

RESEARCH ON STEM EDUCATION MODEL INTEGRATING PROBLEM-BASED LEARNING IN VIETNAMESE PRIMARY SCHOOLS

LUONG ANH QUANG*, NGUYEN THI THUY HANH**, DANG THI THANH HAI***, CAN NGOC QUYET, *ntthanh@daihocthudo.edu.vn*

* Ngo Gia Tu Primary School, Krong Pac District, Dak Lak Province

** Hanoi Metropolitan University

*** The Dewey Schools, Hai Phong City

**** Tran Phu Secondry School, Duc An Commune, Lam Dong Province.

INFORMATION	ABSTRACT
<p><i>Received: 18/07/2025</i> <i>Revised: 16/08/2025</i> <i>Accepted for publication: 18/8/2025</i> <i>Code: TCKH-S03T08-2025-B14</i> <i>ISSN: 2354 - 0788</i></p> <p>Keywords: <i>Stem education, problem-based learning (PBL), primary schools, teaching innovation, Vietnamese education.</i></p>	<p><i>This paper focuses on the application of the STEM education model based on Problem-Based Learning (PBL) in primary schools in Vietnam. By analysing the theoretical foundations of STEM and PBL, the study investigates the current implementation of this integrated model in selected primary schools. The findings highlight both advantages and challenges, including teacher capacity, infrastructure and instructional materials. The study reveals that STEM PBL contributes positively to the development of problem-solving skills, critical thinking and teamwork among primary students. However, several obstacles hinder its widespread and effective adoption. The paper concludes with recommendations and orientations to enhance the application of the STEM PBL model in Vietnam's primary education system in the coming years.</i></p>

1. Problem statement

Resolution No.29-NQ/TW November 4, 2013 on “Fundamental and comprehensive innovation in education and training” clearly identified the requirements for educational development to meet the needs of industrialization, modernization and international integration. One of the key directions emphasized is to innovate teaching methods towards capacity development and enhancing practical application, in which the STEM education model plays a key role. Equipping students with STEM knowledge and skills (Science, Technology, Engineering, Mathematics) right from primary school is not only an international trend but also an urgent

requirement to form a foundation of scientific thinking, critical thinking and problem-solving capacity for future generations of citizens.

In addition, the Problem-based learning model has been proven to be an effective pedagogical method in enhancing creative thinking, collaboration skills and the ability to apply interdisciplinary knowledge to solve practical situations. When integrating STEM education with the PBL method, students not only learn knowledge proactively but also develop comprehensively in terms of capacity and qualities.

In recent years, guiding documents such as Decision No.522/QD-TTg (2018), Circular No.

32/2018/TT-BGDĐT and Official Dispatch No. 4704/BGDĐT-GDTH (2022) have created an important legal basis for implementing STEM education in general education programs, especially at the primary level. These documents encourage interdisciplinary integration in the direction of STEM, promote experiential activities, project learning and early career education. Piloting STEM education in some localities also shows the development potential of this model. However, the process of applying the STEM PBL model in primary schools in Vietnam still faces many difficulties such as: limited facilities, teachers lacking experience in organizing integrated teaching and guidance documents that are not consistent and appropriate to the characteristics of primary school students. These obstacles pose an urgent need to study the practical implementation of the model, analyze barriers and propose feasible solutions.

From that reality, this article focuses on studying the application of the STEM education model oriented towards Problem-based learning in primary schools in Vietnam, in order to evaluate the implementation effectiveness, analyze difficulties and propose future development directions.

2. Research content

2.1. Some basic theoretical issues

2.1.1. STEM education

STEM education is an integrated educational approach that combines four areas: Science, Technology, Engineering and Mathematics. The main goal is to equip students with knowledge and practical skills to face real-world challenges.

Morrison (2006): "STEM education is an interdisciplinary approach to learning in which rigorous academic concepts are combined with real-world lessons as students apply Science, Technology, Engineering and Mathematics in contexts that create connections between

schools, communities, workplaces and global businesses".

Sanders (2009): "STEM education is the intentional integration of Science, Technology, Engineering and Mathematics concepts to create a cohesive learning model based on real-world applications."

According to Bybee (2010): STEM education is an integrated approach that focuses on teaching and learning Science, Technology, Engineering and Mathematics in a connected and practical way, attempting to help students better understand the applications of these fields in the real world.

