

Process of Designing Lesson Plan in Maths Subject According to STEAM Education Orientation



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ABSTRACT: Today, STEAM education is a trend and is strongly deployed by many countries around the world, especially developed industrial countries. STEAM education is one of the Viet Nam general education program orientations after 2018. Vietnam's implementation of STEM education in K12 schools has been shown through the orientations in the overall general education curriculum. This article presents some basic theoretical knowledge about STEAM education such as concepts, characteristics, and forms of organizing STEM education in Vietnam's new general education program. From there, focus on researching and proposing the process of designing Math lessons according to STEM education orientation for primary school students.

KEYWORDS: STEAM, STEM, primary school, Mathematics, lesson plan.

I. INTRODUCTION

We are living in the 21st century in the context of the 4.0 revolution and a strongly developing knowledge economy, information technology and globalization. This challenge poses a task for Vietnamese education and creating people with new capabilities to meet human resources for modern society. On the basis of analyzing the socio-economic characteristics of the 21st century, the Government of Vietnam has identified a system of 11 general competencies required for Vietnamese high school students after 2014, including the following competencies: reading-writing competency and calculation, self-study capacity and self-mastery, information and communication technology capacity; creative capacity and critical thinking; problem-solving capacity, communication and cooperation capacity, and citizenship capacity. STEAM education plays an important role in the implementation of the Vietnam General Education Program from 2018 at the Primary level, contributing to the development of qualities, general and specific competencies for Primary students. In order for students to gradually access technology and apply knowledge to solve practical problems, schools proactively build a list of STEAM/STEM topics/lessons in the direction of strengthening and promoting initiative and positivity. Students' self-study in subjects.

STEAM education began to appear in the late 20th century in the United States and then continued to spread to other advanced countries such as England, Australia, Germany, Finland, Canada, etc. This educational model focuses on Providing future young generations with core skills, thinking, and multidisciplinary knowledge to effectively solve real business and social problems. With such practical purposes, STEAM education is currently being taught by many countries around the world for future generations. These generations are expected to have enough capacity to come up with creative solutions and positive innovations in all fields and industries, contributing to the prosperous development of the country.

STEM education - a new educational model in the world, integrating many subjects and skills to help students develop and integrate well. This educational model is consistent with Vietnam's current educational development goal, which is to focus on developing learners' capacity. STEM education is the integration of skills in science, technology, engineering and mathematics. Helps learners solve the challenges facing the modern world. STEM provides students with skills and experiences that help them become more employable and ready to meet current labor needs. STEM education motivates and inspires young people to develop technology and new ideas. At the heart of this innovative educational approach is helping students learn based on questions. Provide learners with foundational knowledge and encourage them to apply this knowledge in real life. Students are free to practice what they learn and accept mistakes to find ways to overcome them. This way of learning helps learners form different thinking. The core of this method is to give learners flexibility and stimulate curiosity. At the same time, it equips students with the ability to respond to real-world challenges.

In Korea, this country officially introduced STEAM into the national education program in 2009.

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In the island nation of Singapore, many international schools have early exposed students to many advanced devices such as 3D printers and programming applications, to create conditions for students to build their own learning models.

In Israel, children are exposed to STEAM from Kindergarten years, through the three subjects of Science, Technology and Math. At the elementary level, children will learn all STEAM subjects, mainly from daily life activities. At the High School level, students will learn STEAM interdisciplinary knowledge instead of independent subjects. The goal is to equip children with both understanding and application ability. This country also regularly coordinates with large technology corporations such as Google and IBM to bring students many practical experience programs.

It can be said that STEAM is widely deployed in many countries around the world because it is highly appreciated for its effectiveness in educational activities to develop student capacity. Along with the general trend, STEAM educational activities are also being paid attention and developed by countries for children's education systems from a fairly early stage.

II. STEAM EDUCATION

A. *What is the STEAM?*

STEAM is an acronym for the fields of Science, Technology, Engineering, Mathematics, and A (Art). These are fields that are closely related to each other in scientific research and scientific application, creating products to serve life.

