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Navigating the STEM Frontier: Unveiling Teachers' Perception and Implementation Strategies at the Secondary Education Level

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Abstract
"Navigating the STEM Frontier" refers to the challenges, opportunities, and advancements in science, technology, engineering, and mathematics (STEM). The current study is going to unveiling teachers' perception and implementation strategies of STEM education at secondary school level. It was quantitative study that was descriptive in nature. All the secondary school teachers were the population of the study. Researchers selected a sample of teachers (606) through simple random sampling technique to accomplish the objective. Researchers used a questionnaire as a research tool to collect data from the respondents. After collecting data from teachers (606), it was analyzed through SPSS and used statistical techniques to explore the data with interpretations. The findings of the study informed that different levels of implementation were seen between secondary school teachers with academic qualifications and those with professional qualifications. STEM techniques were also more variable among experienced educators than their less-seasoned counterparts. The conclusion of the study address that the study stresses the significance of secondary school teachers' perspectives and methods for implementing STEM education. The importance of STEM education is widely acknowledged, although teachers may sometimes have differing views or methods. These results can guide future studies and initiatives to improve the efficacy of STEM education methods in secondary schools.
Keywords: STEM frontiers, Implementation strategies, secondary education

1. Introduction

Technological advancement has made education much more exciting and adaptive, and people tend to learn based on its prospective outcomes (Ekşioglu & Subhan, 2019). Science and technology, as a joint, systematic venture, contributed to setting new trends in education. According to Zeynep (2019), STEM education is one of the most recent educational trends that international systems worldwide are implementing to improve students' skills and strengthen the global economy. The global economy is changing, jobs are disappearing due to automation, and jobs are emerging every day due to technological advances (Timms et al., 2018). The continual technological advances are changing how students learn, connect, and interact daily. Duran and Nugent (2019) stated that skills developed in students through science, technology, engineering, and mathematics (STEM) provide them with the foundation to succeed in getting new emerging jobs worldwide. For new jobs, employers demand STEM qualifications and high skills, and this will continue to increase in the future.

Moreover, they claimed that 75 percent of jobs in the fastest-growing industries currently require workers with STEM skills. To be competitive, the market workforce needs people who can adapt to a changing workplace (Solanki et al., 2019). STEM empowers individuals with the skills to succeed and adapt to this changing world.

Science, technology, engineering, and mathematics (STEM) are emerging themes in the contemporary education system to meet the requirements of the new emerging job. The term has mainly been driven to improve competency and competitiveness among schools and the curriculum. The concept has implications for diversified sectors, such as developing the workforce and enhancing national security. However, the term is used explicitly in addressing education policy and curriculum. With the rapid development of the global economy, science, and technology, STEM education has become an important strategy and approach for cultivating scientific and technological innovation talents and reforming education and teaching in various countries worldwide. STEM is highly significant for instructors and students since it allows for learning on both ends, i.e., students and instructors. STEM encourages active learning and gives students a sense of ownership over the teaching-learning process inside and beyond the classroom. Given his expertise and skills, a teacher may easily organize and prepare his classes, develop techniques and materials such as content and delivery, and facilitate resource sharing with students.

Although STEM education is defined as the study of science, technology, engineering, and mathematics (STEM), M is a reimagining of traditional techniques in which these four disciplines are combined into a single meta-discipline (Barker et al., 2019; Nugent et al., 2018). Unfortunately, most STEM education is business as usual, with little attempt to integrate these subjects or provide better pedagogical alternatives (Thomas Roberts et al., 2018). What does STEM education entail? Whether we call it STEM or STEAM (Scientific et al.), science education is trending in this direction, from the United States to other countries. Connections between activities and resources, relations between disciplines, and measuring and evaluating student learning are all steps toward a more integrated STEM approach, according to the National Research Council (2014). Researchers in scientific education agreed that engaging inquisitive young minds via inquiry in the early grades, particularly at the secondary level, is one of the best ways to address STEM's underrepresentation in the educational system and dispel its unfavorable reputation (King, 2015).

