

Addressing Global Issues: The Perspectives of Teachers on the Role and Benefits of Stem Education

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Abstract

The Earth's complex challenges necessitate specialized STEM (Science, Technology, Engineering and Mathematics) knowledge, leading to increased demand for STEM education across various fields. The effectiveness of STEM education relies on teachers' perceptions of its benefits and their recognition of its importance in addressing global issues. The focus of this study was to examine the opinions of teachers regarding the merits and purpose of STEM education and its application to global problems. The research design for the study was a descriptive survey. A convenience sampling method was adopted to recruit 100 teachers from senior high schools in Ghana for the study. A 10-statement closed questionnaire on the Likert scale was developed for data collection. The data was processed with Statistical Package for Social Sciences (SPSS) version 30 and both descriptive and inferential statistics were used. Findings indicated that most of the SHS teachers had a very high level of agreement on the positives of STEM as it: 1) Enhances students' higher level of critical thinking; 2) Encourages the spirit of innovation and curiosity in students; 3) Increases students' cognitive skills; 4) Develops problem-solving skills among the students; 5) Develops responsible citizens of the students. The findings also revealed that teachers had a significantly high level of consensus concerning STEM education for addressing important global issues including enabling students to access and understand the real-life problems, providing students with the knowledge to respond to the global issues, providing students with knowledge to minimise pollution, making students cognisant of the sources of renewable energy and water, and enabling students to vision new agriculture

and food production systems. Finally, no statistically significant differences were found in the views within gender of male and female teachers with respect to the benefits and role of STEM in solving global problems. The study suggests that STEM education should be from the bottom up (elementary school to higher education) and that students should have STEM skills to respond to the world's concerns.

Keywords

STEM Education, Benefits, Global Issues, Senior High School, Science Teachers

1. Introduction

Climate change, food insecurity, pandemics, unemployment, energy crises, and rapid technological advancement are just a few of the complicated global issues that the world is currently facing. These problems directly affect developing countries like Ghana and are not limited to developed ones. Ghana, for instance, faces socioeconomic issues like graduate unemployment, inadequate waste management, and restricted access to contemporary healthcare systems in addition to climate-related threats like flooding, deforestation, and desertification. A workforce with critical thinking, creativity, problem-solving, and innovative skills is needed to meet these challenges; STEM (Science, Technology, Engineering, and Mathematics) education is well-positioned to foster these abilities (UNESCO, 2023a; OECD, 2023a).

Around the world, STEM education is acknowledged as a driving force behind giving students the skills and knowledge they need to address real-world issues and support sustainable development. While the OECD stresses the value of STEM skills for green and digital transitions, UNESCO's Education for Sustainable Development framework emphasizes STEM as a means of promoting sustainability-oriented competencies (UNESCO, 2023a; OECD, 2023a). The government of Ghana acknowledges STEM education as a catalyst for socioeconomic change, as evidenced by national policy initiatives like the Science, Technology, and Innovation Policy (2022) and curriculum reforms in the pre-tertiary level. However, there is an ongoing debate in the classroom regarding the extent to which STEM education directly contributes to solving global challenges. STEM advocates contend that it develops problem-solving, creativity, and critical thinking abilities that are applicable in real-world settings (Bybee, 2013; Marginson et al., 2017). Detractors also point out that STEM curricula in many educational systems, including Ghana, continue to be unduly theoretical, limited by strict examination-oriented frameworks, and inadequately integrate applied, project-based, or interdisciplinary approaches (Adu-Gyamfi & Ampofo, 2022; Asare, 2023).

In order to align educational practice with global development goals, it is crucial

to understand teachers' perspectives on STEM education. This study aims to contribute to this discourse by examining how teachers in a sampling of senior high schools in Ghana's Bono Region view the role and benefits of STEM education in addressing global issues. This tension between theory and practice highlights the significance of understanding teachers' perspectives on STEM education. Teachers are the ones who directly implement curriculum and facilitate learning.

