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STEM in Elementary School: How it impacts students' life skills?

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Abstract

The learning approach that provides experiences and abilities to support future life related to the Internet of Things (IoT) is one of the STEM approaches. This research aims to determine the effects of the STEM approach on the development of students' life skills in elementary school. The method used a quasi-experimental design with a pretest-posttest control group design, and the sample was selected through purposive sampling. The instrument used for assessing life skills was the Life Skills Scale for Sport (LSSS) developed by Cronin & Allen. The results of the analysis showed a significance level of 0.002 for life skills. It can be concluded that the STEM learning approach has an impact on the development of life skills in elementary school. This can be considered an alternative for Physical Education teachers in elementary schools to instil life skills from an early age and to foster the development and reinforcement of integration in applying knowledge into skills.

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INTRODUCTION

Education prepares human resources capable of competing in the present and future. The readiness of students in terms of character formation can be influenced by the role of teachers. This aligns with the statement that the advancement of time and technology demands the education sector to produce excellent human resources (Isrokatun, et.al., 2022). To support the maximum learning process, students must be in good physical condition to actively participate in the learning process.

Physical Education in schools encourages students to move, ensuring that their bodies are in good condition and they do not experience excessive fatigue, enabling them to absorb school materials effectively. Physical education serves as one of the avenues for developing students' life skills in school. This is supported by Gumilang, et.al., (2022), physical education is not merely physical education or physical activities, but it is more broadly related to the overall educational objectives and contributes to an individual's life.

Furthermore, schools can benefit from the potential of sports to develop life skills, as almost all children engage in physical activities. The implementation of physical education must align with overall educational goals (Gumilang et al., 2022).

Kendellen, et al. (2017) define life skills as psychological assets, values, and abilities that enable individuals to effectively meet the demands and challenges of daily life and act positively. Primary school is a period of rapid emotional and physical growth. WHO classifies life skills into three categories: thinking skills (skills that enhance brain logic, such as analytical skills, creative and critical thinking, problem-solving skills, and decision-making skills); social skills (including interpersonal skills, communication skills, leadership skills, management skills, advocacy skills, teamwork skills, and team building, among others); and emotional skills (involving self-awareness, knowing and feeling comfortable with oneself, self-management, including managing/ overcoming feelings, emotions, stress, and resisting peer and family pressure). Instilling or nurturing life skills from an early age is essential, including stress management or life skills such as emotional intelligence and resilience, allowing children to manage stress and cope with difficult emotions.

To support the development of life skills in schools, the learning process requires the use of approaches or teaching strategies that can integrate them effectively. Innovation, creativity, and active learning are inseparable from the application of teaching strategies, which is the responsibility of every teacher. The STEM approach is an integrated approach that emphasizes Science, Technology, Engineering, and Mathematics. Force (2014) states that the four-way model aligns with real-world issues and problem-based learning. The STEM model can be applied to elementary school students to enhance critical thinking and problem-solving skills. This model has been widely used in various countries to address the problem-solving challenges of the current century.

The STEM approach has become the focus of educational reform in the United States and has gained popularity worldwide (Eskin et al., 2018). It is an integrated teaching approach that emphasizes the integration of science, technology, engineering, mathematics, and problem -based learning. The fundamental goal of this approach is to create future leaders who can bring about positive change in society. It is possible that the STEM-based learning model can create competitive generations if applied effectively. By integrating the four components of Science, Technology, Engineering, and Mathematics, students can be motivated and confident in both local and remote competitions.

STEM serves as a bridge connecting educational institutions (schools) with the real world. The future world will rely on advanced technologies such as drones, robots, industrial automation, smartphones, etc. The application of STEM in education can encourage students to design, develop, and utilize technology to enhance cognitive, emotional, and applied

knowledge. STEM-based learning can train students to apply their knowledge to design as a form of technology usage to solve environmental-related problems. STEM is necessary in the learning process. STEM literacy refers to an individual's knowledge, attitude, and skills to solve real-life problems, design, and interpret conclusions from various facts in STEM disciplines (Ardianto et al., 2018).