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With the rapid development of the global economy and science and technology, STEM education in Pakistan has become an important strategy and approach for cultivating scientific and technological innovation talents and reforming education and teaching (Ali, 2018). Like other developing nations worldwide, Pakistan is in the early stages of recognizing the importance of STEM and incorporating it into educational institutions' teaching and learning processes. Over the last few decades, provincial governments have invested in STEM to create and promote teaching-learning environments in government institutions. This technique has piqued the curiosity of the teacher community and students alike. STEM may effectively boost the teaching-learning environment within the classroom in the current technological era. STEM is an essential and unavoidable element of today's world. In reality, it is up to teachers and culture to tackle the challenges posed by the explosion of information in this modern age. STEM's emergence has ushered in a technical, social, economic, and political transformation (Ali, 2015).

STEM education is needed for Pakistan to prosper in the 21st century (Awan, 2017). Our students need education and a solid foundation in STEM to face the upcoming challenges of the ever-changing world of technology (Anwar, 2017). Today, the demand for skills has entirely morphed. It has shifted from mundane, manual, routine tasks to non-routine interactive tasks (Malik, 2017). Advancement in STEM is crucial to our future success. Bridging the gap between the current education system and workplace competencies is very important (Jang, 2016). Being a developing country, we can only prosper if we focus on the constant supply of highly competent and technically trained talent. The Global Gender Report 2017 ranks Pakistan at 136 out of 144 countries. There are, without question, several obstacles to incorporating STEM into educational institutions' teaching and learning processes. Various elements impact the importance of STEM in academic institutions to improve the teaching-learning process in Pakistan. The aim of the present research was to investigate teachers' perception about STEM frontiers in implementing strategies at secondary school level. So, the objective of the study was to find out teachers' perceptions about STEM education implementation strategies at secondary school level

2. Literature Review

STEM education is a style of learning that incorporates science, technology, engineering, and mathematics to help students improve their creativity via problem-solving. STEM education is gaining popularity among kids since it is effective in developing their creativity. The value of merging science, technology, engineering, and mathematics has been acknowledged around the world. Integrating STEM practices into discipline knowledge content practices, such as science and mathematics, is accomplished by integrating appropriate technologies' engineering and engineering design practices. According to experts, the STEM education lesson described above is an example of a lesson that integrates the four STEM components necessary for the industry.

The implementation of STEM education has begun in certain developed countries, and it is being considered in developing countries that do not currently have STEM education. The United States must develop a more comprehensive and integrated pre-college education in science, technology, engineering, and mathematics. A comprehensive plan should encompass all STEM disciplines and address the need for greater diversity in STEM professions, a workforce with considerable technical and personal skills, and a STEM-literate populace capable of addressing the world's most pressing problems in the twenty-first century. Recent years have seen a resurgence of efforts to improve science and mathematics education, with the introduction of voluntary national education standards for science and mathematics in the 1990s being a notable example.

However, as a combat veteran of such endeavors, inform that the future decade will be a period in which significant progress may be made in those areas. The term STEM education has gained popularity, but what it means and how it might affect American education are still up in the air. Even though the products of technology and engineering have had such a tremendous impact on everyday life, most people equate technology and engineering with science and arithmetic. Because of STEM education, students' understanding of how things work and their ability to use technology should be improved throughout time. More engineering should be brought into STEM education during pre-college education, as well as during college education. When it comes to issuing solving and innovation, engineering plays an important part. These are two themes that are high on everyone's agenda. Because of the economic importance of engineering to society, students should learn about it and develop some of the required abilities and talents during the designing process.

In a similar vein, the National Academies' proposed Framework for Science Education, which was released earlier this month, identifies technology and engineering as one of four critical areas for science education. In order to be successful in this new cycle of educational reforms, the United States will require equitable treatment for science, which should be defined broadly to include technology and engineering, in the renewal of the Elementary and Secondary Education Act (currently referred to as No Child Left Behind). Because science test scores do not constitute a significant component of the computation used to determine Adequate Yearly Progress, this legislation has had the unintended consequence of reducing or eliminating science from school curricula, particularly at the primary level, over the past eight years, despite its intentions.

The current renewal framework from the United States Department of Education does not address this issue; however, the final law may and should address this issue. According to the National Academies report rising above the Gathering Storm, students must develop adaptability, complex communication, social skills, non-routine problem solving, self-management, and systems thinking to succeed in today's market. The opportunity to learn these critical 21st-century skills through group exercises, laboratory studies, and projects provides children with the opportunity to develop these critical 21st-century abilities and educates them to become citizens who are better equipped to make decisions about their lives. The abilities that individuals require to comprehend and tackle such difficulties, at all levels of society, from the individual to the international, are directly tied to STEM knowledge as they are to economics, politics, and cultural values. The Sputnik-inspired school reforms of the 1960s elicited a significant response from the scientific and technological sector.