STEM education, according to Circular No. 32/2018/TT-BGDĐT promulgating the 2018 general education program, is an educational model based on an interdisciplinary approach, helping students apply scientific knowledge, Informatics, Engineering and Mathematics to solve some practical problems in specific contexts. Therefore, it can be said that STEM is a timely adjustment of general education before the 4.0 Technology revolution.

In addition, in STEM education, we are also interested in integrating connected art education in STEM education: STEM + Art = STEAM.

Art in the context of STEAM education is not simply Music and Painting, ... Art also includes exploring and solving practical problems in a skillful, scientific and humane way in exploring discover and solve practical problems; Presenting and expressing information in a coherent and easy-to-understand manner to help students have the opportunity to express and develop the abilities and qualities required by the program. Artistic elements included in STEM education will arouse students' aesthetic abilities, expressed in design, decoration, and presentation of ideas and products using the symbolic language of colors and shapes. , layout and responsiveness to the development of individuals and humanity in the direction of peace, environmental protection, and sustainable development, and is called STEAM education.

In teaching, STEM/STEAM education is a way to inspire learning, helping students synthesize knowledge between different subjects; Point out applications of school knowledge in life; gives learners the opportunity to practice, turn theory into real tools, participate in hands-on product creation experiences, simulation experiments, and apply relevant skills to solve problems. practice is established.

B. *Characteristics of STEAM educational activities in primary schools*

Children entering primary school will encounter some difficulties and confusion, largely due to the difference in environment and learning requirements of primary school which are very different from those of preschool: from being carefully cared for, play turns into a more disciplined learning environment. Students need to listen attentively to lectures and only have fun at specific times. This has made many children feel anxious, affecting their psychology and academic performance. Thus, at this extremely sensitive transition step, it is necessary to choose an effective educational program that both helps children quickly accept the new environment and improve learning efficiency. One of the widely applied solutions today is STEAM education in primary schools.

STEAM is included in the elementary school curriculum to help equip children with most of the necessary skills such as teamwork, improving the ability to use language in communication and practicing critical thinking,... through projects and team games under the guidance of teachers.

For example, Vietnamese elementary school students are exposed to the field of science through Nature and Society subjects in grades 1,2,3 and Science subjects in grades 4,5. In the traditional teaching model, children will learn basic concepts, rules and theories through books, which are very boring and abstract. However, when applying STEM models to elementary school students, children will learn with visual tools and be equipped with practical knowledge to be able to apply immediately. This way of learning turns a boring subject like Science into more attractive for children than ever. For other subjects such as Technology, Engineering or Mathematics, children also have similar experiences with STEM, making lessons more interesting and engaging.

C. *Forms of STEAM education in primary school in Viet Nam*

Depending on the characteristics of knowledge targeted in the lesson, teachers can implement STEAM lesson plans according to the following instructions:

- In a STEAM education-oriented lesson, only the knowledge specified in the program is mobilized. There are two ways to implement the lesson plan:

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+ If students have not learned this knowledge, teachers will build a STEAM teaching plan in the direction of teaching new knowledge (in the program) through the need to solve problems in life or in a real context. . The destination is a product that solves that problem.

+ On the contrary, if knowledge has been learned, students only need to apply it to create STEAM products to solve practical problems. In this case, the teacher implements applied STEAM.

- In cases where besides the basic knowledge in the curriculum, teachers need to add other knowledge outside the program, we can build exploratory STEAM. At that time, students do experiments, discover new knowledge (not in the current curriculum) and then apply it to make a STEAM product to solve real-life problems.

STEAM classification	Deployment
STEAM teaching and learning	When teaching knowledge units in the curriculum, during in class hours
STEAM application	<p>After students have finished learning the knowledge (which can be consecutive or scattered throughout the school year), teachers let them apply this knowledge to solve practical problems by making a STEAM product, such as on the following occasions:</p> <ul style="list-style-type: none"> - When reviewing at the end of the chapter (if it is a synthesis of knowledge in the subject) - Science Club activities - Extracurricular activities - At home (with parents)/STEAM class time
STEAM exploring	<p>The knowledge needed to make STEAM products is not present in the primary school curriculum but is relatively simple for students to exploring. This form is suitable for the following occasions:</p> <ul style="list-style-type: none"> - Science Club activities - Extracurricular activities - At home (with parents)/STEAM class time

STEAM lessons are an important form of organizing STEAM educational activities in primary schools. STEAM lessons can be understood as a teaching and learning process in which, under the organization of the teacher, students actively carry out learning activities in a specific space and time to solve real-life problems. They practice on the basis of applying knowledge and skills in STEM-related fields, in accordance with specific content in the subject curriculum such as Maths, Nature and Society, Science, Informatics and Technology, Music, Fine arts... contribute to the formation and development of students' qualities and abilities.