This approach is one of the alternative models for developing life skills in physical education, particularly problem-solving skills. After the online learning during the pandemic limited students' physical activities (Farepsi & Suryana, 2021), this research aims to develop students' life skills through the implementation of the STEM approach.

METHOD

Population and Sample

The research was conducted at Pintar Elementary School in Bandung, with the population consisting of sixth-grade students at Pintar Elementary School in Bandung. The method used was a quasi-experimental design with a pretest-posttest control group design, and the sampling technique employed was purposive sampling based on the criteria of (1) the same grade level, (2) participation in and completion of the entire research process, and (3) active engagement in learning, with an attendance rate of 80%.

Instrument

The instrument used to measure life skills or kecakapan hidup was adapted from the Life Skills Scale for Sport (LSSS) developed by Cronin & Allen (2017). LSSS consists of 8 components of life skills, namely teamwork, goal setting, time management, intrapersonal communication, social skills, leadership, problem solving, and decision-making, which are divided into 47 statements. LSSS exhibits high reliability values, specifically for teamwork (0.93), goal setting (0.93), time management (0.92), emotional skills (0.87), interpersonal communication (0.89), social skills (0.86), leadership (0.93), problem solving, and decision making (0.82), falling into the high category and suitable for use as a research instrument (Rohmanasari, R., Ma'mun, A., & Muhtar, T., 2018). Thus, this instrument can be used with a sample population having the same characteristics as the one being studied.

RESULTS

Here is the data description presented in the table shown in Table 1:

Table 1. Statistic Descriptive Life Skill

		Mean	Gain	Std.dev
STEM	Pre-test	120.0	3.05	6.4
	Post-test	123.7		4.7
Non-STEM	Pre-test	110.9	0.52	4.4
	Post-test	111.5		4.4

Based on Table 1, it shows that the average values in the STEM approach indicate a change from the pre-test to the post-test. The average value in the pre-test is 120.6, and in the post-test, it is 123.7. This results in an increase of 3.05 points, indicating that there is an improvement in the average score of the experimental group from the pre-test to the post-test. This means that the treatment in the form of the STEM approach has an impact on the life skills of the students.

On the other hand, the non-STEM group shows that the average values of the pre-test and post-test in the control group also indicate a change. The average score in the pre-test is 110.9, and in the post-test, it is 111.5, resulting in a difference or change of 0.52 points. This difference indicates that there is an increase in the average score of the control group from the pre-test to the post-test. This means that maintaining normal activities without any specific treatment also has an impact on the life skills of the students, although the increase is minimal.

Below are the results of the T-test for both groups, as shown in Table 2:

Table 2. Result of T-test Life Skill

Variable	Sig. (2-tailed)
STEM	0,002
Non - STEM	0,296

Based on the SPSS output presented in Table 2, the significance value (sig.) for the variable "life skills" is 0.002, which is less than 0.05 (0.002 < 0.05). According to the decision-making criteria, this means that H0 is rejected, indicating a significant influence of the STEM (science, technology, engineering, and mathematics) approach on the development of life skills. Therefore, it can be concluded that there is a significant impact of the STEM approach on the development of life skills.

Furthermore, based on the SPSS output presented in table 2, the significance value (sig.) is 0.296, which is greater than 0.05 (0.296 > 0.05). According to the decision-making criteria, this means that H0 is accepted, indicating no significant improvement from the learning program without the STEM approach in enhancing life skills. Therefore, it can be concluded that there is no significant influence of the learning program without the STEM approach on the development of life skills.

