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Examining Challenges and Strategies in Implementing STEM Education in Malaysian Secondary Schools: Perspectives of Teachers and Students

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ABSTRACT

This study examines the obstacles hindering the complete integration of STEM education in secondary schools, considering perspectives from both teachers and students, and proposing effective strategies. Employing a quantitative survey approach, the research involves 30 STEM teachers and 70 secondary school students. Findings demonstrate a consensus among participants, emphasizing issues such as inadequate teaching equipment and facilities as significant barriers to comprehensive STEM implementation. Educators favor technology-integrated teaching methods, while students show enthusiasm for incorporating these tools into their learning. Proposed effective strategies include enhancing internet accessibility and infrastructure. The study underscores the importance of engaging diverse stakeholders—teachers, parents, societal actors, and governmental bodies—to fully understand challenges and promote successful STEM integration in secondary education.

Keywords: *challenges, secondary schools, STEM education, students' perception, teachers' perception*

INTRODUCTION

STEM education, encompassing science, technology, engineering, and mathematics, represents a multifaceted approach to learning across all educational levels and settings (Stohlmann, 2020). Despite its widespread recognition, defining its precise composition remains a subject of varied interpretation. This study delves into the realm of STEM education, focusing particularly on the transition from traditional lecture-based methods to interactive pedagogies like inquiry-based and project-based learning. Such pedagogical shifts foster interdisciplinary engagement and meaningful learning experiences, often integrating multiple STEM disciplines. Within the Malaysian Education Blueprint 2013–2015, a strategic roadmap for integrated STEM education outlines three pivotal strategies to bolster interest in STEM disciplines. These strategies emphasize refining students' learning methodologies, enhancing educators' competencies, and raising awareness among students and parents about the significance of STEM fields (Rahim et al., 2022). In an era of rapid information advancement, national education aims to cultivate students who can independently access learning resources and techniques to meet their self-learning needs (Mishra, 2022). STEM education, regarded as foundational

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for a country's progress and modernization, nurtures critical and creative thinking skills through the teaching of STEM subjects.

Despite being in the third wave of implementation, STEM education in Malaysia faces challenges in achieving universal adoption, particularly in secondary schools. Various factors contribute to this challenge, necessitating the identification and resolution of barriers to ensure the full integration of STEM education across all school levels. STEM education is crucial for Malaysia's development, especially considering the country's aspiration to have 60% of students studying STEM fields (Ramli & Awang, 2020). However, challenges persist in developing a workforce for future STEM-related professions, with studies indicating a decline in the number of skilled workers over time (Korte et al., 2018). Although STEM education aims for excellence through its third wave in 2022, studies indicate a gap between workforce projections and enrollment rates in technologically advanced nations. Urgent action is needed to strengthen STEM education at all school levels and regions, yet complete implementation remains challenging, particularly in secondary schools. Similar obstacles exist globally, with issues like internet access and infrastructure constraints impacting science instruction and student achievement (Jekri & Han, 2020; Shah, 2022). The existing strategies inadequately address the needs of secondary schools, resulting in significant disparities in educational quality between secondary and primary levels (Tan & Wong, 2020). Failure to address these obstacles may impede Malaysia's aim of having 60% of students opt for STEM fields.

Moreover, research on Malaysian secondary schools is limited, leaving more questions than answers. The lack of research on STEM teaching in schools underscores a critical gap in the literature, necessitating further investigation into the barriers hindering the complete implementation of STEM education in secondary schools. Closing this gap is imperative for advancing STEM education in Malaysia and addressing the challenges impeding its widespread adoption.

LITERATURE REVIEW

While STEM education has been an integral part of Malaysia's educational landscape, its effective implementation faces numerous challenges, especially in secondary schools. Recent trends indicate a gradual decline in the number of students opting for STEM fields, particularly in secondary education, where resources are often scarce (Nawawi et al., 2021; Chuan et al., 2021). This decline is exacerbated by outdated teaching methodologies that focus primarily on instructors, limiting students' critical thinking, creativity, and innovation opportunities. Research highlights gaps in science instructors' understanding of the interconnectedness of science and technology, underscoring the need for improved teacher training in STEM education (Blom & Abrie, 2021).