Teachers are essential in placing global issues within local contexts because they are the ones who carry out STEM curricula on the front lines. Their viewpoints influence whether STEM is taught as abstract theory or as applied learning that involves students in resolving issues like ICT-driven entrepreneurship, agricultural innovation, sanitation management, and the adoption of renewable energy. The integration of global problem-solving themes into STEM instruction is greatly influenced by teachers' preparedness, attitudes, and access to professional development, according to recent international research (Papagiannopoulou et al., 2024; Hademenos, 2024). The views of Ghanaian teachers regarding the function and benefits of STEM education in tackling global concerns, however, are not well understood.

This disparity is troubling because Ghanaian teachers frequently encounter systemic obstacles like a lack of resources, large class sizes, and little instruction in integrative STEM pedagogies (Ahmad & Sajid, 2024). Without understanding their perspectives, reforms run the risk of being classroom-weak but policy-driven, which would limit STEM's transformative potential. Furthermore, data on teachers' perceptions of STEM's ability to give students problem-solving abilities applicable to both local and global contexts is necessary to meet Ghana's pressing development needs, which include reaching the Sustainable Development Goals (SDGs) on education, climate action, and innovation.

Thus, the purpose of this study is to investigate Ghanaian teacher's perspectives on the role and benefits of STEM education in addressing global concerns. By prioritizing teacher perspectives, the study aims to provide empirical data that will inform curriculum design, professional development, and educational policy, ensuring that STEM education prepares students not only for exams but also as responsible global citizens and proactive problem solvers.

In the light of the above, the following research objectives guided the study:

- 1) To explore teachers' opinions about the benefits of STEM education.
- 2) To discover teachers' beliefs regarding the role of STEM education in addressing global challenges.
- 3) To compare teachers' gender-wise viewpoints about the benefits and role of STEM education in solving global challenges.

2. Literature Review

According to recent international syntheses, STEM education can be used as a tool to navigate digital, health, and climate disruptions. Teachers are crucial in promoting systems thinking and collaborative problem-solving. According to the

OECD Skills Outlook 2023, which emphasizes that those skills for the green and digital transitions must be purposefully developed through education (OECD, 2023b). Similar to this, UNESCO's Global Education Monitoring (GEM) Report 2023 places teachers at the center of how STEM relates to global issues by emphasizing that technology only improves equitable learning when teachers are suitably prepared and supported (UNESCO, 2023a).

Adoption of inquiry-based and design-oriented pedagogies is influenced by positive attitudes toward STEM education, which are strongly predicted by teacher readiness. According to Papagiannopoulou et al. (2024), attitudes were significantly predicted by readiness, indicating that professional preparation is essential for teachers to incorporate real-world problem-solving into the classroom. The significance of supportive conditions like collaboration time and assessment flexibility was highlighted by Vaiopoulou et al. (2024), who also found nonlinear relationships in teacher attitudes. Simultaneously, Bardoe et al. (2023) reported that teachers perceive obstacles to implementing problem-oriented STEM instruction, including curricular overload, assessment misalignment, and resource limitations.

STEM is emphasized as a means of attaining the competencies that UNESCO's Education for Sustainable Development (ESD) for 2030 identifies as crucial, including systems thinking, futures literacy, and agency (UNESCO, 2023b). In order to translate global issues like climate change and the energy transition into practical classroom projects, teachers are viewed as essential. In order to better prepare students as change agents, research indicates that teachers support the integration of climate-related content but also demand professional development, curriculum models, and assessment frameworks (UNESCO, 2023b).

The goal of STEM education is to create and provide fresh approaches to global issues that are poorly defined, especially those that have a direct bearing on the Sustainable Development Goals for 2030. STEM education solves issues and clarifies many commonplace occurrences. These days, problem-solving, self-improvement, and methodical thinking are critical skills that STEM education cultivates (Bybee, 2010; Roberts, 2012). Learning and using problem-solving, creativity, research-questioning, critical thinking, entrepreneurship, and communication skills are all facilitated by STEM education. Students' problem-solving, creativity, critical thinking, technology literacy, and discovery skills all improve with STEM education (Choi & Hong, 2013; Morrison, 2006). One of the best ways to give children a more comprehensive perspective on the world is through STEM education (Morrison, 2006).

Real-world problems are rarely resolved by knowledge of a single subject. Since this reality should be reflected in students' educational experiences, integrated STEM education has grown (Green, 2014). Teo (2019) asserts that the "4C skills", which stand for communication, cooperation, critical thinking, and creativity, are the essential abilities that modern learners must possess. These are the abilities that comprise 21st-century skills. It is the duty of teachers to give students an ed-

ucation that equips them with the four essential skills required to handle the challenges presented by globalization.