DISCUSSION

In line with the research findings indicating that the STEM (Science, Technology, Engineering, and Mathematics) approach has a significant impact on students' life skills, empirical evidence in the field supports the alignment with life skills theory. Students have shown teamwork, social skills, and leadership qualities during problem-solving and decision-making tasks provided by the teacher. This research is supported by another finding states practical implications for teachers, counseling professionals, and other support staff in schools, as specific guidance activities can be designed to strengthen students' connectedness, sense of meaning in life, and life skills (Yuen, 2021).

The results of this research are consistent with previous studies. Several studies have shown that young people develop a range of life skills through sports (Cronin & Allen, 2017; Rohmanasari et al., 2018; Trottier & Robitaille, 2014; Whitley et al., 2013). As mentioned earlier, although sports have been identified as a beneficial setting for learning life skills, STEM (Science, Technology, Engineering, and Mathematics) is an innovative approach that allows students to expand their knowledge in sciences and humanities while developing 21st-century skills such as communication, critical thinking, leadership, teamwork, creativity, resilience, and other skills (Mu'minah & Suryaningsih, 2020).

The findings of this research indicate that there is a difference in the influence of the STEM approach (Science, Technology, Engineering, and Mathematics) compared to non-STEM learning programs on the development of life skills. This suggests that the STEM approach in physical education learning significantly influences the development of life skills compared to learning programs without the STEM approach. This is based on the data analysis results in Table 2, which conclude that there is a significant difference in the influence of the STEM approach (Science, Technology, Engineering, and Mathematics) compared to non-STEM learning programs on the development of life skills.

Based on the gains in the development of life skills components between those who participated in physical education learning with the STEM (Science, Technology, Engineering, and Mathematics) approach and those who followed non-STEM programs, it is evident that the STEM approach is more effective. This is supported by previous research that indicates that the STEM approach includes life skills that support the development of project-based learning, strengthening students' Pancasila (Indonesian national philosophy) profiles, including aspects such as faith in God, good character, support for global diversity, mutual cooperation, strong independence, critical thinking, and high creativity (Roshayanti, et al., 2022).

This is because the STEM (Science, Technology, Engineering, and Mathematics) approach is a new innovation in implementing learning activities in the 2013 Curriculum and the Mandiri Curriculum (Monkeviciene et al., 2020). The STEM (Science, Technology, Engineering, and Mathematics) learning process is an approach that involves students entirely in exploring and understanding the meaning of current lessons (Kang, 2019; Ozkan & Umdu, 2021). In this case, educators act as facilitators, and students explore and collaborate in completing their learning tasks (Van et al., 2015). STEM (Science, Technology, Engineering, and Mathematics) is an integrated approach that combines the subjects of Science, Technology, Engineering, and Mathematics as a means to develop students' inquiry, communication, and critical thinking skills during learning (Rinke et al., 2016; Chen et al., 2019).

In contrast, non-STEM learning, known as teacher-centered learning (TCL), places the teacher as the expert who imparts knowledge to students (Hutasoit, 2021). The use of teacher-centered models has started to reveal issues such as student passivity in learning, a focus solely on knowledge transfer, and teachers primarily aiming to complete curriculum targets from textbooks, rather than focusing on cognitive, affective, and psychomotor aspects acquired by students (Rozali, et al., 2022). This results in students having limited opportunities to develop critical thinking and problem-solving skills in learning (Serin, 2018). The findings align with the mentioned citation that in learning processes using teacher-centered methods, teachers and students engage in two-way dialogue only occasionally, such as during question-and-answer sessions, and it is limited to answering questions without further in-depth explanations or encouraging students to think deeply or discuss the questions. Therefore, the findings indicate that the development of life skills through the STEM (Science, Technology, Engineering, and Mathematics) approach brings more significant changes to students in this study.

The STEM approach can be considered an alternative by Physical Education teachers in elementary schools to instill life skills from an early age and to get used to developing and strengthening integration in the application of knowledge into skills.

CONCLUSION

Based on the results of research data analysis and discussion, it can be concluded that the STEM (Science, Technology, Engineering, and Mathematics) learning approach has an impact on the development of life skills in elementary schools.

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