Author Breiner et al. (2012) stated: STEM is not simply teaching individual subjects but a multidisciplinary approach, encouraging students to apply knowledge to solve real-world problems.

Kennedy & Odell (2014): STEM education needs to encourage creative thinking, problem solving, logical thinking and innovation through hands-on learning projects.

Author Nguyen Cuong (2016) said: "STEM is a modern educational approach that helps students develop research skills, teamwork and information systems thinking through solving practical problems based on the integration of interdisciplinary knowledge".

Nguyen Thi Binh (2017): "STEM education is a new approach in organizing teaching and learning, integrating knowledge and skills related to Science, Technology, Engineering, Mathematics and learning to create opportunities for students to learn and experience practical experiences".

Summary: STEM education is an integrated educational approach that connects knowledge and skills from the fields of Science, Technology, Engineering and Mathematics. It emphasizes learning through hands-on experiences and practical problem solving, to develop creative thinking, collaboration,

critical thinking and other skills needed to meet the demands of the 21st century.

2.1.2. *STEM education in primary school*

STEM education at the primary level emphasizes the integration of basic knowledge from Science and Mathematics, Technology to train logical and creative thinking. STEM education activities are often accompanied by small learning projects to encourage students to explore and apply knowledge.

According to author Bybee (2010): "STEM education in primary school is an integrated approach to learning that helps young students explore the connections between the fields of Science, Technology, Engineering and Mathematics. Through simple and age-appropriate hands-on activities, students develop logical and creative thinking skills".

Moore et al. (2014) stated: "STEM education at the elementary level focuses on engaging young learners in age-appropriate, hands-on activities that foster curiosity, problem-solving skills and an understanding of how Science, Technology, Engineering and Mathematics connect to their everyday lives."

Nguyen Thi Binh (2017): "STEM education in primary school is an integrated teaching method, in which students learn through practical experiences, exploring and solving simple problems, helping them form creative and logical thinking skills early".

Le Dinh Trung et al. (2018): "STEM education in primary school focuses on stimulating students' interest in learning through simple, hands-on projects. This is the foundation for developing skills such as observation, analysis and creativity for young children".

Thus: STEM education in primary school is an integrated method, combining knowledge and skills from the fields Of Science, Technology, Engineering and Mathematics. This method uses practical experience activities, suitable for students' curiosity, to arouse

curiosity, develop students' creative thinking, problem-solving ability and collaboration skills, and help them see the connection between subjects and reality.

2.1.3. *STEM education according to the STEM Problem-based learning model in primary schools*

The STEM PBL model is a model that combines two popular teaching methods: STEM and Problem-based learning. This is an educational approach that Integrates science, Technology, Engineering and Mathematics subjects and focuses on solving real-world problems through learning projects. The PBL model in STEM education in elementary schools is an integrated teaching method in which students are assigned to solve practical problems related to the fields of Science, Technology, Engineering and Mathematics. This method not only focuses on theoretical theories but also pays attention to learning through practical experiences and solving real-world problems, helping students develop necessary skills such as: Critical thinking, problem solving ability, cooperation skills, creativity and innovation.

According to author Barrows (1996): "Problem-based learning is a learning method in which students face real-world problems, through which they develop problem-solving skills, critical thinking and self-learning ability when applied to the STEM model, PBL helps students integrate knowledge of Science, Technology, Engineering and Mathematics to solve real-world problems".

Lai and associates (2016): "In STEM education, Problem-based learning is a teaching method that engages students in actively solving problems using knowledge and skills in Science, Technology, Engineering and Mathematics. This approach allows young learners to apply their knowledge to real-world situations, promoting creativity, teamwork and critical thinking."

Nguyen Thi Binh (2017): "PBL model STEM education in primary school is an

integrated teaching method, in which students solve practical problems, combining knowledge from Science, Technology, Art, Engineering and Mathematics, they develop problem-solving skills, creativity and critical thinking, while enhancing the ability to cooperate in groups".

Le Dinh Trung et al. (2018): "The PBL model in STEM education in primary schools not only helps students learn through practice but also develops creative thinking and problem-solving skills through applying knowledge of Science, Technology, Engineering and Mathematics to real-world problems".

