Annual of Konstantin Preslavsky University of Shumen
vol. XXV C, 2024, pp. 53 – 56, https://doi.org/10.46687/QWYW3947

METHODOLOGICAL GUIDELINES FOR THE ORGANIZATION AND CONDUCT OF STEM TRAINING*

KRASIMIR V. HARIZANOV

ABSTRACT: *This article examines some methodological guidelines related to the organization and implementation of STEM education in schools. Attention is paid to the preliminary preparation of the development of a STEM lesson and how to implement it in a learning environment. A model is proposed describing the sequence of actions in the development of a STEM lesson.*

KEYWORDS: *STEM education, STEM environment, Project-based learning, STEM technology.*

2010 Math. Subject Classification: *97P20 u 97B20*

Introduction

STEM education has been gaining attention in recent years through innovative technologies and teaching methods. Students, faculty, and teachers are rediscovering the possibilities of solving practical problems, applying critical thinking to specific situations, and building team relationships.

Using unconventional approaches that combine science, technology, engineering, and mathematics, lay the foundation for a higher professional qualification for the trainee and an opportunity for good future realization.

STEM education

STEM education is relatively new to Bulgarian education, but it is slowly and surely starting to grow and gain more and more popularity. According to many authors, the first use of this acronym was introduced by the American biologist Judith A. Ramaley in 2001, replacing the then abbreviation SMET.

In many studies, the authors point out that in STEM education, the main actor is the student, and the teacher is only the organizer of the learning process. The organization of this process includes the combination of science, technology, engineering and mathematics, integrated into "knowledge,

*This paper is (partially) supported by Scientific Research Grant of RD - 08-112/31.01.2024

methods and approaches from different disciplines in order to create a richer and more connected learning experience." [1]. The goal of this type of education is not for the student to use his knowledge from one discipline when solving tasks, but to direct his efforts to solve problems with a "practical focus, application of what has been learned and understanding of knowledge and skills in life situations" [2].

Creating challenges related to everyday life is a difficult process, given that the teacher must take into account the life experience of students, their social environment, as well as their knowledge in various fields. Very often, with younger students, situations are presented in the form of a game. And like any game, it must have conditions, a goal, resources, rules, etc. "For each type of game, it is important how exactly it can be used for educational purposes. In order to obtain truly effective and motivating learning, the teacher should have a number of competencies." [4]

With older students, STEM approaches are geared towards working in collaboration and solving problems that require a wide range of knowledge and competencies.

However, why does STEM education have difficulty entering the educational process? There are several reasons. On the one hand, "the modern teacher is challenged to be competent in these four disciplines and to set tasks whose goals are solutions related to the challenges and problems of the modern world." [5]. In support of this, the authors in [3] present a study in which, "out of a total of 156 respondents, only 27.5% know what STEM means", and 22% indicated that they teach lessons through STEM.

Another important prerequisite for organizing STEM education is the availability of STEM rooms and, if there are any, to what extent they can be useful to teachers. In the last few years, the Ministry of Education and Science has paid serious attention to this direction. Several operational programs have been launched aimed at "building STEM centers and high-tech equipped and connected classrooms (HTECC) in schools through the supply of equipment/furniture/software" [6].

The teacher and STEM centers

STEM centers are the place where students can apply their knowledge, using the available resources and equipment. In order to fulfill the goals of a STEM lesson, it is necessary to go through a preliminary preparation of the teacher, which may include:

1. Choosing a challenge;
2. Studying the curricula;
3. STEM room capabilities;
4. Formulating the task;
5. Evaluation criteria.

The first step (choosing a challenge) includes the main idea that must be solved within one or several hours (as is the case in most cases).

The second stage is related to studying the curricula for the current school year, as well as those studied at an earlier stage. Here it is time to understand what knowledge and skills can be used in solving the task.

The capabilities of the STEM office, here every teacher should know what equipment, applications and resources are available. Very often, due to a lack of supplies or a certain technique, the condition for the implementation of a task changes.

The final formulation *of a task* is related to the analysis of the previous steps. Depending on the material base and the expected results provided for in the curricula, the goal of the task may change partially or completely.

The criteria for evaluating the assigned task can be formulated by each teacher according to the observations he has on the student groups. As with any project task, the main challenge for evaluation is the contribution of each student in solving the task.

Using this model could support the work of every novice teacher so that he can plan and implement all the interdisciplinary goals he has foreseen in his tasks.

An important aspect of the correct implementation of more than one STEM lesson is the level of knowledge that the students have. Even if some of them have hesitant knowledge, these types of lessons consolidate the knowledge and make it more permanent in their consciousness.

Conclusion

The use of STEM approaches in education gives each student the opportunity to present their knowledge, skills and competencies in solving real challenges. Working with various technologies, combined with natural sciences and creative activities, motivates and engages students' attention to science and the problems of everyday life. Working in an appropriate STEM environment is a suitable start for the future realization and professional orientation of both schoolchildren and students in higher education.

REFERENCES:

[1] Алексиева, М., Мултидисциплинарни иновации за социални промени: stem ученето като катализатор за трансформация в образованието, Сборник с научни трудове на БСУ. ISBN 978-619-253-038-9, с. 392-403, 2024

[2] Борисова, П., STEM формите – начин за интеграция на интердисциплинарния подход в българската образователна система, Е-списание „Педагогически форум“, Том 1, ISSN 1314-7986, с. 176-181, 2023.

[3] Кожухарова, Д., М. Желязкова. Същност на STEM обучението. Е-списание „Педагогически форум“, бр. 3, стр. 19-28, 2021.

[4] Павлова, Н., Д. Марчев. Игри в обучението по математика и природни науки, KNOWLEDGE – International Journal, Vol.46.2, с. 317-322, 2022.

[5] Mustan, S., Kr. Harizanov, Some possibilities for applying the micro:bit in stem education grades 5-7., Annual of Konstantin Preslavsky University of Shumen, 77-84, 2023.

[6] URL: https://sf.mon.bg/?go=news&p=detail&newsId=1156 – Оперативна програма BG-RRP-1.015 „Училищна STEM среда“, 25.10.2024

Krasimir Valentinov Harizanov
Konstantin Preslavsky University of Shumen
kr.harizanov@shu.bg