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THE IMPORTANCE OF MATHEMATICAL TASKS IN STEAM EDUCATION A WORLD EXPERIENCE

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Abstract:

This article discussed the importance of math tasks in Steam learning in the context of world experience. Mathematics is the means and basis for the solid development of learning skills, logical thinking and reasoning. Without these strong skills in the XXI century, college programs leading to STEM careers will either be unattractive to high school graduates, or worse, will produce below-average talent. STEAM-based learning provides students with the tools and methods to explore new and creative ways to solve problems, map data, innovate, and connect multiple domains. It teaches them to think outside the box.

Keywords: STEAM education, mathematics, interdisciplinary approach, interdisciplinary connections, research

In the modern world, unthinkable without the use of technology, art, science and engineering thinking are increasingly moving closer and closer together, ceasing to contradict each other. And the ability to collaborate and display creative abilities, the ability to convey to others the meaning of one's statement in the most understandable, visual form in any type of activity come to the fore among the important abilities that need to be developed throughout life [1].

Mathematics in STEAM education is challenging in the sense that it is undeniably important for student development, but it is also the hardest thing to engage students. The idea of STEAM education is to emphasize the importance of science, technology, engineering, arts and mathematics and to encourage the teaching of these subject areas to be more integrated. Of these fields, mathematics is one of the most established academic subjects. However, it is still vital to emphasize the importance of mathematics in education and life in general. So, what is STEAM education, why is math so important, and how should math be viewed in the broader context of STEAM?

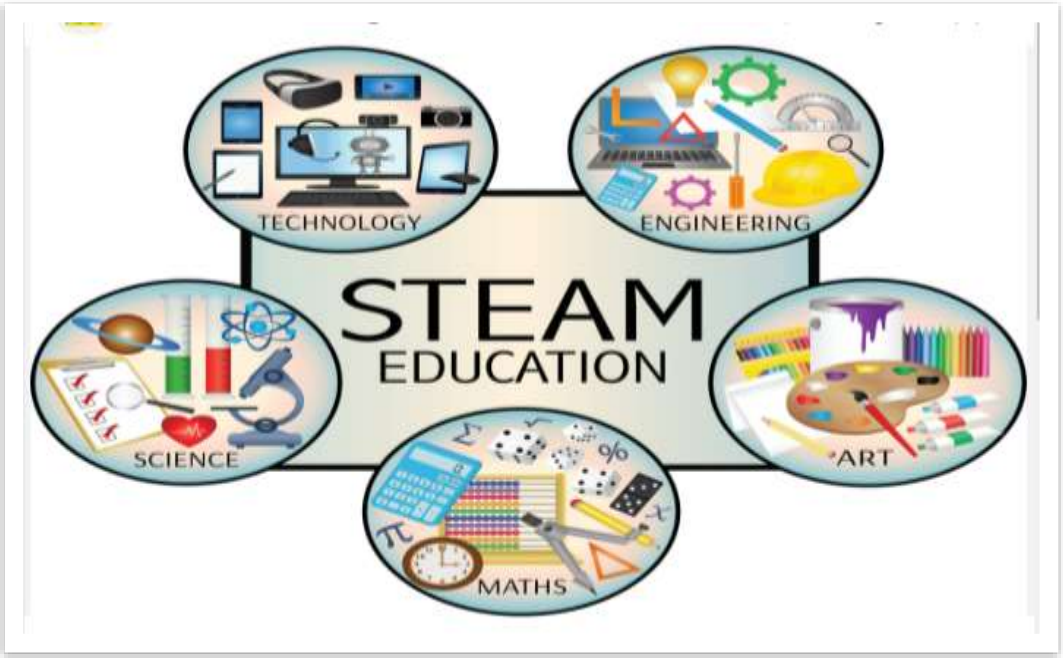

Fig.1. STEAM Education

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STEAM education is a concept that originated from STEM education, which stood for science, technology, engineering, and mathematics. The "A" in STEAM has added arts to the mix, but both concepts are mostly based on the idea of highlighting subjects that are important in developing the transferable skills that employers are looking for. Both STEAM education and STEM education initiatives agree that mathematics is one of the areas vital for children's development and subsequent education. In this article, we will take a closer look at what math is, evaluate its overall importance, and its relationship to the other four areas of STEAM education.