Thus, STEM education combined with the STEM PBL model in elementary schools is an integrated teaching method in which students

solve practical problems related to the fields of Science, Technology, Engineering and Mathematics. This method combines theoretical learning with practical experience, encouraging students to apply knowledge to solve practical problems, thereby developing creative thinking, problem solving, teamwork and critical thinking skills".

2.1.4. STEM PBL education content in primary schools

STEM PBL education in primary schools is a comprehensive learning method that helps students combine theoretical knowledge with practical skills. This process not only develops creative thinking and collaboration skills but also arouses a passion for learning and a sense of solving practical problems from an early age.

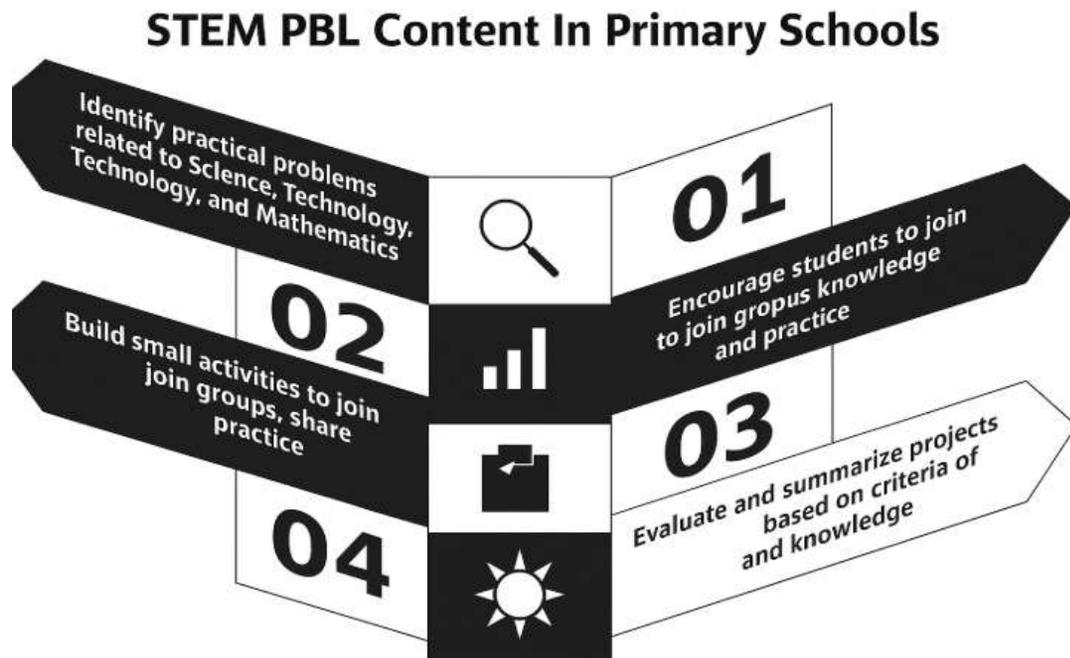


Figure 1: STEM Problem-based learning educational content

Identifying real-world problems related to Science, Technology, Engineering and Mathematics: The first step in STEM PBL education is to help students identify real-world problems related to the fields of Science, Technology, Engineering and Mathematics. These problems should be selected to be

appropriate for primary school age, easy to understand and close to students. For example, issues such as saving water in daily life, processing recyclable waste or building safe traffic models can be mentioned. These problems not only arouse curiosity but also create opportunities for students to connect the

knowledge they have learned to reality, thereby forming analytical thinking and creativity.

Building small Project-based activities: In PBL education, large projects need to be broken down into small activities to reduce pressure and enable students to carry out each step effectively. These activities can be divided into stages such as understanding the problem, planning, implementing and finally checking the results. For example, students can start with a simple experiment, such as testing the water permeability of soil types or building a miniature windmill model from recycled materials. In addition, using supporting tools such as simulation software or information technology applications also helps increase the attractiveness and effectiveness of these activities.

