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# USING STEM EDUCATION IN SCHOOLS

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**Abstract**

STEM education is an educational approach that contains multiple scientific disciplines and has become a popular method in recent years. Since more efforts are made to integrate STEM more effectively into the educational system, educators face major challenges in finding teaching methods and strategies. STEM education offers many advantages to students, teaching them critical skills they can use to succeed in life. STEM assignments can be easily adjusted to suit different age ranges, abilities, group sizes and interests. Their adaptability is part of what makes them so great to use in teaching and learning environments. The main purpose of implementing STEM education in standard curriculum is for students to learn to solve problems through scientific methods and mathematics to become highly skilled workforce in the future. Although history has played and continues to play a role in STEM education, there are many variations and opinions about what STEM education is and how it should be taught. This paper will attempt to break through the complexities of STEM in the fields of education and will try to give a clear definition of STEM, as well as the aspects in which STEM is implemented.

**Keywords**: STEM, teaching approaches, students, education

## 1. Introduction

When STEM is mentioned within the framework of education, many educators and students have questions about what exactly this term means. STEM is a phrase used to group the distinct but related disciplines of science, technology, engineering, and mathematics. In fact, STEM stands for Science, Technology, Engineering and Mathematics. There is no single answer as to which disciplines are particularly in STEM, especially since STEM can also include social sciences such as psychology, sociology, and economics. STEM education, in various formats, has been around for a long time, but now educational administrators are recognizing its importance. When one hears about STEM, the first association is science with computers. But here, science and computing are separated from STEM and they represent educational mechanisms used to implement scientific methods. Although STEM is gaining great popularity in our schools its potential has not yet been achieved. With STEM children experience our environment at an early age, then build on it with more complex STEM concepts as they get older.

Engaging students in high-quality STEM education requires that programs include specific instruction, and assessment, integrate technology and engineering into the science and mathematics curriculum, and promote scientific inquiry. Students and teachers must be part of the STEM vision and must be provided with adequate opportunities for professional development. In this way, students and educators from schools and universities can work together to develop pedagogical models that provide quality education and effective STEM teaching (Kenned & Odell, 2014). Educational approaches based on the study of the real-world help students to see the relevance of science to their daily lives and to enhance their interest and enjoyment in solving the real situations around them (Eisenhart & all, 2015). Real-world teaching and learning assume that everyday situations familiar to students can be explored and appropriate responses can be provided through STEM concepts. Studies have shown that students' interest in science increases through teaching approaches that are based on real-world situations. Students can make connections between real-life contexts and the concepts they are learning and are more interested in learning if they see what they learn in school relates to what they do in their everyday lives. This kind of learning and reasoning will change the behavior of students towards their environment (King & Henderson, 2018). Through real-world-based teaching

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approaches, STEM education can influence students' internal representations and understanding of the real world and ultimately transform students' attitudes toward environmental protection as well.

## 2. Defining STEM

The four aspects of STEM are science, technology, engineering, and mathematics and are fundamental to the academic careers of all students: especially science and math. They are defined as:

*Science*: the systematic study of the nature and behavior of the material and physical universe, based on observation, experiment and measurement, and the formulation of laws to describe these facts in general terms.

*Technology*: a branch of knowledge concerned with the creation and use of technical means and their interrelationship with life, environment, everyday surroundings, drawing on subjects such as industrial arts, engineering, applied science and pure science.

*Engineering*: the art or science of the practical application of knowledge from the pure sciences, such as physics or chemistry, as in the construction of engines, buildings, transportation vehicles, factories etc.

*Mathematics*: a group of related sciences, including algebra, geometry, and calculus, that deal with the study of number, quantity, shape, and space and their interrelationships using specialized notation.

While these definitions are common and established descriptive terms for STEM fields, there is clearly more to them. Science and math are at the front of STEM Education mainly because these popular fields that most people can relate to in terms of academia. Technology and engineering are the fields that are most underrated, but also the most underfunded in education, specifically in the primary schools (Miaoulis, 2011). The question is how do those in education interpret and integrate into their classrooms?

## 3.Concepts of STEM application

### *3.1. Concept of learning through problem solving*

The problem-based learning concept is a teaching practice in integrated STEM education. Problem-based learning is a pedagogical approach in which students learn about science and develop their critical thinking and real-world problem-solving skills (Jumaat & all, 2017). This approach is based on the theory that students' abilities are improved through social learning in a small group, where, guided by teachers, they identify problems, collect data, develop solutions and choose solutions that can solve the problem. This approach encourages students to work together and use their knowledge to learn new information and then solve complex problems.