Issues such as teacher workload and a lack of STEM training further impede STEM education in Malaysian secondary schools (Ismail & Salleh, 2019; Karuppannan, 2021). Moreover, challenges like internet connectivity hinder the integration of technology into STEM education. Hands-on activities are crucial for enhancing students' skills and fostering interest in STEM subjects but limited prior knowledge and parental support pose additional obstacles (Martin et al., 2012). Parental involvement plays a pivotal role in shaping students' attitudes towards STEM education, necessitating proactive steps to demonstrate its relevance in everyday life (Marco-Bujosa, 2021).

The perspectives of teachers on embracing STEM education vary, with some demonstrating enthusiasm while others remain skeptical or ill-prepared to integrate STEM practices into their teaching (Ryu et al., 2018). Lack of understanding, particularly regarding the technological aspect of STEM, underscores the need for comprehensive teacher training and support (Ryu et al., 2018). Students, however, express a keen interest in applying STEM knowledge to future careers, emphasizing the need for engaging and relevant STEM education programs (Black et al., 2021). Several initiatives, such as the STEM@IDEAS and BizMath Challenge modules, aim to enhance STEM education in Malaysia by promoting competition and practical application of STEM concepts (Othman et al., 2020, 2021). Despite these

efforts, Malaysia's performance in international assessments like TIMSS and PISA remains subpar, highlighting the need for pedagogical reforms in STEM education (Zainal et al., 2018).

Pedagogy plays a crucial role in STEM education, emphasizing inquiry-based and project-based learning approaches to actively engage students (Lertcharoenrit, 2020). Professional training for teachers in STEM integration is essential to ensuring effective implementation of these pedagogical approaches (Chieng & Tan, 2021). Additionally, addressing the diverse backgrounds and experiences of students, including their cultural and linguistic diversity, is crucial for promoting inclusivity and equity in STEM education (Kervinen et al., 2020).

In conclusion, addressing the multifaceted challenges facing STEM education in Malaysian secondary schools requires a concerted effort from policymakers, educators, parents, and students. By prioritizing comprehensive teacher training, fostering parental involvement, and promoting innovative pedagogical approaches, Malaysia can overcome these challenges and foster a thriving STEM education ecosystem conducive to the nation's progress and development.

RESEARCH OBJECTIVES

In order to pursue the objectives, there are research objectives as follows:

1. To identify the challenges that make STEM education difficult to adapt in secondary school. (RO1)
2. To examine the teachers' and students' perceptions of the implementation of STEM education in secondary school. (RO2)
3. To investigate the effective strategies to make STEM education fully implemented in secondary schools from teachers' perspectives. (RO3)

RESEARCH METHODOLOGY

The quantitative method was chosen as the research approach for its capacity to handle a larger sample size and offer a detailed, comprehensive overview. This method also enables swift and precise evaluation of multiple datasets simultaneously, with data presented numerically for streamlined analysis, particularly when utilizing tools like SPSS. The research design selected is a survey, involving the administration of a questionnaire. This design was preferred for its ease of implementation, broad applicability, and efficient data collection, allowing the capture of perspectives and opinions from both teachers and students on the research topic. Various means, including face-to-face interactions and online platforms, will facilitate questionnaire administration.

The sample size represents specific groups in the study: STEM teachers and secondary school students. Utilizing a formula such as the one proposed by Krejcie and Morgan (1970), the sample size for STEM teachers in secondary schools in the Klang Valley is determined to be 30, while for students, it should be 70. Simple random sampling will be employed in this study, ensuring an equal chance of selection for all population members. The questionnaire, a standardized research instrument comprising a series of questions or prompts, will be utilized to collect data, measuring all objectives of the study while ensuring internal consistency and coherence for subsequent analysis. Employing an online questionnaire will save costs by eliminating the need for labor, paper, printing, phone calls, or mailing and facilitating rapid distribution through various online mediums. The research instrument will be adapted from previous studies and questions developed by the researcher through exploration, including reading articles and engaging in discussions with friends, teachers, and lecturers to gather information on the subject matter.