Encourage students to ask questions in groups, share knowledge and practice: To develop teamwork and communication skills, STEM PBL education should encourage students to discuss in groups, share ideas and practice. In this process, students are placed in situations to solve problems together, learn to listen to others' opinions and ask critical questions themselves. Roles in the group should be clearly assigned, such as note taker, practitioner or presenter, to ensure that all students have the opportunity to

participate and develop their personal strengths. Teachers also play a guiding role, encouraging students to experiment, learn from mistakes and continuously improve their ideas. **Assessing and summarizing projects based on skills and knowledge criteria:** An important part of STEM PBL education is assessing project effectiveness based on two criteria: skills and knowledge. This assessment focuses not only on the final result but also on the implementation process, to recognize students' efforts and progress. Assessment criteria may include teamwork skills, problem-solving ability, understanding of science content and the ability to apply mathematics in real life. In addition, teachers should encourage students to present their products, answer critical questions and comments from their peers. Individual feedback is also an effective way to help each student recognize their strengths and improve their weaknesses.

2.1.5. Steps in the STEM PBL model in elementary schools

The STEM PBL model is a powerful learning method that helps students develop important skills in the modern world, while creating a dynamic, creative and real-world learning environment. The STEM PBL model includes the following 6 steps.

Steps in the STEM PBL (Problem-Based Learning) Model



Figure 2: 6 steps in the STEM PBL (Problem-based learning) model

Step 1. Identify the problem or project

Objective: Students are introduced to a real-world problem or project related to STEM fields. These problems may be community issues, new technologies or environmental issues that need to be solved; Method: Teachers help students understand the problem and identify the goals to be achieved from the project.

Step 2. Plan and assign tasks

Objective: Students will plan and divide work within a group, identifying specific steps to take to solve a problem or complete a project; How: Students use STEM knowledge to plan research, design solutions and assign work to team members.

Step 3. Research and apply STEM knowledge

Objective: Students will research, collect information and apply knowledge from Science, Technology, Engineering and Mathematics to projects; How: Students explore scientific principles, use technological tools, design engineering models and apply mathematics to solve problems.

Step 4. Project implementation and execution

Objective: Students perform activities, experiments or manufacture products while solving problems; How: Students apply researched solutions to real-world situations, working with materials, tools and technologies to create or test.

Step 5. Evaluation and feedback

Objective: After completing the project, students evaluate their performance and receive feedback from teachers or peers; How: Students self-assess their learning, problem-solving and skill improvement. Teachers can use assessment criteria to provide feedback on the quality of work and solutions.

Step 6. Share results and conclusions

Objective: Students present the results of their project, sharing what they learned and conclusions from the problem solving process;

Method: Students can present their results through presentations, reports or real-world products (e.g. models, software, engineering solutions) and share their learning experiences with other groups or the community.

The STEM PBL model is a powerful learning method that helps students develop important skills in the modern world, while creating a dynamic, creative and real-world learning environment.

2.1.6. International lessons on applying the STEM PBL model in primary schools

Countries such as the United States, Japan and Singapore have achieved remarkable results in applying the STEM PBL education method, thanks to effective and systematic implementation strategies. First of all, these countries focus on building flexible curricula, integrating subjects such as Science, Technology, Engineering and Mathematics, helping students easily connect knowledge and apply it to practice. Second, they invest heavily in modern educational equipment and in-depth training programs for teachers, to ensure that both teachers and learners have the conditions to develop optimally. Finally, these countries promote cooperation between schools and businesses and scientific organizations, thereby creating practical projects, providing resources and creating a socially connected learning environment. These factors are important lessons for other countries to refer to in effectively implementing STEM PBL education.

STEM PBL model in elementary schools in the US

Integrating STEM into general education: Schools in the US have successfully integrated STEM into the general education curriculum through practical projects such as programming robots, studying the environment and solving social problems. This helps students develop creative thinking, problem-solving skills and teamwork.

Initiative National: Initiatives such as the Next Generation Science Standards (NGSS) have guided schools to develop project-based STEM programs. This is a foundation for students to both learn and apply knowledge in real life, increasing their access to STEM careers in the future.

Corporate collaborations: Collaborations between schools and major corporations such as Google, Microsoft and NASA have provided resources, learning tools and practical opportunities for students.

STEM PBL model in elementary schools in Japan

STEM is linked to local practice: Japan develops projects related to disaster prevention (earthquakes, tsunamis), renewable energy development or smart traffic models. These projects not only educate students but also bring useful solutions to society.

Developing technical skills: School robotics competitions have become a useful playground, helping students practice technical and programming skills, while promoting the spirit of innovation.

