

## THE STEM APPROACH IN MAN AND NATURE EDUCATION IN 4TH GRADE THROUGH THE PRISM OF DIFFERENTIATED TRAINING IMPLEMENTED THROUGH STATION WORK

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**Abstract:** In a world where traditional education is failing to meet the needs of today's learners, the STEM approach is emerging as a beacon of hope. By integrating science, technology, engineering, and mathematics into a cohesive and interdisciplinary curriculum, STEM offers a more hands-on and relevant approach to learning. This approach is particularly effective when combined with "open" forms of learning, such as station work, which allows students to become active participants in their education. By involving them in hands-on activities and encouraging interaction with their environment, STEM empowers children to become discoverers and explorers of the world around them. This not only makes learning more enjoyable but also facilitates a deeper understanding of the material.

STEM is not just a didactic approach; it is a philosophy of education that is aligned with the needs of 21<sup>st</sup>-century learners. STEM-based learning teaches children to think critically, work collaboratively, and communicate effectively. By integrating the arts and design into the curriculum, STEM also nurtures creative thinking, a key component of innovation. With STEM, students learn how different disciplines integrate and work together, preparing them for real-world jobs that require a wide range of skills.

One of the most promising aspects of the STEM approach is the variety of forms and methods of work it allows. The open learning concept, which includes station work, provides a flexible and dynamic environment that engages students in project work, workshop learning, and more. This approach is a critical step toward a more student-centered model of education that promotes lifelong learning.

The STEM approach in education and "open" forms of learning, such as working at stations, benefit the understanding and assimilation of information by primary school students. STEM is one of the approaches that help to achieve the integration of theory into practice. Involving students in "active" learning and interaction in their acquaintance with the environment puts them in the role of discoverers and researchers of the world, which is essential for easier acquisition and understanding of the learning content.

In conclusion, the STEM approach and station work has the potential to revolutionize education by providing learners with the tools and skills they need to succeed in the 21<sup>st</sup> century. By encouraging active learning, interdisciplinary thinking, and collaboration, STEM can help students be better prepared for the challenges and opportunities of the future.

**Keywords:** STEM, learning in stations, open form of learning, interaction

### 1. INTRODUCTION

A significant part of the problem with modern education is that it aims to teach 21<sup>st</sup>-century students by combining a 20<sup>th</sup>-century curriculum with a 19<sup>th</sup>-century structure. The result is an equation that doesn't work and an education system long out of date. Our current modes of teaching and assessing today's learners are outdated. Schools are still largely based on an industrial model where students are forced to struggle with a one-size-fits-all education. Educator Sir Ken Robinson describes the traditional school approach as a production model based on linearity and conformity, like a mass production line where attendance is imperative and learning is optional. Bells, whistles, and chimes are repeatedly rung to the students, telling them when it is appropriate to start and stop certain activities. Similarly, educational revolutionary David Lowder argues that students in the traditional model are also limited by the division of students into classes, subject knowledge, and schedules. These approaches to schooling are impractical and do not provide learners with real-life knowledge [1].

Rejecting education oriented only to the "material" or only to the "method" or only to the "teacher", the concepts of reform pedagogy put at the center of education "life", "the child himself" with his experiences, accessible and pleasant forms of training [2].

STEM is one of the approaches that help to achieve the integration of theory into practice, to create an environment in which the child will be his teacher, researcher, and traveler in the field of science.

### 2. MATERIALS AND METHODS

Elementary-aged children are naturally interested in science and how the world works. But they also live in a world full of environmental challenges and a technological revolution that relies on problem-solving whose solution is rooted in interdisciplinary and transdisciplinary thinking. The big ideas of science are both transdisciplinary and

interdisciplinary, and this provides a conceptual basis for STEM initiatives in education and beyond. By choosing 'real-life' contexts and challenges, the STEM approach is an exciting way to spark children's natural curiosity about science and its relevance to their future [3].

STEM is not a new approach. It has been known since the 1990s, but in recent years it has gained wider popularity and applicability. STEM (Science, Technology, Engineering, Math) generally means Science, Technology, Engineering, and Mathematics. However, the STEM approach is more than "gluing" concepts together. It is a philosophy of education that covers teaching skills and subjects in a way that resembles real life. As a curriculum, STEM is based on the idea of focused learning in the four disciplines – science, technology, engineering, and mathematics – in an interdisciplinary and applied approach. Rather than teaching the four disciplines as separate and discrete subjects, it integrates them into a coherent learning paradigm based on real-world application.

1. STEM is a didactic approach that removes the traditional barriers between the four disciplines and integrates them into real, serious, and relevant learning activities.