In this form, students can meet the requirements for specific subject content specified in the curriculum through STEM lessons. These lessons are planned right in the subject's educational plan, and are implemented right in the process of teaching STEM subjects using an intra-subject or interdisciplinary approach.

Depending on the characteristics of the lesson content, the goal of developing qualities and abilities for students is determined in the lesson, implementation time, and practical conditions of the school (physical facilities, capacity of students and teachers,...), can implement STEAM lessons according to appropriate procedures. However, no matter what process is implemented, STEM lessons need to meet some of the following requirements:

+ STEAM lessons have content that closely follows the general education curriculum at the primary school level with related subjects. This requirement is to ensure that students have the opportunity to learn/discover/formulate knowledge and skills in the subject program, and apply that knowledge and skills to solve learning or practical problems that arise. out in STEM lessons. From there, students meet the prescribed requirements for the content related to the lessons specified in the program.

+ Teaching and learning content and problems raised in STEAM lessons are linked to the nature and scientific principles of the natural world and practical problems.

+ In STEAM lessons, through active learning activities following the process of scientific discovery or technical design, students are given opportunities to participate in exploration and discovery, action-oriented and create learning products.

+In STEAM lessons, students are enhanced with diverse and effective group activities to solve problems.

+ STEM lessons prioritize the use of readily available and accessible equipment and technology to ensure all students in the class can participate.

+ The design of STEAM lessons is done based on analyzing the content, requirements to be met in the program, context and problems to be solved in practice in different areas of life. The STEM lesson plan is implemented according to the teaching framework of Official Dispatch 2345/BGDDT-GDTH dated June 7, 2021, which uses active teaching methods and techniques that contribute to developing student's capacity and qualities. Primary school students belong to the basic education stage, whose central educational goal is to form and develop the basic elements that lay the foundation for harmonious physical and mental development, qualities and abilities. The main orientation is education about personal values, family, community and necessary habits and routines in learning and living. Therefore, STEAM lessons can focus on content such as discovering or solving some close problems such

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as self-discovery and learning problems, understanding common phenomena and problems in the families, the community and the surrounding natural world.

D. Notes when implementing STEAM education

The STEAM topic is a topic aimed at applying and integrating knowledge in the fields of Math, Science, Engineering and Technology to solve practical problems in specific contexts; When all four elements S, T, E, A, M are involved, it is called a full STEAM topic, if there are only 2 or 3 elements it is a missing STEAM topic.

The STEAM topic is the basis for implementing STEAM educational activities at the primary level in many different organizational forms such as: teaching subjects according to STEAM lessons, organizing STEAM experience activities, organizing STEAM activities, scientific and technical research.

To build the STEAM topic, it is necessary to be orientation on content and implementation form, duration and implementation time. Selected primary school STEAM topics need to meet the following criteria:

- The content of the STEAM topic closely follows the primary school education program.
- The problems raised in STEAM lessons are related to practical problems.
- To solve problems, students need to practice, experience, and orient to making/improving products.
- Students have the opportunity to participate in effective group activities to solve problems.
- Problem solving is multifaceted and sees failure as part of the learning process.
- Prioritize the use of available, easily accessible materials, equipment and technology at minimal cost.
- STEM topics are designed and organized so that students have the opportunity to explore knowledge and skills in the subject program and apply that knowledge and skills to solve practical problems.
- The content requires the integration of at least two elements in STEAM, closely following the general education program at the primary school level.
- The teaching method in the STEAM topic takes students into exploration and discovery activities, action orientation, experience, hands-on experiments and making/manufacturing products.
- The form of organizing activities in the STEAM topic attracts students into constructive group activities.
- The plan to organize activities in the STEAM topic needs to take into account options with multiple correct answers and consider failure as a necessary part of learning.