Teacher training: Japan focuses on training teachers to become project leaders, supporting students in problem solving and developing creative thinking skills.

STEM PBL model in primary schools in Singapore

Comprehensive STEM education program: Singapore has built STEM programs from primary to secondary levels, focusing on project-based learning, helping students learn how to apply knowledge into practice.

Science and technology centres: Dedicated student research centres, such as the Singapore Science centre, provide state-of-the-art facilities, workshops and competitions for students to practice and explore.

International collaboration: Singapore strengthens collaboration with international

organizations and businesses such as Google and IBM, giving students access to cutting-edge technologies and global projects.

2.1.7. Legal basis and implementation orientation in Vietnam

2.1.7.1. Legal basis

The implementation of STEM education combined with Problem-based learning in Vietnam is clearly oriented through directive documents and policies of the Party, State and Education sector.

Firstly, Resolution No.29-NQ/TW on fundamental and comprehensive innovation in Education and Training (2013) emphasizes the shift from education that focuses on knowledge transfer to developing learners' qualities and capacities, while encouraging "integrated and interdisciplinary teaching and learning, promoting students' positivity, initiative and creativity" - this is the basis for the orientation of applying STEM and PBL education.

Second, the 2018 General education program (Ministry of Education and Training, 2018) clearly demonstrates the requirements for integrated teaching and capacity development. According to this program, the subjects of Science, Information Technology, Technology and Mathematics in primary schools are built in an open direction, creating conditions for integrating STEM content through practical experience and problem-solving activities.

Third, Decision No.1268/QĐ-TTg October 19, 2022 of the Prime Minister approving the "National Action program on digital transformation in the field of Education and Training to 2025, with a vision to 2030" clearly identified the role of science and technology in educational innovation, emphasizing the application of STEM and innovation of teaching methods towards capacity development.

In addition, documents such as Official Dispatch No.3089/BGDĐT-GDTrH (2020) on guidelines for implementing the general

education program for the 2020-2021 school year also mention the implementation of STEM teaching activities at educational institutions.

2.1.7.2. Orientation for implementing STEM PBL education in Vietnam

In the context of education transforming towards competency development, Vietnam has taken initial steps in implementing STEM combined with PBL, especially at the primary level - where the foundation of thinking and qualities for students is formed.

The main directions include: (1) Strengthening the development of open learning materials and guidance documents on STEM education integrating PBL suitable for the psychological characteristics and level of primary school students. (2) Organize training and fostering for teachers on interdisciplinary and integrated teaching methods and PBL teaching organization techniques, helping teachers confidently implement the STEM-PBL model in classroom practice (Nguyen Thi Hanh & Nguyen Thi To Nga, 2023). (3) Encourage schools to organize experiential activities, science and technology competitions and learning projects with close practical issues to help students develop their creativity and teamwork (Tran Thi Thanh & Pham Van Hung, 2021). (4) Gradually standardize facilities and equipment, especially STEM rooms, technology rooms or creative spaces, to meet the needs of integrated learning.

With the synchronization of policies, programs, staff and facilities, STEM-PBL education is fully capable of sustainable development and is suitable for the current goal of general education innovation in Vietnam.

2.2. Results of current research

2.2.1. Research organization

2.2.1.1. Approach

This study uses a mixed methods approach, combining qualitative and quantitative methods to ensure depth and breadth in data collection

and analysis. Qualitative methods are used to deeply understand the experiences of teachers, administrators and students in the process of implementing the STEM PBL model. Quantitative methods are used to collect and process large-scale survey data, thereby determining the current situation, advantages, difficulties and needs for implementing this model in primary education in Vietnam.

2.2.1.2. Research subjects, scope and area

Research subjects: teachers, administrators and students at primary schools that have, are or are planning to implement STEM education combined with Problem-based learning.

Survey subjects: including 120 teachers, 18 administrators and 240 students in grades 4 and 5 at primary schools in 3 provinces and cities representing 3 regions: Hanoi (North), Da Nang (Central) and Can Tho (South). Research period: October 2023 to April 2024.