The general global environment is evolving according to climate and environmental changes. Furthermore, the development and increasing use of digital technology is transforming people's daily lives and societies. New types of jobs will be needed, as will the expertise they will require. Therefore, education will have to adapt to equip students with the necessary skills, qualifications and flexibility to fill these jobs. This concept of learning improves students' capacity to think and integrate previously gathered knowledge and experience in the process of lifelong learning. This develops students' skills, including reasoning, critical thinking, applying theory to practice, communication, reflection and teamwork (Belland, 2017).

### *3.2. Design-based learning concept*

Another concept of STEM education is the engineering design process, where scientific research, artistic design, civil engineering, critical reasoning, and technology are used to solve real-world problems (Zheng & all, 2020). Design-based problem-solving learning is a form of problem-based learning in which students are given a real-world problem. It is an inquiry-based teaching approach that leads to innovative solutions. This approach is focused for students to increase their experience by developing their scientific understanding and problem-solving skills. Design-based learning is considered a teaching method to improve overall learning and increase students' interest in science. It is commonly used in teaching science, engineering and design skills. Design-based learning, as a form of project-based learning, offers students creativity and an innovative mindset for sustainability practices. A multidisciplinary approach is an essential element in design thinking,

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therefore essential to problem solving. A design-based learning approach begins with defining a problem from a real-world context and involves developing optimal solutions to societal challenges (Huang & all, 2020).

### *3.3. Concept of cooperative learning*

The cooperative learning approach is another pedagogical method that involves students in small groups to help each other learn. The goal of STEM education is to provide students with a wide range of skills and interdisciplinary knowledge. Cooperative learning plays an essential role in helping to develop, expand and sustain the role of education in society. It has been shown to be an effective teaching method that provides a wide range of student outcomes and academic achievement (Roseth, Johnson & Johnson, 2008). The positive effects of cooperative learning include:

a) *motivational aspects*, where emphasis is placed on the motivation for independent learning and encouragement, as well as helping colleagues to learn.

b) *social cohesion*, where the goal of the group is to enable all members of the group to learn.

c) *cognitive development*, where the interaction between students increases to complete certain tasks together.

Cooperative learning builds students' cooperation and teamwork skills. By building collaborative skills in school, students will develop positive attitudes and behaviors outside the classroom to work together for the sustainable development of our community (Griffin & all 2013).

### 3.4. Formative assessment of students

Assessing and monitoring student progress in class with STEM education is challenging. Traditional methods such as exams and quizzes generally do not perform well with this approach to learning. Formative assessments are a much better way to check student progress because they provide feedback that is intended to improve learning. More specifically, formative assessments help students identify their strengths and weaknesses, pointing out areas where they need improvement. This type of assessment is ideal in STEM learning because it is closer to how real-world scenarios play out, encourages active involvement in class, and does not rely on the power of memory (Nguyen, Nguyen & Tran, 2020). Not all students are good at remembering large amounts of information, which does not mean that those students are not intelligent or capable of learning. Summative assessments, such as tests, can discourage some students from learning if they perform poorly. This can be especially the case in science and math, where written tests can be very difficult. STEM should not be about whether you are a good writer or a good memorizer, but rather about practical creativity and problem solving.

## 4. Conclusion

This paper provides basic insights into how pedagogical approaches in STEM education can be applied to teach science in the context of sustainable development. Most STEM curriculum projects that are developed by teachers integrate three to four fields of STEM and apply contemporary pedagogical methods, such as problem-based learning, design-based learning, and collaborative learning. All these approaches emphasize a learner-centered teaching approach. Students engage in questioning, problem solving, collaboration, and hands-on activities while dealing with real-world problems. STEM educated students are logical thinkers, effective communicators, and are technologically, scientifically, and mathematically literate (Bharti, 2022).

In STEM education, teachers function as facilitators in the classroom. They guide students through the process of problem solving and planning projects that lead to content mastery and STEM proficiency. Teachers must be qualified and skilled so that, through their lessons, students develop their critical and creative thinking. Importantly, teachers must be able to encourage students to apply and contextualize their learning and innovate by designing, creating and producing solutions to real-world problems. This implies that training should be provided to teachers to improve their knowledge and application of modern constructivist pedagogical approaches to promote students' self-direction, cooperation, and problem-solving ability.

STEM education should be a priority in elementary school. At this stage of education, pupils often lose interest or consider it unimportant for their education. This means that a huge number of

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young students worldwide do not want to do science. (Murphy, 2011). The solution is to get students interested in STEM from an early age, thereby overcoming the belief that these subjects are difficult to learn. It is necessary to change and upgrade classical learning in way that they study and solve situations they encounter in everyday life.

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