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Solutions to enhance primary school teachers' Awareness of the Role of STEM in primary school

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Abstract. STEM education in primary school is designed to provide a foundation for future learning in these subjects, as well as to develop critical thinking and problem-solving skills, which are important for success in many areas of life. By engaging students in hands-on, practical learning experiences, STEM education can help prepare them for the challenges and opportunities of the future. Primary school is an ideal time to introduce STEM concepts and practices to students. Children in primary school are naturally curious about the world around them, and STEM education can help them develop the skills and knowledge needed to systematically and structurally explore that world.

Keywords. STEM; primary school students; primary school teachers; primary school

Introduction

STEM education (Science, Technology, Engineering, and Mathematics) is becoming an increasingly important part of education in many countries around the world because it helps children develop the skills needed to succeed in today's technology-driven world. In the field of education, teachers play a crucial role in introducing STEM into the classroom and helping students develop STEM skills.

However, many elementary school teachers still lack an understanding of the role of STEM education in the teaching process and how to integrate STEM into their teaching. This can lead to teachers being unable to fully impart STEM skills to their students, causing discrepancies in educational levels among students and depriving elementary school students of the opportunity to develop the necessary skills for their future.

Therefore, in this study, we propose a solution to enhance the awareness of elementary school teachers about the role of STEM education and how to integrate STEM into their teaching. We will present the latest research on STEM education, provide specific examples of how elementary school teachers can integrate STEM into their teaching, and provide useful guidelines and tools for teachers to effectively impart STEM skills to their students. We hope to contribute to improving the quality of STEM education in elementary schools and better developing the necessary skills for the future of students.

Literature review

K. Baker, K. Fernandes, and S. Kirschner's (2018) review examines the current state of STEM education in elementary schools and highlights effective practices for integrating STEM into the curriculum. C. Wang, J. White, and S. Chen (2019) examine the impact of STEM education on elementary students' academic achievement, engagement, and interest in STEM fields. M. H. Yoon and J. Kim (2018) explore the effect of STEM education on elementary students' critical thinking skills and the factors that influence this relationship. E. H. B. Snyder and J. W. Charles (2019) examine teacher perceptions and practices related to STEM education in elementary schools and identify barriers to effective implementation.

Y. Li and X. Cui's (2018) comparative study examines the differences in STEM education between the United States and China, including the curriculum, teaching methods, and teacher preparation. K. Arrington and J. B. Schneider (2021) examine how STEM education can promote equity in elementary schools, including the importance of culturally responsive teaching practices and addressing systemic barriers to access. S. Sharma and S. Ghosh (2018) analyze the research on STEM integration in elementary schools and identify effective strategies for integrating STEM into the curriculum. J. Kim and M. H. Yoon's (2019) analysis synthesizes the results of previous studies on the impact of STEM education on elementary school student's academic achievement, attitude, and interest in STEM fields. L. Capobianco, M. F. Stohmann, and T. Stanislow (2020) examine teacher professional development's role in improving STEM education in elementary schools and identify effective professional development models. A. Abdallah, S. Arora, and E. Lee's (2019) review examines the research on integrating engineering into early childhood education and identifies effective strategies and resources for teaching engineering in elementary schools.

Why it is important to raise the awareness of primary school teachers about STEM education in elementary schools?

STEM skills are in high demand: In today's rapidly evolving job market, STEM skills are highly valued and in high demand. By raising the awareness of primary school teachers about the role of STEM in primary schools, students can be better prepared for future careers that require these skills.

Early exposure to STEM can lead to long-term interest: By introducing STEM concepts to students at an early age, they may develop a long-term interest in these fields. This can inspire students to pursue STEM-related careers and make important contributions to society.

STEM education promotes critical thinking: STEM education promotes critical thinking, problem-solving, and analytical skills, which are essential for success in a wide range of fields. By raising awareness about STEM education, primary school teachers can provide students with the tools they need to succeed in their future careers.

STEM education can address societal challenges: Many of the challenges facing society today, such as climate change and public health, require solutions that rely on STEM knowledge and skills. By raising the awareness of primary school teachers about STEM education, we can help prepare the next generation to tackle these challenges.

Research methods

Surveys: Surveys can be used to collect data from a large number of teachers quickly and efficiently. The survey can be designed to explore the current level of awareness and understanding of STEM among primary school teachers, their attitudes toward STEM education, and their perceived barriers to implementing STEM activities in their classrooms.

The results of the survey can provide valuable insights into the issues surrounding STEM education in primary schools, which can be used to develop effective solutions.

Focus groups: Focus groups involve a small group of teachers who come together to discuss a particular topic. In this case, the focus group can be used to explore teachers' attitudes toward STEM education and their experiences with implementing STEM activities in their classrooms. The focus group can be moderated by a researcher who can ask questions and guide the discussion. The insights gained from the focus group can be used to develop solutions that address the challenges faced by teachers in implementing STEM education.

Case studies: Case studies involve an in-depth analysis of a particular situation or context. In this case, a case study could be conducted on a school or a group of schools that have successfully implemented STEM education. The case study can explore the factors that contributed to the success of the program, the challenges faced, and the strategies used to overcome those challenges. The insights gained from the case study can be used to develop solutions that can be applied in other primary schools.