2.2.1.3. Data collection tools

To ensure reliability and diversity of data sources, the study used a combination of the following tools: The survey (structured questionnaire) was designed for teachers and students to collect quantitative data on their knowledge, readiness, attitudes and needs related to STEM PBL education. The questionnaire was developed based on theoretical foundations, combined with previous studies (Krajcik & Blumenfeld, 2006; Nguyen Thi Binh, 2017). Semi-structured in-depth interviews were conducted with 15 teachers and 6 administrators to explore their views, perceptions, difficulties and suggestions in the process of organizing teaching and learning according to the STEM PBL model. Classroom observations and analysis of teaching materials to determine the extent of STEM and PBL integration in current teaching practices. Field notes were used during surveys and classroom visits to document how problem-based STEM activities were organized.

2.2.1.4. Data analysis method

Quantitative data from the survey were processed using SPSS 26.0 software. Descriptive statistics (frequency, percentage, mean, standard deviation) and inferential statistics (t-test, ANOVA) were used to analyze the differences between groups of subjects and the level of influence of some factors on the implementation of STEM PBL. Qualitative data from interviews and observations were analyzed using content analysis. The information was coded, categorized by themes (coding) and outstanding patterns and trends were drawn about the implementation status, advantages, difficulties and improvement solutions.

2.2.2. Results of current situation research

This study applied a mixed methods approach to data collection and analysis, providing a comprehensive and in-depth view of the current situation, advantages, difficulties and needs of implementing the STEM PBL education model in Vietnamese primary schools. Below are the main results from the quantitative and qualitative analysis.

Quantitative data were collected from 120 teacher surveys, 18 management staff surveys and 240 student surveys of grades 4 and 5 in Hanoi, Da Nang and Can Tho then processed using SPSS 26.0 software.

(1) *On the level of understanding and awareness:* Approximately 75% of teachers have a basic understanding of STEM education and 60% are aware of PBL. However, only 45% of teachers are confident in their ability to integrate both methods effectively. The t-test results show that teachers in large cities (Hanoi, Da Nang) have slightly higher levels of understanding and readiness than those in Can Tho but there is no significant difference between implemented and oriented schools. 89% of administrators recognize the importance of STEM PBL in the current educational context and 72% strongly support the implementation of

this model. 85% of students expressed high interest in learning activities that involved practice, exploration and teamwork. The average score for students' enjoyment of STEM PBL activities was 4.2/5 points.

(2) *On readiness and convenience:* Regarding facilities: About 55% of teachers believe that the school's current facilities do not fully meet the needs of large-scale STEM PBL implementation, especially specialized functional rooms. About documents and programs: 68% of teachers and administrators want more specific guidance materials, pre-designed sample STEM PBL topics for each grade level. Regarding attitude: Most teachers (88%) and students (92%) have a positive attitude and are open to innovation in teaching and learning methods.

(3) *About difficulties and needs:* Main difficulties: 70% of teachers have difficulty designing interdisciplinary project topics, 65% have challenges in classroom management when organizing group activities and 58% are concerned about assessing student learning outcomes under the new model. Training needs: 80% of teachers expressed a need for in-depth training on how to develop project topics, organizing skills and evaluating STEM PBL activities. Qualitative data were collected through 15 in-depth semi-structured teacher interviews, 6 administrator interviews, along with classroom observations and analysis of teaching materials, combined with field notes. Content analysis helped to code and categorize the information to draw out emerging patterns and trends.

(4) *On views and perceptions:* The administrators all emphasized that STEM PBL is an inevitable trend of modern education, helping to develop students' comprehensive capacity and qualities. They considered this an important direction to improve the quality of primary education. However, some administrators are still quite vague about the specific implementation roadmap. Teachers have

recognized the benefits of STEM PBL in stimulating students' interest in learning, developing problem-solving and teamwork skills. They appreciate the fact that students can do it themselves and explore on their own.

About the advantages in implementation

Student engagement: All classroom observations noted student enthusiasm, initiative and active participation in STEM project activities. Students demonstrated greater creativity and teamwork than expected.

Support from superiors: Some schools receive attention and initial investment in facilities and training from the education department and education department.

Available resources: Some teachers have taken advantage of recycled materials, simple, easy-to-find materials to serve small projects.

On difficulties and challenges

Curriculum and duration: Teachers shared difficulties in adjusting the current curriculum to have enough time to implement PBL projects, which require longer time than traditional methods.

