STEAM to School

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What is STEAM Education?

STEAM education is a learning approach which integrates Science, Technology, Engineering, Arts, and Mathematics. Learning these five subjects together is a more holistic approach for students to understand the surrounding world. STEAM education framework embraces a practical learning model involving planning, building, testing, and designing, and STEAM focuses on encouraging students to discover deep into the subject, and students thrive on enthusiasm and deep understanding of the subject. The ultimate objective of STEAM is to advance 21st-century skills in students such as cooperation, critical thinking, problem-solving, and creativity and prepare them to find solutions to real-world challenges and future careers. By including Arts and creativity into the traditional STEM framework that focused on Science, Technology, Engineering, and Mathematics, STEAM expands its scope to uplift not only Science and Technology but also creativity and aesthetic perception. It encourages students to think out of the box, address problems through multiple perspectives and develop real-world skills.

Why STEAM Education?

Currently, almost every country in the world is working on embracing the STEAM education approach. Let's discuss the reasons for this global trend toward the STEAM approach.

- It promotes a holistic approach to education by combining Science, Technology, Engineering, Arts, and Mathematics. It encourages students to think critically, creatively, and analytically, facilitating them with richer learning experiences.
- STEAM learning approach emphasizes applying knowledge and skills practically. It demonstrates how these subjects are linked together and how they can apply to real-world problems. This is an integrative approach in preparing students for future careers.
- Via STEAM, education encourages students to explore, experiment, and discover innovative solutions and also improve skills that are required for the modern world such as communication, cooperation, analytical thinking, and critical thinking.
- Most of the highly paid and fast-growing future careers lie in the scope of STEAM. STEAM education prepares students for a wide range of career paths by providing a solid foundation of subjects. STEAM education equips students with the necessary skills that are required to succeed in the technology-based modern world.
- STEAM education facilitates creativity and innovative ideas. Encourages students to uplift out-of-the-box thinking, take risks and develop entrepreneurial skills. Instead of using traditional methodologies by polishing entrepreneurial mindset empowering students into becoming inventors, creators, and problem solvers.
- To withstand the current more competitive global market every country is trying to output a highly skilled workforce. STEAM education plays a

critical role in competing in the rapidly evolving world of technology by providing the necessary knowledge and skills.

Overall, the key importance of STEAM is to prepare students for the future, equip them with the necessary skills, and contribute to the development of a competitive society by promoting innovation.

Plans, Resources, and Teaching Methods that Facilitate STEAM

The key to nurturing STEAM education is to provide students with an active learning experience that utilizes practical applications, and interactive curricular activities that promote critical thinking and creativity. To achieve that learning environment in a classroom there must be a collection of plans, resources, and teaching techniques. Let's consider each of these plans, resources, and teaching techniques.

When considering planning, curriculum development and organization of related school programmes are important. When considering the curriculum, providing room-to-subject integration can generate opportunities for STEAM education via introducing STEAM education streams or specially including STEAM activities. It also encourage performance evaluations on curriculum based on planning and implementing STEAM education opportunities via curricular and extra curricular activities.

Providing resources such as laboratories for science & mathematics, and computer markerspaces are important providing other necessary technical tools and internet facilities are mandatory when considering resources. It's vital to follow the student-centered interactive approach when planning the teaching methods. It can make the STEAM education experience more meaningful by using constructivism-based teaching technics such as project-based learning and problem-based learning.

STEAM education for schools today

The introduction of STEAM education to schools in Sri Lanka can be considered in two stages. The first phase is to update the current curriculum. Implementing suggested group activities in such a way that the curriculum is focused and practical is vital. It's important to guide students to complete every activity creatively and successfully rather than just completing the curriculum. Providing room for group study activities is very important when achieving goals in STEAM education. Encouraging students to use their different skills and potential when doing group activities provides an opportunity to use their unique Science, technical, Engineering, art, and mathematical skills efficiently and to understand the connection between those subjects.

Organizing field visits to natural environments, workplaces, and public places also provides STEAM education experience. Field trips should be organized to cover several subjects without limiting to one subject. During these field visits, special care should be taken to create opportunities for experts to share their experiences in the working world. Also, it is more effective to engage the students in post-work such as in-depth observation of the functioning of machinery, their technology, production process, aesthetics of finished products, dealing with the market, preparation of reports, creation of models, etc. After studying community services, planning an extension to organizing and implementing such services is also a role that the school should play to expand the STEAM education experience.

Another area that educational systems around the world are focusing on for creating STEAM educational experiences is STEAM competitions and games. This strategy is more suitable for pre-school and elementary stages. There are many software and applications specially designed for this purpose. Examples include video games such as "Kerbal Space



Program", coding games such as "Code Combat", and educational computer games such as "The Oregon Trail".

These games provide engaging and interactive experiences that support STEAM learning. They can be used as supplemental resources to enhance classroom instructions or as stand-alone activities to foster independent learning.