Reliability tests in statistics are essential for evaluating the consistency and stability of a test or measurement tool. Among the primary strategies for addressing reliability concerns are stability and internal consistency. Given that internal consistency reflects the homogeneity of variables within the measure that assesses the construct, the researcher opted to focus on this aspect to address reliability.

To ascertain the consistency of respondents' responses across all items in the measure, inter-item consistency reliability was employed. The assessment of internal consistency was conducted using Cronbach's alpha, a widely used test for inter-item consistency and reliability.

To ensure the robustness and reliability of the data, triangulation of methodology was considered. Triangulation involves using multiple methods or data sources in research to develop a comprehensive understanding of phenomena. This study incorporated triangulation by combining quantitative methods with insights gained from literature reviews and expert consultations. This approach not only enhances the validity of the findings but also provides a more nuanced understanding of the challenges and strategies related to STEM education in secondary schools.

Table 1 presents the reliability analysis of the survey instrument used in the study. The table includes different parts of the survey, the number of items in each part, and their corresponding Cronbach's alpha coefficients, which measure the internal consistency and reliability of the items within each part.

Table 1: Survey Instrument Reliability Analysis

Part		No of Items	Cronbach Alpha
A	Demographic profile		
B	Teachers' perception challenges using STEM education	9	.757
C	Teachers' perception in STEM education	9	.799
D	Students' perception of STEM education	10	.898
E	Effective strategies in STEM education	8	.884
	Total number of items	36	

Part A of the survey pertains to the demographic profile of the participants and is not subject to reliability analysis. Parts B, C, D, and the section on Effective Strategies in STEM Education are all subjected to reliability analysis. For Part B, which focuses on Teachers' Perception Challenges Using STEM Education, there are 9 items, and the Cronbach's alpha coefficient is.757. Similarly, for Part C, which examines teachers' perceptions of STEM education, there are also nine items, with a Cronbach's alpha coefficient of.799. Part D involves students' perceptions of STEM education and comprises 10 items. The Cronbach's alpha coefficient for this section is.898, indicating a high level of internal consistency among the items. Lastly, Part E on Effective Strategies in STEM Education contains 8 items, with a Cronbach's alpha coefficient of.884, indicating strong internal consistency among these items as well. Overall, the Cronbach's alpha coefficients for all sections except for Part B (Challenges using STEM Education) demonstrate good to excellent internal consistency, suggesting that the survey instrument is reliable for measuring the constructs of interest within each section.

FINDINGS AND DISCUSSION

The results and discussion will be structured into two main sections: demographic data (Part A) and findings for research questions (Parts B, C, D, and E). Descriptive analysis will be employed to analyze demographic data, utilizing measures of central tendency such as descriptive statistics.

Findings for the Demographic Profile

Part A questionnaires served the purpose of collecting demographic data from the participants. This section encompasses responses to four questions aimed at gathering background information about the respondents, including their gender, race, subject of instruction for teachers, and academic level for students. It was obligatory for all participants in this study to complete the background information form.

Table 2 presents the demographic distribution of both teachers and students based on the provided questionnaire data. For gender (Q1), 20% of teachers are male, while 80% are female. Among students, 21.4% are male, and 78.6% are female. Regarding race (Q2), most teachers (96.7%) are Malay, while a small percentage are Chinese (3.3%). Among students, 87.1% are Malay, 12.9% are Indian, and none are reported as Chinese. In terms of teaching subjects (Q3), the distribution among teachers is varied, with the highest percentage in physics (20%), followed by mathematics (16.7%), science (10%), biology (10%), and additional mathematics (10%). Other subjects collectively represent 26.7% of teachers. No specific subjects are reported for students in this table. Lastly, for Form 4 (Q4), 34.3% of students are in Form 4, and 65.7% are in Form 5. No form data is provided for teachers in this table. Overall, the table offers insight into the demographic composition of both teachers and students participating in the study, providing a snapshot of their gender, race, teaching subjects (for teachers), and academic level (for students).