There has been a great deal of interest from countries across the globe in STEM education in recent times. STEM education has become more internationalized: in the United Kingdom, European and Asian nations appear to trend in growth; in the United States, European and Asian nations appear to trend in growth; and in Australia, Australia appears to trend in growth (Hali et al., 2020). The Pakistani STEM education system also faces some issues, two of which are highly visible, namely the absence of teaching skills among STEM teachers and inadequacy in student activities. Private schools place more importance on STEM education than public institutions. As a result, there are not enough classrooms, laboratories, and other equipment for STEM subject education. Fundamentally, Pakistan's institutional apparatus for educating students about STEM-type subjects is poor and misoriented, and the government has to have absolute intervention to augment the efforts of all the stakeholders concerned, such as the general public and private players (Hali et al., 2021).

Empirical evidence in Ghana presents potential and remaining challenges. Akon-Yamga et al. (2024) revealed that teachers and students view STEM as important for tackling national challenges such as sanitation, energy, and agriculture but noted obstacles like inadequate resources, weak teacher preparedness, and weak industry-school relations. Anning (2024) also illustrated that teachers' individual and sociocultural environments significantly affect their effectiveness in STEM, suggesting the need for locally responsive support. Bardoe et al. (2023) further confirmed that resource gaps and rigidity in assessment are significant challenges across Sub-Saharan Africa.

Ghana's UNESCO ESD for the 2030 Country Initiative commitment sets out priority interventions to mainstream sustainability education and strengthen teacher capacity, and inextricably linking STEM with climate resilience, waste management, and sustainable livelihoods (UNESCO, 2023c). The UNESCO-Teacher Task Force Global Report on Teachers 2024 highlights systemic tensions in teacher workforce, particularly in Sub-Saharan Africa, highlighting the reasons why teacher perceptions are determinative of STEM reforms (UNESCO, 2024).

Prior research indicated that education in the fields of STEM has gained immense relevance in recent decades since it can increase students' critical thinking, problem-solving, and innovative skills. According to the study, there are many benefits of STEM education. For example, Hidayat et al. (2024) examined 28 studies of analytical thinking in STEM settings and found that problem-based learning is a solution to increase students' analytical and critical thinking skills. Johnson et al. (2022) indicated that students who participated in STEM activities gained higher scores in courses in science and mathematics, which attests that STEM education influences the degree of academic achievement. Smith & Brown (2023) found that STEM education promotes career goal formation aligned with the

needs of the current labour market. [Chen et al. \(2023\)](#) recognized that students engaged in STEM activities demonstrated improved skills to solve intricate problems, create innovative solutions, and make informed decisions. [Martinez et al. \(2023\)](#) indicated that students engaged in STEM activities had greater self-confidence, teamwork, resilience, motivation, and learning enjoyment. [Li et al. \(2023\)](#) discovered that STEM activities and projects enhance students' creativity and improve their ability to think outside the box. [Daulay et al. \(2024\)](#) questioned 18 experiments in physics courses integrating STEM and reported significant improvement in cognitive ability as well as in critical thinking, especially when combined with problem/project-based learning. [Akon-Yamga et al. \(2024\)](#) are of the opinion that STEM education facilitates the growth of motivation, resilience, and civic agency if projects are framed around authentic problems. [AlAli et al. \(2023\)](#) established that STEM education prepares teachers to incorporate SDGs in their classroom lessons—especially promoting quality education, reducing inequality, and creating environmental solutions.

3. Methodology

This study utilized a descriptive survey design, which enabled the researchers to collect and analyze data quantitatively to examine the opinions of senior high school teachers in Ghana regarding the merits and purposes of STEM education and its application to global problems.