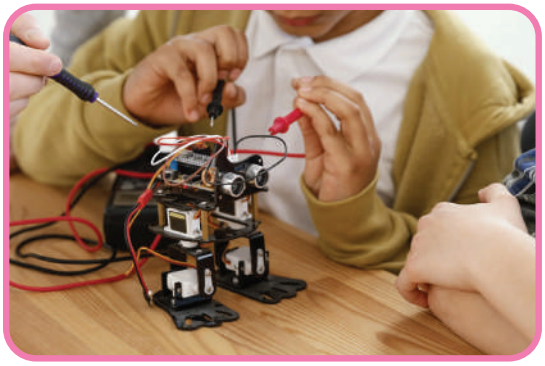
Additionally, there are many extracurricular activities that nurture students with STEAM educational experiences that can be introduced within the current school environment as well as under an educational reform. The establishment of STEAM Associations, STEAM Days, STEAM Camps, and STEAM Exhibitions are prominent among them.

It is important to pay more attention to popularize innovation associations that are already active in some schools. These programs can be expanded not only at the school level but also at divisional, regional, provincial, and national levels. The ultimate goal should be to expand the above programs to the international level.

STEAM education for future school

Education reforms play an important role as a measure to be taken at the national level to install the STEAM education approach more effectively in the Sri Lankan education system. Under that, a great role can be played through various reforms. The STEAM curriculum must be identified as a priority in future reforms. Also, introducing a module system that encourages self-study and knowledge-building will be a great help to take STEAM education to a more effective level. The

Learning Methodology	Example
Project Based Learning	Planning a sustainable city Students work in teams to design a sustainable city that addresses environmental, social, and economic aspects. They research on renewable energy sources, efficient transportation systems, waste management, and urban planning. They create a comprehensive plan, including architectural plans, financial models, and sustainability strategies, and the project culminates in a presentation of their city plans to a panel of experts.
Problem-Based Learning	The water conservation challenge Students are presented with a real-world problem of water scarcity in their community. They research the causes and consequences of water scarcity and explore potential solutions. They analyze water usage patterns and suggests conservation strategies. Develops educational campaigns to raise awareness. They present their findings and recommendations to local authorities or the community.
Phenomenon-Based Learning	Exploring climate change impacts Students investigate the phenomenon of climate change and its effects on ecosystems. They explore temperature changes, weather patterns, and biodiversity. They collect and analyze data, conduct experiments, and conduct field observations. Students collaborate to understand the causes of climate change and propose mitigation and adaptation strategies.
Blended Learning	Flipped classroom In a blended learning environment, students access online resources to watch pre-recorded video lectures or learn new subject content at home. Classroom time is then used for collaborative activities and discussions to reinforce understanding and apply knowledge. For example, students watch instructional videos on math concepts at home and then engage in problem-solving group activities in class and engage in discussions on the use of relevant concepts.



introduction of a set of core modules studied by all students and a set of elective modules for each grade will be fruitful. It is recommended that the optional modules be tailored to different areas of application of STEAM education experiences. The modules provided should provide opportunities for knowledge exploration, design, interactive learning, and presentation of discoveries in innovative ways. The proposed reforms should set the stage for more widespread implementation of constructivist learning theory-based learning methodologies in the classroom. Accordingly, project-based learning, problem-based learning, phenomenon-based learning, inquiry-based learning, and blended learning are implemented in connection with modules whenever possible. An example for each of the above is shown below.

Assessing students in STEAM education

When assessing students engaged in STEAM education, it is important to use a variety of assessment tasks that are consistent with the interdisciplinary nature of the subject. Using Rubric in those assessment tasks can help maintain consistency and transparency and provide timely feedback. Below are some assessment tasks suitable for STEAM education.

Project Portfolio: Students may maintain a portfolio showcasing their work throughout their time on a project. This may include design sketches, engineering diagrams, code copies, scientific observations, and process observations. Accordingly, students' ability to apply knowledge, demonstrate skills and communicate their understanding can be assessed.

Performance-Based Assessments: Here, students are provided with practical tasks or simulations that demonstrate their skills and knowledge in real-world contexts. For example, students can be assigned to build a working model, conduct experiments, present a scientific demonstration, or design a robot to complete a specific task. There they can assess their ability to apply concepts, solve problems and communicate their processes and results.

Collaborative Problem-Solving: Group tasks or projects can be assigned where students work together to solve complex problems. Students can be assessed considering their contribution to collaborating and communicating effectively in the team's solution.

Presentations and Exhibitions: Students may be assigned to showcase their learning and projects, prepare, and present presentations, or participate in exhibitions. Student's ability to communicate ideas, present evidence, and engage with an audience should be assessed.

Problem-Solving Scenarios: Students are presented with real-world scenarios or case studies that require them to solve interdisciplinary problems. Student's ability to identify the problem, analyze relevant information, propose solutions, and justify their arguments is assessed. A rubric that assesses critical thinking, creativity, and integration of multiple disciplines is appropriate here.

Strengthening the STEAM education approach as a whole requires the active participation of all stakeholders involved in the education process. The student is a self-motivated active learner, critical thinker, and problem solver, the teacher is a facilitator and resource person, the principal is a collaborative leader and strategic resource provider, the educational administration is the coordinator of all stakeholders, parents are resource providers, and the overall supporters. The general public should also be determined to make the current generation of students suitable for the new job opportunities of the future world and overcome global challenges by contributing to strengthening the approach.



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