A bold new government plan for boosting education is required in the United States, as is the establishment of high-quality, integrated training and resources and investigating problems associated with significant societal challenges. Let us set aside our clichés and work together to ensure that all children access STEM learning opportunities.

Technological advancement has made education much more interesting and adaptive. People tend to learn on the basis of its prospective outcomes. Science and technology, as a joint systematic venture, contributed to set new trends in education. STEM learning is one of the latest trends in education which is adopted by the leading education systems of the world. The term STEM was first suggested by one of the Directors of National Science Foundation in 2001, STEM is an acronym used for 'Science, Technology, Engineering and Mathematics'. It is actually an integrative approach that makes STEM a well knitted curriculum in which four disciplines cannot be separated. The relation between STEM and economic development of the country has always been focused by the researchers.

Furthermore, specific content-related ideas appear frequently in diverse definitions of STEM integration, indicating that they are essential. Many academics feel that for an activity to be considered STEM integration, it must allow students to apply principles from mathematics and science to their learning experience (Johnson et al., 2016; Meyrick, 2011; Moore, Guzey, et al., 2014; Nadelson & Seifert, 2017; Shaughnessy, 2013; Wang & Knobloch, 2018). On the other hand, Bybee (2013) and Walker et al. (2018) argue for the use of data and data analysis tools in the context of science, technology, engineering, and mathematics integration. Engineering methodologies and habits of thought, according to some academics, have the potential to be applied in STEM integration (Guzey et al., 2016; Hauze, 2016).

STEM has come to mean more about how multiple disciplines are connected than it has come to mean a substitute label for each of these diverse disciplines. STEM integration can be addressed in several ways (Breiner et al., 2012; Brown et al., 2011; Bybee, 2013; Johnson, 2012; Ring et al., in review). It is accomplished through the use of nine distinct models, which range from separate and siloed subjects (as in early notions of STEM education) to an integrated, trans-disciplinary curriculum (as proposed by Bybee (2013)). Explicitly connecting the four disciplines in a single class, curricula, or program. STEM integration frameworks and science content standards (National Governors Association Center for Best Practices & Council of Chief State School officers, 2010; the NGSS Lead States, 2013) have been developed in recent years to encourage the integration of engineering content and design processes into science classrooms.

According to research, student scientific achievement and interest in STEM-related careers have improved when engineering is used as a context for learning science material (Becker & Park, 2011; Wendell & Rogers, 2013). There are a variety of strategies for establishing these connections, and the language used in the articles under consideration varies as well. In their work, for example, Wang et al. (2011) distinguish between multidisciplinary and interdisciplinary approaches. According to the authors, students are expected to make connections between concepts and skills taught in many disciplines, who believe that a multidisciplinary approach teaches subject-specific concepts and skills independently in each field. Rather than subject-specific content and abilities, interdisciplinary approaches begin with a real-world problem or issue and focus on interdisciplinary content and talents (e.g., critical thinking and problem solving). However, Satchwell and Loepp (2002) give a different definition of interdisciplinary based on their research. Instead of referring to multidisciplinary approaches, they distinguish between interdisciplinary and integrated approaches.

STEM education refers to courses that are taught in the fields of science, technology, engineering, and mathematics (STEM). For pupils to perceive the world as a whole, it provides them with a bridge of opportunities to link the different knowledge they have gained into a cohesive whole. Tran's disciplinary learning is a learning technique that aims to address the limitations associated with traditional education, such as the segregation of information across many areas and the inability of pupils to solve problems holistically. In Pakistan, STEM education faces various challenges, including a shortage of STEM instructors with solid teaching abilities, a lack of STEM curriculum syllabus, and a lack of student activities that are sufficient to achieve all of the goals of this style of instruction.