The target population for this study consisted of all teachers employed at senior high schools within the Bono region of Ghana. Using a convenience sampling technique, a total of 100 teachers were selected from two institutions: Presbyterian Senior High School (Berekum) and Notre Dame Girls Senior High School (Fiapre). The choice of convenience sampling was influenced by accessibility and willingness of the schools to participate. Equal representation from both schools was ensured to enhance the comparability of findings. Both institutions are government-assisted schools with relatively adequate teaching resources and professionally trained staff, comparable to other senior high schools in the region. While Notre Dame Girls Senior High School serves an all-female student population and Presbyterian Senior High School is co-educational, their overall student demographics and institutional characteristics broadly reflect those of public senior high schools in the Bono Region. However, it is important to note that the use of convenience sampling may limit the generalizability of the findings, as the views obtained may not fully represent those of all teachers in the Bono Region or Ghana at large. The results, therefore, should be interpreted with caution, recognizing that they primarily reflect the perspectives of teachers who were readily accessible to the researchers. Nonetheless, this approach was deemed appropriate for the exploratory nature of the study and provides useful insights that may guide future large-scale investigations employing more representative sampling strategies.

Data were collected using a structured survey questionnaire consisting of ten (10) statements developed to measure two main areas: 1) teachers' perceptions of

the benefits of STEM education and 2) their views on the role of STEM education in solving global problems. Each item was rated on a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree, allowing respondents to indicate the extent of their agreement/disagreement. Example items included “STEM education enhances students’ ability to think critically and solve problems” (benefits) and “STEM education provides practical tools for addressing global challenges such as climate change and health crises” (role in solving global problems).

Teachers’ responses were compiled using descriptive statistics (mean and standard deviation). The following ranges were used for interpretation: 1.81 - 2.60 = Low, 2.61 - 3.40 = Moderate, 3.41 - 4.20 = High, and 4.21 - 5.00 = Very High. These standards offered a consistent framework for evaluating how much teachers agreed or disagreed with the purpose and advantages of STEM education.

Prior to administration, the validity and reliability of the questionnaire items were established through pilot testing with a small group of teachers not included in the main study. The internal consistency of the questionnaire items was confirmed using Cronbach’s alpha coefficient ($\alpha = .731$). Hence, the instrument was found to be internally consistent and appropriate for data collection because its estimated reliability exceeded the minimum threshold value of .70 recommended for research work (Borg, Gall, & Gall, 1996; Cohen, Manion, & Morrison, 2007; Sirem & Çatal, 2022). However, the face and content validity of the questionnaire items were ensured through expert review.

Following data collection, the responses were analyzed using SPSS version 30. Descriptive statistics such as means, and standard deviations were employed to answer research questions 1 and 2, while independent samples t-test was used to test for gender differences in research question 3. The results are presented in tables and discussed in line with the objectives of the study.

Ethical approval was obtained from the relevant authorities, and informed consent was secured from all participants before the study was carried out. Participants were assured of the confidentiality of their responses and their right to withdraw from the study at any time.

4. Results

Results in **Table 1** show that all the statements have mean scores higher than 3.50 and fall within the good level of agreement. Overall, the mean score and standard deviation were ($M = 4.75$, $SD = .595$). This indicates that the majority of senior high school teachers strongly agreed or agreed with all the statements related to the benefits of STEM education.

As noted in **Table 2**, all statements identified mean scores above 3.50, which centered within good agreement level. Generally, mean score and standard deviation came out to be ($M = 4.59$, $SD = .915$). This determined that most of the teachers agreed highly or very highly with all statements regarding the role played by STEM education in solving world problems.

Table 1. Responses of teachers toward the benefits of STEM education (N = 100).

N	Statements	M	SD	Agreement level
1	STEM education enhances critical thinking skills in students	4.85	.386	Very high
2	STEM education develops innovation and curiosity in students	4.91	.379	Very high
3	STEM education improves students' cognitive skills	4.78	.561	Very high
4	STEM education develops students' problem-solving skills	4.78	.613	Very high
5	STEM education produces responsible citizens	4.42	1.037	Very high
	Overall Results	4.75	.595	Very high

Table 2. Discernment of teachers towards the role of STEM education in solving world problems (N = 100).