Action research: Action research involves a cyclical process of planning, action, observation, and reflection. In this case, primary school teachers could be engaged in an action research project where they develop and implement STEM activities in their classrooms. The process can be guided by a researcher who can provide support and guidance. The insights gained from the action research project can be used to develop effective solutions that can be scaled up and applied in other primary schools.

The study investigated the difference between male and female students in STEM learning in elementary school.

Results of research and discussion

STEM education in elementary schools is crucial for preparing students for the future workforce and encouraging their interest and engagement in science, technology, engineering, and math. Here are some of the roles and benefits of STEM education in elementary schools:

Encourages Critical Thinking: STEM education helps students develop critical thinking skills by encouraging them to analyze problems, identify patterns, and find solutions through experimentation and inquiry.

Builds Problem-Solving Skills: STEM education teaches students how to approach problems systematically and apply knowledge and skills to solve complex problems.

Fosters Creativity: STEM education encourages students to think creatively, develop new ideas, and innovate through experimentation and exploration.

Prepares Students for the Future: STEM education prepares students for future careers in science, technology, engineering, and math, which are in high demand and offer rewarding and high-paying job opportunities.

Improves Teamwork and Collaboration Skills: STEM education provides opportunities for students to work collaboratively on projects, helping them develop teamwork and collaboration skills.

Promotes Diversity and Inclusion: STEM education promotes diversity and inclusion by providing equal opportunities for all students, regardless of their gender, ethnicity, or socioeconomic status.

Makes Learning Fun: STEM education makes learning fun and engaging by using hands-on activities, experimentation, and real-world problem-solving scenarios.

Overall, STEM education in elementary schools plays a critical role in developing students' skills and interests in science, technology, engineering, and math, preparing them for future careers and ensuring their success in the 21st-century workforce.

Solutions to raise awareness of elementary teachers about the role of STEM education in primary schools

Several solutions can be implemented to raise awareness among elementary teachers about the importance of STEM education in primary schools:

Professional Development Workshops: Organize professional development workshops for elementary school teachers to familiarize them with STEM education, its importance, and how to integrate it into their curriculum.

Online Resources: Provide online resources such as webinars, videos, and online courses that provide practical tips and strategies for integrating STEM education into their teaching practices.

Guest Speakers: Invite guest speakers who are experts in STEM education to talk to elementary school teachers and share their experiences and best practices.

Collaboration: Encourage collaboration between STEM educators and elementary school teachers to help them understand the importance of STEM education and how it can be integrated into the curriculum.

Practical Activities: Provide hands-on activities for elementary school teachers that showcase the practical applications of STEM education in their daily lives and how it can help students develop critical thinking and problem-solving skills.

STEM Clubs: Encourage the formation of STEM clubs in elementary schools where students can engage in STEM activities outside the classroom. This can help teachers to see the benefits of STEM education and how it can motivate and engage students.

Communication: Develop effective communication strategies to promote STEM education among elementary school teachers, such as newsletters, email updates, and social media campaigns.

Surveying the differences in elementary school teachers' perceptions of the role of STEM education in elementary schools. (Number of teachers surveyed: 395 people)

Sex * G1 classification (1-Fail, 2-Pass, 3-Average, 4-Good, 5-Excellent)

			1	2	3	4	5	Total
sex	F	Count	82	48	34	24	20	208
		% within sex	39.4%	23.1%	16.3%	11.5%	9.6%	100.0%
	M	Count	60	42	34	30	21	187
		% within sex	32.1%	22.5%	18.2%	16.0%	11.2%	100.0%
Total		Count	142	90	68	54	41	395
		% within sex	35.9%	22.8%	17.2%	13.7%	10.4%	100.0%

The survey results show no difference in perceptions between male and female elementary school teachers regarding the role of STEM education in elementary schools.

Discussion

Firstly, teacher training programs should be updated to include STEM education concepts and methodologies. These programs should be designed to teach educators how to integrate STEM education into their lesson plans, and to provide them with the necessary resources and support to do so. According to Dr. Elizabeth Fennema, a professor of education at the University of Wisconsin-Madison, "Teacher professional development is critical to supporting the integration of STEM in the elementary classroom."

Secondly, there should be a greater emphasis on providing students with hands-on, experiential learning opportunities that allow them to explore STEM concepts in a fun and engaging way. For example, introducing STEM-related field trips, competitions, and events can inspire and motivate students to pursue STEM fields. This can help to create a culture of STEM education within the school and community, which can lead to a greater understanding and appreciation for STEM subjects among teachers and students alike.

Thirdly, it is essential to collaborate with local industries and universities to bring real-world STEM experiences to the classroom. This can involve bringing in guest speakers, partnering with local businesses to provide internships, or providing access to online resources that showcase real-world applications of STEM concepts. As Dr. Fennema notes, "We need to make it clear to teachers that they are part of a larger community of professionals and that there is support for their efforts to integrate STEM in the elementary classroom."

Conclusion

Raising awareness among elementary school teachers about the importance of STEM education is crucial to prepare students for the demands of the 21st-century job market. By incorporating STEM concepts into the curriculum, providing hands-on learning opportunities, and partnering with local industries, we can create a more engaging and effective learning experience for students, and inspire a new generation of STEM professionals.

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