Pakistan needs long-term industrial expansion in order to increase the number of STEM-related jobs available. Shortly put, Pakistan's STEM education system is underprepared and uncoordinated, and the government must act in a sustained and exclusive manner to promote the efforts of all stakeholders, public and private alike. STEM education is essential in addressing Pakistan's most pressing problem. For the record, we intended to portray the reality of STEM education in Pakistan in this study for various reasons, one of which was to demonstrate the importance of STEM education in Pakistan. As a starting point, the Pakistani government has formed that type of education and has mandated far too much study in this subject to accomplish high-quality education and long-term progress in that country. A positive outcome could lead to the establishment of beneficial partnerships with other countries worldwide by Pakistan's administration.

Second, STEM education should be inclusive of all levels of learning and should assign a specialized curriculum based on the availability of appropriate equipment and labs. Third, to stay up with the rapid growth of the world economy, the Pakistani government must enhance its financing for STEM education in Pakistan. Fourth, support research in this area and make data and information available to academics working on development projects.

Effective teacher professional development directly correlates with positive outcomes in student learning. Research indicates that well-trained teachers are better equipped to implement innovative pedagogies, resulting in increased student engagement, improved academic performance, and the development of critical thinking skills (Luna Scott, 2015). The ripple effect of teacher professional development extends beyond individual classrooms, influencing school cultures and contributing to systemic improvements in STEM education. The need for responsive and dynamic teacher professional development becomes more pronounced as the STEM education landscape evolves. Future directions may involve integrating emerging technologies, such as virtual reality and artificial intelligence, into training programs. Additionally, fostering cross-disciplinary collaborations among educators from different STEM fields can enhance the sharing of effective practices and diverse perspectives. Continuous efforts to align professional development with evolving educational standards and research findings will be essential in preparing teachers for the challenges and opportunities that lie ahead. In conclusion, teacher professional development stands at the forefront of fostering innovation in STEM education. By investing in the ongoing training and support of educators, educational institutions can ensure that innovative approaches are implemented effectively and have a lasting impact on student learning outcomes and the overall advancement of STEM education.

The success of innovative approaches to STEM education hinges on the expertise and adaptability of educators. Recognizing teachers' pivotal role in shaping students' learning experiences, there is an increasing emphasis on the importance of continuous professional development in STEM education. Teacher training goes beyond traditional methods and equips educators with the knowledge, skills, and pedagogical strategies to implement innovative approaches effectively. Professional development provides opportunities for educators to stay abreast of emerging trends, refine their instructional practices, and foster a growth mindset that embraces ongoing learning (LoucksHorsley, Stiles, Mundry, Love, & Hewson, 2009; Zepeda, 2019). While the importance of teacher professional development is evident, challenges exist in its implementation. Limited time, resources, and resistance to change are common barriers. Overcoming these challenges requires a multifaceted approach. First, recognizing and addressing the specific needs of educators is crucial. Tailored professional development programs that consider teachers' diverse backgrounds, experiences, and expertise can enhance their receptivity to new methodologies (Shernoff, Sinha, Bressler, & Ginsburg, 2017). Collaborative learning communities, where teachers share insights and best practices, create a supportive environment for ongoing development. Additionally, mentorship programs and peer observations foster a culture of continuous improvement (Antinluoma, Ilomäki, & Toom, 2021; Roberts & Pruitt, 2008).

In recent years, Science, Technology, Engineering, and Mathematics (STEM) education has emerged as a cornerstone in preparing individuals for the dynamic challenges of the 21st century (R. Elliott et al., 2022; Miller, 2015). The intertwining complexities of the modern world demand a workforce equipped with a deep understanding of STEM disciplines and the ability to think critically, solve problems creatively, and adapt swiftly to technological advancements. Traditional approaches to STEM education, while foundational, are being reexamined in light of the rapidly evolving educational landscape and the demands of a globally competitive society (N. R. Council, 2011; J. G. Wells, 2019). The imperative to cultivate a STEM-literate populace is underscored by the realization that the solutions to many of the world's most pressing challenges, from climate change to public health crises, lie within the realms of science, technology, engineering, and mathematics (Collis, 2019; Shahidullah, 2016; Teeple, 2018). In response to this imperative, educators, policymakers, and researchers have increasingly turned their attention to innovative approaches that transcend the boundaries of conventional teaching methodologies. This review aims to critically examine and synthesize the existing literature on innovative approaches to STEM education. By delving into the current discourse surrounding pedagogical advancements, technological integration, and interdisciplinary strategies, this paper aims to elucidate the transformative potential of these innovative methods.