N	Statements	M	SD	Agreement level
1	STEM education enables students to understand real-world problems	4.61	.875	Very high
2	STEM education helps students acquire knowledge to tackle global issues	4.65	.821	Very high
3	STEM education can help students acquire knowledge to eliminate pollution	4.54	1.029	Very high
4	STEM education can help students discover sources of renewable energy and water	4.46	1.105	Very high
5	STEM education can help students develop novel agricultural and food production techniques	4.70	.745	Very high
	Overall results	4.59	.915	Very high

T-test statistic values in **Table 3** were used to determine gender-wise differences in teachers regarding the benefits and the contribution of STEM education towards global problem-solving. The results indicated that there was no statistically significant difference between male and female teachers regarding the benefits of STEM education ($p = .137$) and its contribution to solving global challenges ($p = .065$).

Table 3. Differences regarding benefits and role of STEM education in solving world problems based on gender.

Variables	Gender	N	Mean	Std. Deviation	t-value	p-value
Benefits	Male	59	5.80	1.760	2.247	.137
	Female	41	5.54	1.051		
Global challenges	Male	59	6.678	2.542	4.585	.065
	Female	41	6.317	1.724		

5. Discussion

The findings of the study supported that of [Hidayat et al. \(2024\)](#). It reviewed 28

studies of analytical thinking in STEM settings and confirmed problem-based learning as effective in developing analytical and critical thinking in students. The study also agreed with that of [Daulay et al. \(2024\)](#). They reviewed 18 studies in STEM-integrated physics courses and reported robust gains in cognitive ability and critical thinking, especially in combination with problem/project-based learning. Furthermore, the current findings are consistent with studies by [Johnson et al. \(2022\)](#), [Smith & Brown \(2023\)](#), and [Martinez et al. \(2023\)](#), which confirmed that STEM education has various benefits, including improving students' performance, promoting the development of career goals aligned with workforce demands, and improving students' confidence, teamwork, persistence, motivation, and enjoyment of learning.

In addition, the results of the present study corroborate the findings of [AlAli et al. \(2023\)](#), who reported that STEM-inclusive education enables teachers to connect classroom learning to the Sustainable Development Goals (SDGs), especially in promoting quality education, reducing inequalities, and addressing environmental challenges. Similarly, [Chen et al. \(2023\)](#) found that students exposed to STEM activities developed improved competencies in tackling complex problems, designing innovative solutions, and making evidence-based decisions.

Again, the study is in line with [Li et al. \(2023\)](#), who concluded that STEM activities and projects increase creativity and foster students' ability to think critically and innovatively in solving real-world challenges. This confirms the significant role of STEM education not only in enhancing students' academic and cognitive skills but also in equipping them with practical tools to contribute to solving global issues.

Lastly, the findings suggest that gender did not significantly influence teachers' perceptions of the benefits of STEM education or its role in addressing global issues. Both male and female teachers demonstrated similar levels of agreement on the importance of STEM education in equipping learners with problem-solving skills relevant to global challenges. This alignment may indicate a shared professional understanding of the transformative potential of STEM education, irrespective of gender differences.

6. Conclusion and Recommendation

Most of the senior high school teachers were found in the research to strongly agree with the benefits of STEM education. They agreed that STEM education enhances the critical thinking skills of students, develops innovation and curiosity among students, enhances the cognitive capabilities of the students, enhances problem-solving skills of the students, and makes the students civic-minded. The study also revealed that most S.H.S. teachers endorsed the role of STEM education in solving global issues, i.e., STEM education helping in understanding real-world issues by the students, STEM education helping in delivering knowledge to the students for the purpose of solving global issues, STEM education helping in delivering knowledge to the students to eliminate pollution, STEM education help-

ing in the identification by the students of renewable water and energy sources, and STEM education helping students to implement new farming and food production techniques. Again, both male and female teachers hold similar opinion on the benefits of STEM education and how STEM education can contribute to addressing global challenges. The research therefore recommends that a STEM pedagogical method should be followed from elementary school through to the levels of higher education in an effort to equip students with STEM information and abilities to address global challenges.

The current research has some limitations including having a small sample size, the study's limited scope of focusing only on senior high school teachers within a small geography, and the limited research method. Hence, a comprehensive study can be conducted including teachers who are working in all levels of education from primary schools to universities, as well as a wide gathering of quantitative and qualitative data along with new and supplementary variables.

The contributions of this research are to guide stakeholders in senior high school education and policymakers regarding the need to adopt a STEM education approach to increase senior high school learners' awareness and skills in STEM.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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