2. What sets STEM apart from traditional education and science is the blended learning environment that demonstrates to students how the scientific method can be applied to everyday life. A variety of STEM is STEAM, which includes A /Arts/ - arts, and design. Artistic design and the arts are an important part of STEM-based learning, as creative thinking is relevant to the development of innovation. A large part of STEM lessons involves building models and simulating situations. In this way, they reflect real life. This is precisely the answer to the question: Why choose STEM-based training?

Jobs in the real world are interdisciplinary. Rarely does a job require only one set of knowledge and skills. For example, the profession of an architect requires knowledge of mathematics, engineering, technology, and art daily. Hence the need for children to be taught how different disciplines integrate and work together. Memorizing facts today gives way to the need to think critically and evaluate information. STEM обхваща четирите принципа, идентифицирани като ключови в образованието на 21-ви век: творчество, сътрудничество, критично мислене и комуникация [4].

The STEM approach enables the choice of various forms and methods of work. Particularly suitable are educational solutions from the so-called "open type of learning". "Open learning" is a key concept associated with internal school reform and includes educational offerings other than those dominant in traditional education. It is the intersection of a network of concepts such as "free work", "weekly plan", "daily plan", "project work", "workshop training", "station work/learning", etc. Open learning approaches the notion of a "school for life" open to experience and action [5].

Station learning is an innovative form of learning. It occupies an intermediate place between classical and open learning. The idea of the stations is borrowed from the field of sports. The station combination is a training program created in 1952 by R. Morgan and G. Adamson and offers athletes different training stations (exercise stations) through which they pass sequentially or on a free-choice basis. The training phase of one station lasts 2-5 minutes and is followed by a short break to unload before proceeding to the next station. This structure from sports is carried over and adapted to education in primary school.

Stations are designated work areas in the classroom where students complete specific tasks. Each of the stations is assigned a name or number, the tasks to be performed, as well as the materials required for the purpose. Station learning is tied to a unifying theme, within which children complete a variety of learning tasks within a set time, in designated locations. Through this form of organization of the learning process, an opportunity is provided, on the one hand, for the independent discovery of new knowledge through the active participation of students, and on the other hand, for its consolidation and enrichment.

Learning by stations provides an opportunity to achieve different goals:

- an in-depth examination of a given thematic area, as children can work on the content independently, according to their capabilities and pace;
  - independent processing of thematic areas, in which students, through various methodological proposals, research, search for information, learn facts and shape them;
- stimulation of children's independence, enrichment of children's experience.

**The organization of work in station learning is specific and includes:**

1. Choosing a learning topic and differentiating the tasks on it - the tasks can be both for group work and for individual or partner work.
2. Setting up stations - the number of stations depends on the topic and the number of students in the class. It should be noted that the number of stations is recommended to be greater than the number of formed groups. This is because some of the groups can finish their work faster. At each station, a specific task is performed. Work tasks are framed as specific instructions, sketches, worksheets, and guidelines for

working with other work materials, for discovering information on the pages of books or experimental settings.

3. Students work in groups - it is appropriate for the groups to be composed so that students with different cognitive abilities and interests work together. In the group, everyone has their role and contribution to solving the common task. Each group has a person in charge who changes periodically.
4. Sequentially, each group passes through all mandatory stations. Through the created additional stations, only the groups that have coped with the set tasks pass faster [6].

Work at stations goes through the **following stages**:

- The teacher introduces the students to the topic, explains the different types of tasks that are proposed at the stations, divides the class into groups, and gives instructions for passing through the stations. Each group receives a plan (sheet) in which the sequence of passing through the individual stations is recorded.
- Task performance stage in the framework, at which the obtained results and solutions of each task are noted on worksheets provided by the teacher; providing an opportunity for self-control and verification of performance. It is important that students can check the answers/solutions to the problems. For this purpose, a worksheet with ready-made answers is prepared for each station.
- Final conversation, during which the students of each group report on the performance of the tasks in the individual stations. All information is then summarized. This phase of reflection is of great importance, as students share not only the results of the work done but also the difficulties they have gone through. An in-depth discussion becomes possible, which allows the topic to be brought to a new cognitive level [7].