3. Research Methodology

It was a quantitative research study. The current study is navigating secondary school teachers’ perceptions related to the implementation strategies of STEM education. As the title of the study refers it’s a descriptive type of research because it exploring the existing phenomena about the implementation strategies of STEM education in secondary schools. All the secondary school teachers in district Sialkot were the population of the study. The researchers selected a sample of secondary school teachers (606) to accomplish the objective that has been set for the current study. Questionnaire was pilot tested, furthermore, the content and face validity of the questionnaire checked by the experts in the field and senior teachers. To check the reliability of the questionnaire, it was administer to the individuals (30) who were not the part of sample but included in the population of the study. Overall value of Cronbach Alpha coefficient of the questionnaire was 0.858 which showed items in the questionnaire were highly correlated which were recommended for final data collection. A refined and finalized questionnaire administered to the respondents and collected data from the required sample and then put into the SPSS for further analysis. The statistical techniques of mean score, standard deviation, t-test and ANOVA were used to exploration meanings from the raw data.

4. Results and Findings

Table 1: Demographic variable wise analysis to find the differences in the teachers' awareness regarding STEM implementation strategies

Demo Variables		N	M	SD	Df	t/F	Sig
Gender	Female	295	92.45	4.983	604 601.259	t -5.479	.000
	Male	311	94.82	5.622			
Qualification	Between Groups	33.417	2	16.709	2 603	F 20.508	.000
	Within Groups	491.289	603	.815	605		
	Total	524.706	605				
Teaching Experience	Between Groups	146.613	4	36.653	4	F	.000
	Within Groups	378.093	601	.629	601	58.263	
	Total	524.706	605		605		

Table 1 depicts the results of the mentioned statistics gender-wise category that there is no significant difference in the mean score of male and female regarding teachers' awareness in using STEM implementation strategies. Furthermore, there is a significant different among secondary school teachers use of STEM implementation strategies on behalf of their qualification i.e. academic and professional qualification. On the basis of teaching experiences, there is a significant different in employing the STEM strategies in the class by the experienced teachers and the less experienced teachers.

Table 2: Respondents' perception about STEM implementation strategies

Sr.#	Statements	Mean	SD
1	I know about STEM education.	4.37	.707
2	I have participated in STEM workshops / seminars / conferences / trainings	4.27	.809
3	Our education system has a dire need of STEM education.	4.41	.651
4	Teachers know the effectiveness of STEM	4.45	.723
5	STEM Education is improving students' perception towards technology	4.04	.825
6	STEM Education is improving students' perception towards engineering	3.95	.769
7	STEM Education is improving students' perception towards mathematics	4.28	.808
8	Colleagues have supportive behavior toward STEM education	4.32	.556
9	STEM Education is a systematic way for learning	3.59	1.075
10	STEM Education is improving problem solving skills	4.41	.777
11	STEM Education is improving creativity skills	4.18	.717
12	STEM Education is improving scientific skills	4.00	.606
13	STEM Education is increasing interest in the course	1.77	.599
14	STEM Education is encouraging student interest to learn	4.41	.578
15	I use STEM Education to develop interdisciplinary interaction among students	2.98	1.287
16	I use STEM Education is providing career guidance (contribution to future) to my students	1.30	1.178
17	I conduct STEM activities to integrate the science with other subjects	2.13	1.018
18	While using STEM education, I promotes latest knowledge into students	2.05	1.131
19	STEM education is product-focused education	4.42	.660
20	Using STEM education, I need more time as compare to traditional teaching	1.64	.895
21	I use problem solving activities during my teaching	1.92	1.217
22	School administration cooperate in conducting STEM activities in the class	1.68	.902

Table 2 reveals that to get a feel for how people feel about STEM (Science, Technology, Engineering, and Mathematics), we polled them, and here are the findings. Respondents were asked to score their level of agreement with each statement in the table, which indicates their perception of STEM education. While the mean values show how in agreement the respondents are on average, the standard deviation (SD) shows how spread out or variable the replies are.

The findings indicate that most respondents have a favorable impression of STEM education. With mean scores above 4, it's clear that people strongly agree with propositions 1, 2, 3, 4, 7, 8, 10, 11, and 12. According to the results, people who took the survey are familiar with STEM (science, technology, engineering, and mathematics) education, have done some STEM-related activities, see the importance of STEM education in schools, think STEM classes are practical, and think STEM education helps students develop their scientific, mathematical, creative, problem-solving, and engineering abilities.