Project design skills: Many teachers feel confused about turning an academic topic into an engaging, elementary-age-appropriate STEM PBL project that incorporates the S, T, E and M elements.

Assessment: The assessment of students' processes and products according to STEM PBL criteria is still unclear, making it difficult for teachers to quantify students' progress.

Materials and training: Teachers and administrators alike want hands-on training with specific guidance from experts so they can confidently implement.

Exam pressure: Although the model brings many benefits, the pressure of scores and exams is still a barrier that makes some schools hesitate to widely implement it.

Coordination: Coordination between subject teachers to jointly develop and implement an interdisciplinary project is still limited.

Regarding suggestions and solutions for improvement:

A set of standard guidance documents, including sample project topics, implementation procedures and assessment tools appropriate for the Primary level, should be developed.

Strengthen training courses and in-depth training for teachers in both STEM PBL theory and practice. Building a network to share experiences between schools and teachers has been and is being implemented effectively. Invest appropriately in facilities and equipment to support practical activities.

The research results show that the STEM PBL model has great potential in primary education in Vietnam, receiving positive reception from students, teachers and administrators. However, effective implementation requires synchronous investment in programs, materials, training and facilities to address existing challenges.

2.3. Solutions applied in Vietnam

From the research results obtained in both theory and practice, we propose the following measures:

(1) Building a flexible STEM education program

Design an integrated STEM curriculum that is suitable for the characteristics of primary school students, ensuring practicality and creativity. The program needs to integrate subjects such as Science, Technology, Engineering and Mathematics in a gentle, easy-to-understand way, suitable for students' thinking development. Build content around familiar issues such as the environment, renewable energy and simple technology. Ensure flexibility in lesson organization, encourage students to carry out small projects.

(2) STEM PBL teacher training: Organize specialized training courses in-depth to improve STEM knowledge and project guidance skills for

teachers. Develop short-term training programs combining theory and practice. Invite international experts to organize workshops to share experiences on the STEM PBL method. Provide STEM teaching materials and tools for teachers to easily implement the model in the classroom.

(3) *Investing in facilities and equipment:* Building specialized STEM classrooms in primary schools with full equipment such as: Science experiment kits. 3D printers, educational robots and basic programming devices. Software and applications to support simulation, design and STEM learning. Ensuring a stable budget to maintain and update necessary equipment.

(4) *Strengthen international cooperation:* Connect with advanced countries such as the US, Japan, Singapore to learn from experiences in applying STEM PBL. Refer to and apply high-quality STEM teaching materials and modern technology tools. Organize professional exchange programs between Vietnamese teachers and international experts. Participate in international projects to apply global standards to STEM teaching.

(5) *Organize STEM activities and competitions:* Organize STEM competitions for primary school students, encourage students to be creative through practical projects such as: Designing basic robot models, making products from recycled materials, solving practical problems using science and mathematics applications. Rewards to encourage and promote students' learning spirit. Build a STEM club at school so that students have a regular practice environment.

(6) *Develop master plans:* The short-term plan (1-2 years) focuses on curriculum development, teacher training and organizing basic STEM activities. The medium-term plan

(3-5 years) focuses on expanding practical projects, investing in facilities and enhancing international cooperation. The long-term plan (over 5 years) aims to popularize the STEM PBL model in most primary schools, linking STEM education with local and national practices.

3. Conclusion

The STEM PBL educational model is not only an innovative learning method but also brings outstanding value in developing comprehensive thinking for primary school students. By integrating knowledge from the fields of Science, Technology, Engineering and Mathematics, STEM PBL helps students connect theory with practice, while at the same time stimulating a passion for discovery and the ability to solve real-world problems.

Through systematic implementation steps, from problem identification to sharing results, this model not only consolidates professional knowledge but also trains important soft skills such as teamwork, critical thinking and communication. Experience from advanced countries such as the US, Japan and Singapore has proven that STEM PBL is an effective educational strategy, playing a key role in preparing the young generation to enter the modern world with creative thinking and high adaptability.

In Vietnam, the application of the STEM PBL model requires comprehensive investment from education programs, teacher training, to facilities and international cooperation. With practical solutions and a clear development roadmap, this model has the potential to not only improve the quality of education but also promote the connection between students and practical social issues, contributing to building a generation of competent and responsible global citizens.

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