Table 2: Demographic Distribution of Teachers and Students

Question	Demographic Variable	Category	Percentage	
			Teachers	Students
Q1	Gender	Male	20%	21.4%
		Female	80%	78.6%
Q2	Race	Malay	96.7%	87.1%
		Chinese	3.3%	0%
		Indian	0%	12.9%
Q3	Teaching Subject	Science	10%	-
		Physics	20%	-
		Chemistry	3.3%	-
		Biology	10%	-
		Mathematics	16.7%	-
		Additional Mathematics	10%	-
		Science Computer	3.3%	-
		Others	26.7%	-
Q4	Form	Form 4	-	34.3%
		Form 5	-	65.7%

The analysis of The Research Questions

The survey delved into various aspects of STEM education, encompassing an exploration of teaching challenges, the perspectives of teachers and students, and effective instructional techniques in secondary schools. To ensure comprehensive responses, the questionnaire was structured into sections B, C, and D for teachers, with students responding only to section B. The Likert scale served as a discerning tool, facilitating the collection of validated data on respondents' opinions regarding encountered difficulties, held perspectives, and the efficacy of STEM education strategies in secondary school contexts. Section B consisted of nine questions focusing on the challenges associated with STEM education implementation, particularly in secondary schools. Section C included questions nine and ten, aimed at capturing insights into both teachers' and students' perceptions of STEM education. Section D further explored effective strategies for STEM education implementation through eight thoughtfully crafted questions. Subsequent analysis of questionnaire responses enabled the researcher to derive meaningful conclusions from the gathered data.

Research Objective 1 (RO1): To identify the challenges that make STEM education difficult to adapt in secondary school.

According to Table 3, the main challenges to fully implementing STEM education in secondary school, based on mean scores, are the incomplete equipment facilities for teaching and the lack of time to develop students' critical thinking due to syllabus overload, both with a mean of 4.20. The second-highest mean score of 4.00 indicates that students' lack of interest in STEM subjects due to the

perception of difficulty is also a significant challenge. This is followed closely by the challenges of inadequate internet facilities and a lack of infrastructure, both with a mean score of 4.17.

Table 3: Teachers' Perception of Challenges in STEM Education in Secondary Schools

Items	Mean
Internet facilities are the main challenge.	4.17
There is no support from the students' parents or environment.	3.73
Equipment facilities for teaching are not complete.	4.20
Lack of infrastructure.	4.17
Gap in the use of English and Malay in STEM subjects.	4.10
Lack of teacher training and competence.	3.80
There is a lack of time to develop students' critical thinking (conduct experiments or project-based learning) because of the many syllabuses.	4.20
Students are less interested in doing assignments that require them to explore information on their own.	3.83
Students are less interested in STEM subjects because their mindset thinks that stem is difficult.	4.00

The original research objective aimed to identify barriers to fully implementing STEM education in secondary school settings. The study's findings revealed unanimous agreement among respondents regarding all the challenges outlined in the questionnaire. Notably, three items, each with the highest, second highest, and the lowest mean values warrant particular attention.

Firstly, the findings highlighted that incomplete equipment facilities for teaching represent a significant challenge in fully implementing STEM education in secondary schools. This aligns with prior research by Jekri & Han (2020) and Pearson et al. (2022), who similarly identified insufficient school facilities as a barrier to STEM implementation. Inadequate resources, coupled with a shortage of trained teachers, present hurdles to the adoption of STEM education, hindering the cultivation of future scientists, engineers, and technologists. Vygotsky's theory underscores the significance of "tools of intellectual adaptation," underscoring the pivotal role of resources—especially technology and equipment in facilitating hands-on learning experiences and skill development. To mitigate educational disparities, ensuring equitable access to these resources for all students, irrespective of socioeconomic status or school location, is imperative.

The second major challenge identified is the lack of time to foster students' critical thinking skills, attributed to a packed curriculum with multiple syllabuses. Pressure to cover extensive syllabi within limited timeframes leads to rushed teaching and potential teacher burnout—an issue commonly faced by educators. Conversely, the challenge of receiving no support from students' parents and the environment was noted with the lowest mean value. While acknowledged as a challenge, it was not identified as the primary obstacle to fully implementing STEM education in secondary schools. This finding resonates with the research of Yean & Chin (2019), who found that parents in Malaysia often lack awareness and possess misconceptions about STEM, impeding their ability to effectively guide their children. Other pertinent issues, such as limited internet access and inadequate teacher training, merit serious consideration.