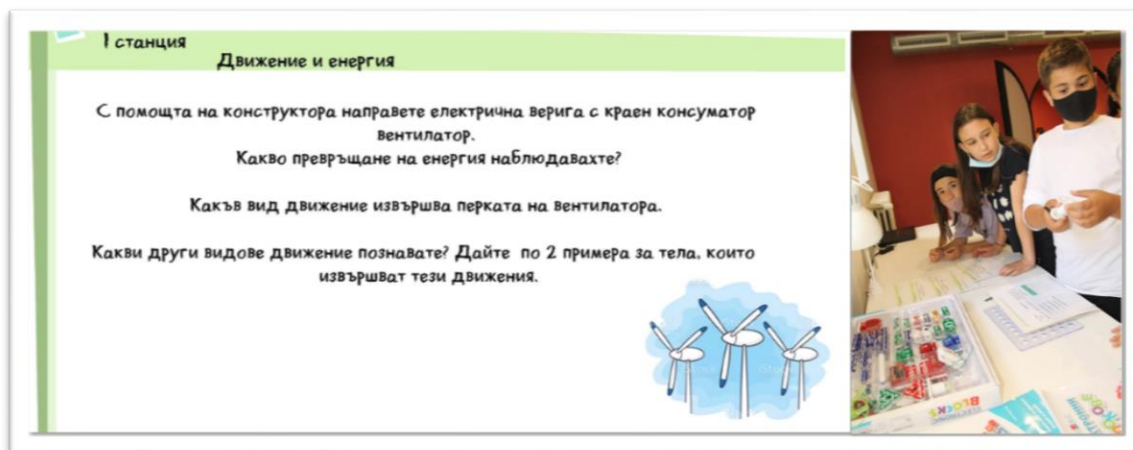
### 3. RESULTS

The presented practical realization of work on stations was carried out in an innovative class - 4th grade of "Ioan Exarch Bulgarian" Secondary School, Shumen City. The lesson took place in the school's STEM center and was chosen for the annual summary.

#### I. Motion and Energy Station

The students are assigned the task of connecting, with the help of a special constructor, an electrical circuit with an end consumer, a fan. To describe what kind of motion the fan blade makes, to state what other kinds of motion they know. (fig. 1)

Figure 1 Motion and Energy Station



#### I. Solar System Station

Students are provided with tablets to scan a QR code linking to an online application. The in-app game consists of questions whose answers unlock puzzle pieces. The same station has an encyclopedia discovery question. (fig. 2)

Figure 2 Solar System Station

II станция  
Слънчева система  
СЪНЪТ ИЛИ ЗЕМЯТА

Сканирайте QR кода и отговорете на въпросите. Ако работите правилно, ще отключите парчета от пъзел. Наредете го.

Прочетете от енциклопедията - на стр.100 информация за животните в Космоса.  
Как се казват двата паяка, които са изпратени с мисия "Скайлаб"?

Inset photo: Two students wearing masks and caps are working at a computer workstation in a station.

### I. Life Processes Station

In this station, a diagram of the development of a bee is illustrated, to which questions are posed. It has a QR with embedded text content for reading comprehension and questions to it. (fig. 3)

Figure 3 Life Processes Station

III станция  
Живни процеси

Отговорете на въпросите към схемата с цикъла на пчелата

- За колко дни от яйцето се развива пчелата?
- На кой ден от развитието на пчелата от яйцето се излюпва ларвата?
- Кога ларвата се покрива с папус и в какво се превръща тя?
- Която етапа включва жизненият цикъл на пчелата и кои са те?
- По какво жизненият цикъл на пчелата прилича на този на пеперудата?
- По какво прилича на този на жабата?

Отворете QR кода и прочетете текста.  
Защо са важни пчелите за хората?  
Посочете две причини.

Inset photo: Two students wearing masks are looking at a laptop screen in a station.

### II. Environment Station

In the station, a diagram of a mind map is presented for the students to complete. (fig. 4)

Figure 4 Environment Station

IV станция  
Среда на живот  
Допълнете мисловната карта

Среда на живот

The diagram shows a central box labeled 'Среда на живот' (Environment) with two main branches leading to empty ovals. Each of these branches further divides into three smaller empty ovals, creating a tree-like structure for students to complete.

### III. Healthy Eating Station

A table is a set of the main nutrients, what they are for, and in which foods they are most abundant. For the last column, illustrations of different food items are provided to be cut out and pasted in the corresponding places.

An additional station is planned - a short text from a popular science article with missing numerical data, which is discovered after solving mathematical examples.

### 5. DISCUSSIONS

STEM-based learning teaches children to think critically, work collaboratively, and communicate effectively. By integrating the arts and design into the curriculum, STEM also nurtures creative thinking, a key component of innovation. With STEM, students learn how different disciplines integrate and work together, preparing them for real-world jobs that require a wide range of skills. One of the most promising aspects of the STEM approach is the variety of forms and methods of work it allows. The open learning concept, which includes station work, provides a flexible and dynamic environment that engages students in project work, workshop learning, and more. This approach is a critical step toward a more student-centered model of education that promotes lifelong learning.

### 6. CONCLUSIONS

The communication channels of today's children are different from those of generations before them. That is why the approaches in education must be aimed at the needs of the new learners. The STEM approach to education and "open" forms of learning, such as station work, facilitate understanding and assimilation of information. Engaging students in "active" learning and interacting with their environment puts them in the role of discoverers and explorers of the world. Which is a prerequisite for easier learning and understanding of the learning content.

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