Often, science needs visual disclosure of meanings to convey information through art and technology, and artists use digital technologies and scientific forms of thinking to express themselves. This interpenetration, catalyzed by digital technologies, also meets the needs of modern school education. The new language of the future is not only the possibilities of speech and writing, but also the possibilities of quickly created media, available already in the present - the creation of illustrations, animations, videographs, models. However, the possibilities of their application do not cancel the development of creative thinking and freedom of personal manifestation in people, but are only those modern tools that help to communicate, express themselves and achieve results as quickly as possible [2-5].

The development of such qualities as the ability to be carried away by the process of cognition, to have a research interest in the subject of study, to dream, to imagine, to critically analyze information and to have one's own opinion, to educate the will and the ability to distribute its efforts over a long period of time, is also an actual challenge of modern education. The desire to learn, experiment, empathy, the ability to calmly experience mistakes and try again without losing stability, the ability to convey one's thoughts and ideas to others (to present oneself or content) should be considered as important learning outcomes as academic results [4].

STEAM is an educational convergent technology that combines several subject areas. It is a tool for developing critical thinking, research competencies and group work skills. It can be stated that there is a problem of finding and justifying the effectiveness of teaching methods for schoolchildren based on the use of STEAM technologies.

It is worth noting that the STEM approach is built "from above" as a way of connecting, integrating, building relationships between established sciences / academic disciplines for teaching them to students. At the same time, for many years there has been a development of the practice of learning through discoveries, which is built "from below", on understanding the nature of the development and maturation of the child, the formation of his activity and cognition.

One of the global trends in the development of education is personalization, which is technically facilitated by the development of tools and methods of digital education. However, at the moment, the mass digitalization of education does not always contribute to the entry of learning through discoveries into the everyday fabric of school life, since programmed algorithms often require unambiguous and monosyllabic answers, decisions, and formats for presenting results. Only in recent years have begun to develop open learning situations in the digital environment, using digital sensors, data processing algorithms - helping students to master the algorithm and research and design tools. Such tools allow the student to independently reveal on local material (which is always unique and specific) the general patterns known in science. Situations in which a child solves problematic problems with an open ending - where the course of activity is more indicative than a specific answer, where "how" is more important than "what" - very slowly and gradually begin to enter mass education. The real personalization of education also requires a radical restructuring of the entire learning process, the lesson system or the lesson organization format. There are not so many standards and examples of new formats of education, which naturally hinders the entry of new forms of organization of education based on research and project activities into a mass school [5]. The general social context (and education is part of society) also reacts ambiguously to the increase in diversity, uncertainty, and variability. The demand for stability, controllability, and external control begins to grow in society, when the situation of changes is not ready to be used as a resource. As soon as you create a situation in which the child himself can determine what and why he should study, the uncertainty of adults and teachers immediately arises that this is right, necessary, etc. And this fear is supported by the fact that "in our time it was not like that". The approach about the "norm" of learning based on past experience (the main argumentation of a large number of adults) is clearly in conflict with the tasks of education for the future (which no one had experience with). And the practice of learning through discovery, where the student himself masters the algorithm of conscious and purposeful activity in a situation of novelty and uncertainty, seems natural for updating the content and form of building

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education for the future. However, understandable "traps" also appear here: how to evaluate the result if it is not initially known, how to check whether it is correct or not? The habit that everything should have uniquely correct and verifiable answers naturally hinders the entry of the practice of building learning through research into the daily life of the school.

Mathematics can be a difficult subject for many students and has historically been taught in a traditional way that is not suitable for all learning styles. This can make it difficult for some students to participate fully, which can lead to misunderstandings of some of the basic mathematical concepts on which later lessons are built. One idea that has been recommended to improve learning outcomes is to try and teach math by formulating some of the traditional math problems in a more integrated way that allows students to relate concepts to real life situations. This is relatively easy with fields like physics and engineering where math already plays a key role, but it can also be done with the rest of the STEAM education fields.