Research Objective 2 (RO2): To examine the teachers' and students' perceptions on the implementation of STEM education in secondary school.

Descriptive statistics for teacher perceptions of STEM education in secondary schools are presented in Table 4. The highest mean value, indicating strong agreement, is observed for the item "I like learning techniques that utilize technology and the internet," with a mean of 4.23. Following closely are "I am ready for changes in teaching methods" and "I am willing to engage in STEM activities and programs," both with a mean of 4.03.

Table 4: Teachers' Perception of STEM Education Implementation in Secondary Schools

Items	Mean
I understand STEM teaching methods.	3.77
I am ready for changes in teaching methods.	4.03
I like learning techniques using technology and the internet.	4.23
My skills at using technology are very good.	3.90
I know about LEGO education, and I am willing to apply it to my teaching.	3.40
STEM subjects are more appropriate and effective if they are taught in English.	3.53
I support it if STEM education is implemented entirely in secondary schools.	3.83
I am willing to engage in STEM activities and programs.	4.03
I agree if STEM elective subjects are added at this school (e.g., Additional Science, Sports Science).	4.00

Meanwhile, Table 5 outlines students' perceptions, with the highest mean value of 4.44 attributed to the item "I am willing and very interested in using technology and the internet for learning." Additionally, the second-highest mean of 3.80 is recorded for "I am interested in learning that requires 4C (critical thinking, communication, collaboration, and creativity) such as creating products, investigating problems, and finding solutions."

Table 5: Students' Perception of STEM Education Implementation in Secondary Schools

Items	Mean
I understand clearly about STEM education.	3.40
I am ready for all the changes in the learning method.	3.60
I support it if STEM education is fully implemented in this school.	3.76
I am willing and very interested in using technology and the internet for learning.	4.44
I am interested in learning that requires 4C (critical thinking, communication, collaboration and creativity) such as creating products, investigating problems, and finding solutions.	3.80
I like to explore and find information on my own about the topic to be studied or task given.	3.66
I am willing to take more than one STEM elective subject.	3.33
I am interested in learning more about STEM education.	3.76
I am ready and interested in participating in programs involving STEM.	3.41
I am willing if STEM subjects are taught in English.	2.74

In addressing the second research objective, which explores teachers' and students' perceptions of STEM education in secondary school settings, the consensus among teachers indicates agreement with all items in this section. Particularly noteworthy is the majority of teachers' positive attitude towards adopting technology-based learning techniques and integrating the internet into their classrooms. This aligns with existing research, which underscores teachers' high level of intention and involvement in utilizing technology for online teaching, as well as their shared belief in the importance of enhancing digital skills (Mailizar et al., 2021). It underscores teachers' recognition of the value that technology brings to their instructional practices.

However, the survey identifies two items with the lowest mean among teachers. The first pertains to teachers' awareness and willingness to incorporate game-based learning (GBL) techniques, such as LEGO Education, VR, and Minecraft, into their classroom instruction. Some teachers may lack familiarity with GBL, and integrating it poses challenges such as time constraints, limited technical knowledge, and difficulties in selecting appropriate teaching games (Vien et al., 2019). The Zone of Proximal Development (ZPD) is relevant for both students and teachers. School administrators or instructional leaders can play a crucial role in assessing teachers' current levels of knowledge and skills in GBL and providing them with appropriate support and resources aligned with their ZPD. This approach can prevent teachers from feeling overwhelmed by complex GBL techniques before they are adequately prepared to use them.

Another notable finding is that a minority of teachers believe that using English in STEM subjects has a limited impact on STEM education implementation. This indicates a divergence in

teacher opinions regarding the language of instruction for STEM subjects, with some suggesting that English may not significantly affect the overall implementation of STEM education.