There is more response variability for a small number of statements with more significant standard deviations and lower mean scores. Among the claims, those with lower mean scores imply slightly less agreement among respondents. For example, "STEM Education is improving students' perceptions towards engineering" and "STEM Education is a systematic way for learning" fall into this category. Statement 13 ("STEM education is increasing interest in the course") has a relatively low standard deviation and a substantially lower mean score, suggesting that respondents are more likely to agree with this perception than others. Ultimately, the findings indicate that while most people have a favorable impression of STEM education, there are certain areas where opinions could differ or where things could be better, including attracting more students to take STEM classes.

The table also shows the survey results, which asked people to rank their opinions on STEM education implementation tactics. The results are presented as mean scores and standard deviations (SD) for different assertions. With a mean score of 4.42, we find statement 5: "STEM education is product-focused education," which shows that most respondents strongly agree. This indicates that the participants view STEM education mainly through the lens of making physical things.

Contrarily, with a mean score of 1.30, statement 2, "I use STEM education in providing career guidance (contribution to future) to my students," showed minor support or agreement with the importance of STEM education in career guidance. Statements 6, 7, and 8 also had low mean scores, suggesting respondents had conflicted feelings about them. With a mean score of 1.64, respondents seemed to agree with Statement 6, "Using STEM education, I need more time as compared to traditional teaching," which implies that they think STEM education implementation might take more time than traditional approaches. Results for Statement 7, "I use problem-solving activities during my teaching," had a mean score of 1.92, suggesting that STEM education may not emphasize problem-solving activities as other areas. Lastly, with a mean score of 1.68, statement 8, "School administration cooperates in conducting STEM activities in the class," indicates that there is potential for development in the perception of cooperation from school administration.

The moderate mean scores for statements 1, 3, and 4 shows that respondents agreed. With a mean score of 2.98, Statement 1, "I use STEM education to develop interdisciplinary interaction among students," might be considered moderately agreed upon. A mean score of 2.13 for Statement 3, "I conduct STEM activities to integrate science with other subjects," indicates that respondents understand the significance of integrating STEM activities. However, the execution may use some work. With a mean score of 2.05, Statement 4, "While using STEM education, I promote the latest knowledge to students," was moderately agreed with.

When it comes to STEM education, there is much consensus on the product-focused nature of it. However, opinions and actions differ regarding other parts, like career guidance, time commitment, problem-solving activities, and administration support. These results could guide future studies or interventions to improve the implementation of STEM education methodologies.

5. Conclusion and Discussion

The study "Navigating the STEM Frontier: Unveiling Teachers' Perception and Implementation Strategies at the Secondary Education Level" results allow us to conclude.

The study examined how teachers' perceptions and use of STEM implementation strategies vary by gender. Table 1 shows that there is no significant difference between male and female instructors on average when it comes to teachers' knowledge of STEM implementation methodologies. Nevertheless, there were notable disparities when considering educators' credentials and years of experience. Different levels of implementation were seen between secondary school teachers with academic qualifications and those with professional qualifications. STEM techniques were also more variable among experienced educators than their less-seasoned counterparts.

Additionally, as indicated in Table 2, a survey was used to analyze respondents' attitudes regarding STEM education. Respondents had a favorable view of STEM education in general and ultimately agreed on claims concerning the relevance and usefulness of STEM education in the classroom. Statements concerning the methodical character of STEM learning and the growing interest in STEM courses were two areas where answers varied.

In addition, the poll results provide insight into how people feel about particular strategies for implementing STEM education. There was a consensus on the concrete outcomes of STEM education (a product-focused approach). However, opinions were divided into other topics, including career counseling, time commitment, problem-solving exercises, and school administration support.

In conclusion, the study stresses the significance of secondary school teachers' perspectives and methods for implementing STEM education. The importance of STEM education is widely acknowledged, although teachers may sometimes have differing views or methods. These results can guide future studies and initiatives to improve the efficacy of STEM education methods in secondary schools.

5.1. Recommendations

Recommendation of the study drawn on the basis of findings and conclusion;

- This study may suggest reviewing professional development programs that help secondary school teachers comprehend and implement STEM education concepts.
- The study may become a source to assess teachers' impressions of school administrators' support and identify effective STEM education environment solutions.

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