I. HOW TO DESIGN AND ORGANIZE STEAM LESSON IN MATHS SUBJECT

Step 1: Research the curriculum of subjects related to STEAM education

To design STEAM lessons, teachers need to carefully study the Math curriculum. At the same time, teachers also need to research the requirements of other subjects in the STEAM field to look for integration opportunities and determine which requirements students can achieve.

Step 2. Identify the problem

In engineering design, the problem to be solved is a technical challenge, a product needs to be manufactured or improved to solve a practical problem. Problems can be identified through observing the natural world, living environment, reading documents, surveying needs, etc. For primary school students, teachers often proactively set up situations to solve problems. Elicit product ideas from students. The proposed product needs to have specific requirements clarified according to criteria to serve as a basis for the research, design and manufacturing process.

For example, the teacher leads students on the task of Designing a Super Chef Kids Handbook from designing a Daily Menu to having a nutritious meal. In particular, teachers can mention current obesity and malnutrition.

Step 3. Research background knowledge

During this stage, students propose solutions based on the information and knowledge they have learned. To propose solutions, brain storming is often used in combination with thinking support tools. Teachers need to create space for students to be creative, but at the same time need to have appropriate instructions so that the proposal of ideas is linked to the knowledge learned in previous activities. Teachers can organize for students to share their design ideas with each other so that they can help them adjust and perfect the design.

For example, a vehicle has 4 wheels and the wheels need to be circular, so bottle caps can be used; Or to run a car without using a battery, it can create movement thanks to elastic materials such as rubber bands or balloons... In this step, students will present their ideas through illustrations and annotations.

Step 4. Fabrication, testing and evaluation

Students rely on the completed design to make the product. In this step, students need to perform technical operations combining using elements suitable materials. Therefore, to ensure the effectiveness of this activity, teachers need to have an estimate of the materials and tools that can be provided to students to orient themselves from the design activity or limit the learning task of student

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For example, with the activity of creating a super chef handbook, teachers can ask students to take advantage of cheap, easy-to-find materials to have raw materials to meet the making activities.

After making, students will test and record the results from the product. Teachers can guide students to think about the improvements needed to make the product more effective.

Step 5. Share, discuss and adjust

At the end of the technical process, a product or solution is completed that meets the given requirements to solve a problem or task. Students will share products with teachers, friends and more broadly with relatives, family and the community.

Sharing activities once again help students consolidate the concepts or knowledge they have acquired after the product design and making process. Teachers can support with suggested questions about sharing content and sharing methods so that students can get acquainted and gradually form habits and skills in sharing results.

For example, students presented how to design a menu, focusing on a nutritious menu with enough quality, quantity, and change dishes between days. Students share and present their products for others to exchange and give feedback.

Based on the problem chosen to build the topic, whether it is a scientific question or a technical solution, teachers will choose the appropriate process to build an appropriate STEAM education organization process. In this document, STEAM educational activities are mainly organized in the technical design process to increase opportunities to practice technical operations, create products to solve problems and be creative.

III. CONCLUSIONS

Teaching Mathematics according to STEAM education orientation is one of the highlights of the Viet Nam General Education Program after 2018. In the world and in Vietnam, there have been many research projects and applications of teaching theory. STEM/STEAM in a variety of content and conditions. STEM/STEAM-oriented education will equip students with knowledge in all fields, integrating knowledge from many subjects into the same subject, helping knowledge in different subjects to be linked together. This educational method will place students in a multi-factorial environment such as a real-life environment, so that students are trained to handle real-life problems.

When designing STEAM educational activities, teachers need to design activities that stimulate creativity and require children to explore and discover. In addition, teachers need to ask students suggestive questions, attract them to group activities, and collective activities so that they have the opportunity to develop their rational cognitive process. Comprehensively as well as their creative ability through their imagination. These will be favorable conditions for children to develop creative imagination in the next stages.

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