % of teachers were unaware, while the rest of the teachers said they were familiar with this new education system;

9. The advantages and disadvantages of compiling training tasks on STEM were also shown; Our recommendations and disadvantages of the study:

10. 54 teachers took part in the survey. In this direction, the study can be further deepened, covering a large scale.

11. 50 % of the surveyed teachers are teachers with 1 year of work experience; this is probably the only reason why teachers are not aware of the STEM method. After all, young teachers have little experience, and most of them have only university education. This means that at the faculties of teacher training in universities, emphasis should be placed on STEM and the direction of training through the project. The competent authorities should also monitor. 57

12. It turned out that 72.2 % of teachers work with written tasks, 61.1 % with test tasks, 55.6 % with individual tasks and 50 % with group tasks; when analyzing this section, it is necessary to reduce test tasks with only one correct answer as much as possible, and instead focus on Written tasks that increase research and critical thinking skills.

13. It turned out that the task is compiled by the teachers themselves and the management uses school textbooks, didactic tools and the internet; during the preparation of the task, seminars and instructions were developed for teachers on how to prepare tasks that enhance research and critical thinking skills and have a connection with everyday life, and the prepared tasks should be supervised by the school management.

As a conclusion, it was found that there are advantages and similarities between the compilation of educational tasks on traditional and STEM education. It would be a light if we could analyze both methods and bring the best aspects of both into our education system, filtering our national values.

In the end, I took a test from students about a biological topic. At first, they passed on with the traditional training system. The total figure is 62.8%. In the next class, this topic was explained by STEM, and tasks based on STEM were compiled and distributed to students. The total task was given a full 35 minutes. After the practical part, testing on simple relations and simple line graphs was obtained. The test result is 88.4%.

Table 1 – Traditional education system

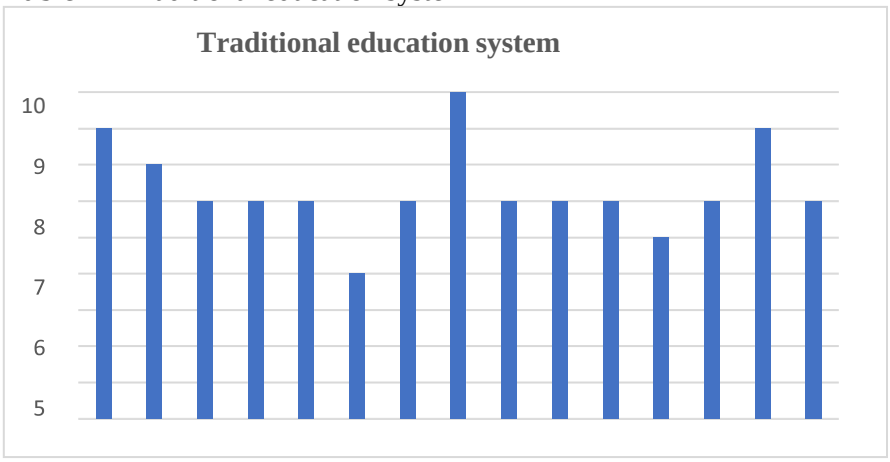
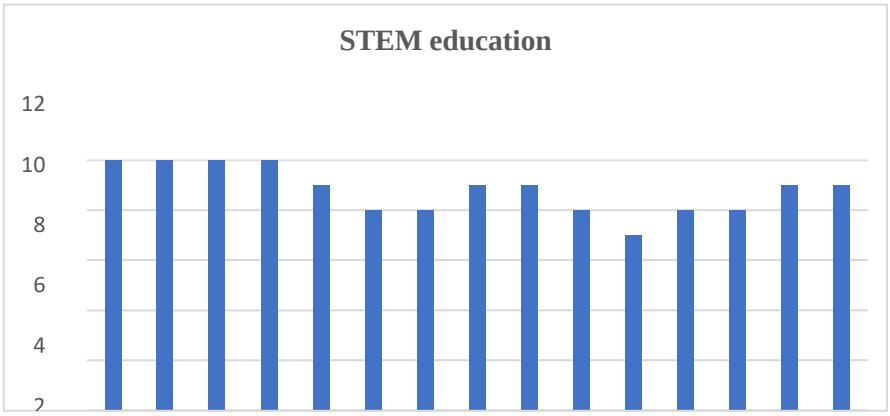


Table 2 – STEM education



Conclusion

In conclusion, preparing educational tasks in STEM education involves several key features that distinguish it from traditional learning approaches. These features are designed to promote interdisciplinary integration, practical application, critical thinking, and creativity among students.

One of the primary features of STEM education tasks is the emphasis on real-world relevance. STEM tasks are designed to connect learning to authentic, practical situations, enabling students to see the direct application of knowledge and skills in solving real-life problems. This approach helps students develop a deeper understanding of concepts and fosters their ability to think critically and analytically.

Another important feature is the integration of multiple disciplines. STEM tasks go beyond the boundaries of individual subjects and encourage students to make connections between science, technology, engineering, and mathematics. By integrating these disciplines, students develop a broader perspective and gain a comprehensive understanding of how different fields are interconnected.

Moreover, STEM tasks often involve project-based learning, where students actively engage in hands-on activities and collaborate in teams to solve complex problems. This approach promotes teamwork, communication, and problem-solving skills, as students learn to work together, share ideas, and think creatively to find innovative solutions.

STEM tasks also frequently incorporate the use of technology and digital tools. Students are encouraged to utilize various technological resources, such as software, hardware, and online platforms, to gather data, conduct experiments, analyze information, and create prototypes or simulations. This integration of technology not only enhances students' technical skills but also prepares them for the increasingly digital and technology-driven world.

In summary, preparing educational tasks in STEM education involves designing activities that are relevant, interdisciplinary, project-based, technology-integrated, and inquiry-driven. These features aim to develop students' critical thinking, problem solving, collaboration, and creativity skills, preparing them for future careers and equipping them with the necessary skills to thrive in an increasingly complex and interconnected world.

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