For example, mathematics is increasingly being integrated with technology through things like computer databases and spreadsheets. In fact, computers have played a key role in proving some age-old mathematical concepts to be true. In addition, mathematics can also be integrated with the humanities, in particular psychology is a good example of this as it is a subject area that uses statistics and data samples.

In this context, STEM education has two development vectors:

1. strengthening the importance of the academic study of academic disciplines, united in a separate block;

2. integration of knowledge and methods of various disciplines in solving design and research problems (both every day and problems of the development of modern science and technology).

The report acknowledges that education within the individual disciplines of STEM is important and that efforts to improve discipline-centric teaching and learning must continue; discusses the great benefits associated with integrating subjects within STEM. The report is quite broad and ambiguous in its endorsement of an integrated approach to STEM education. It is noted that proponents of more integrated approaches to teaching STEM K-12 argue that teaching STEM in a more interconnected way, especially in the context of real-world problems, can make STEM subjects more suitable for students and teachers. This, in turn, can increase motivation to learn and increase student interest, achievement, and engagement, as well as targeting more students for careers in a STEM-related field [4].

Recently in the US, both the Common Core Education Standards in Mathematics (CCSSM) and the Next Generation Science Education Standards (NGSS) have called for broader and deeper links between STEM subjects. NGSS explicitly incorporates practical methods and core disciplinary ideas from engineering along with scientific ones. This implies that science teachers will teach science and engineering in an integrated way.

While there is growing interest in providing learners with learning experiences that foster connections across all STEM disciplines, there is little research or evidence on how best to do this or what factors make students more likely to integrate subject matter knowledge, increase learning outcomes, interest, engagement, academic achievements, etc.

Integrated STEM learning is far from a holistic practice. It includes a number of different ways of subject teaching in different formats and degrees of connection with each other. Integration between STEM subjects can occur within one or more grades, throughout the curriculum, reflected in the organization of a single course or the entire school, or cover extracurricular activities. Each integrated STEM learning option offers different planning approaches, resource requirements, implementation challenges, and outcomes.

Existing approaches to integrating subjects within the framework of STEM education in the United States are largely focused on solving the problems of increasing the general literacy of the population in the field of STEM and developing the competencies of the XXI century; increasing student interest and participation in STEM; attracting young professionals to work in the field of STEM. From the point of view of the results of STEM education, the following are considered: the level of completion of training courses and academic achievements in subjects included in STEM; employment related to STEM; the formation of "STEM-identity" among students; the ability to transfer understanding across STEM disciplines while solving integrative problems.

The experience of using STEAM educational technology demonstrates the following results:

- there is an experience of design creative work for a long time;

- there is a change of vertical relations teacher - student to the horizontal cooperation and constructive interaction of all participants in the process;

- conditions are created for the formation of students' independent critical thinking;

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- students are given the opportunity to stay in a situation of creating a joint product that is unique;
- there are opportunities for interpenetration and mutual enrichment of different scientific fields, art, design and technology;
- the possibility of implementing a practice-oriented model is acquired, in which each participant receives his own experience related to an active activity position [3].

In the field of psychological and pedagogical results, it should be noted:

- greater involvement of students in the learning process;
- maintaining their involvement and motivation throughout the whole time;
- the formation of stable connections among group members that ensure the productivity of interaction;
- manifestation and realization of the creative potential of students;
- a high level of reflection among students regarding their work in traditional classes.

Thus, meeting the challenges of the time, educational STEAM technology, the introduction of which, as a rule, is based on the large-scale use of computer tools and systems, is becoming one of the necessary educational tools. Nevertheless, it is important to note that for the current stage of development of education, such training requires great efforts from the teaching staff and school administration, both technological and methodological.

In conclusion, I would like to note that mathematics has long been considered one of the main academic subjects, so its inclusion in the concept of STEAM education is perhaps not surprising. However, one of the main priorities of the STEAM concept is to promote integration, which is actually key for teachers and academic institutions. To improve student engagement and overall learning outcomes, it can be beneficial to apply math concepts to real-life situations so that students can more easily identify math problems. Fortunately, there is significant crossover potential with science, technology, engineering, and the arts, making this goal achievable.

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