Analyzing student perceptions reveals a significant percentage of students who are prepared and enthusiastic about using the internet and technology in their learning. Students today demonstrate technological proficiency and a strong inclination towards utilizing internet resources for academic purposes. Their access to information, interaction with educational content, and engagement with learning resources have all been substantially influenced by the digital era. This observation is supported by Xu et al. (2019), who highlight the positive correlation between internet access and students' academic performance. Those with internet access demonstrated greater academic progress than those without. However, it's important to note that the mere availability of multiple internet portal connections doesn't guarantee immediate access to all available resources.

One notable exception among students is the majority disagreeing with the statement, "I am willing if STEM subjects are taught in English." This suggests that students prefer learning STEM subjects in Malay, indicating a reluctance to change the language of instruction for these subjects. This underscores the importance of considering students' language preferences when designing and implementing STEM education programs, recognizing that teaching in Malay may be more suitable and aligned with students' comfort and readiness to learn STEM concepts.

Research Objective 3 (RO3): To examine the teachers' perceptions on the implementation of STEM education in secondary school.

Table 6 presents descriptive statistics regarding teachers' suggestions for enhancing STEM education in secondary schools. According to the mean values, the most effective strategy for fully implementing STEM education is for teachers to increase their proficiency in using technology, with a mean of 4.53. Following closely is the suggestion to upgrade infrastructure to facilitate activities more effectively, with a mean of 4.50. Additionally, the government reconsidering the number of syllabuses is identified as the third-highest mean suggestion, with a value of 4.47.

Table 6: Teachers' Suggestions for Enhancing STEM Education in Secondary Schools

Items	Mean
Increasing the internet's reach for secondary schools.	4.40
Parents and teachers should encourage questioning and curiosity to make students excited to explore and learn about STEM topics.	4.27
Parents and society should support students by visiting a science museum and providing STEM extracurriculars.	4.43
Complete teaching equipment to facilitate student research and project completion.	4.33
Upgrading the infrastructure so that an activity can be carried out perfectly and easily.	4.50
Teachers must increase their proficiency using technology.	4.53
The government should reconsider the number of syllabuses.	4.47
Students ought to be self-aware enough to look up and investigate information on their own.	4.33

Regarding the third research objective, which investigates effective strategies for the full implementation of STEM education in secondary schools from the perspective of teachers. The findings indicated that most respondents agreed with all the strategies outlined in the questionnaire. Particularly notable are two strategies that received the highest mean scores: "increasing the internet's reach in secondary schools" and "upgrading infrastructure to facilitate seamless activity execution."

According to Becking & Grady (2019), addressing the digital divide by allocating funds to low-income schools, providing access to digital tools and frameworks, and enhancing technology training for teachers in these districts is crucial. These initiatives aim to mitigate the effects of the digital divide, enhance student learning outcomes, promote STEM careers, and offer relevant learning opportunities, especially in underserved communities.

Additionally, infrastructure, including necessary equipment, should be upgraded and completed to ensure a smooth execution of hands-on activities. One strategy that may have a limited impact on STEM education implementation is "encouraging questioning and curiosity among students to foster excitement about exploring and learning STEM topics." However, it is essential to acknowledge that other strategies, such as gaining parental support, enhancing teachers' proficiency, and reconsidering the number of syllabuses, among others, should be prioritized to ensure comprehensive and effective implementation of STEM education in secondary schools.

CONCLUSION

The pursuit of increased student participation and enrollment in STEM fields remains a persistent challenge in Malaysian secondary schools. Recognizing this as imperative, our study serves as a vital examination, evaluating the factors inhibiting the integration of STEM education in secondary schools while considering the challenges encountered by both teachers and students. Furthermore, it delves into the perceptions of teachers and students regarding STEM education and discusses effective strategies for its successful implementation.

Consequently, our research serves as a valuable resource for researchers and academics, aiding in the identification and resolution of critical barriers and issues integral to the successful integration of STEM education in secondary schools. It underscores the importance of educators and researchers remaining attuned to these challenges, shedding light on the obstacles faced by STEM education in secondary schools.

Moving forward, several recommendations emerge to further enhance our understanding and address existing gaps in STEM education implementation. Firstly, expanding the sample size, particularly for teacher participants, could offer more comprehensive insights into their perspectives and experiences regarding STEM education. Additionally, employing a mixed-methods research approach would enable a more nuanced exploration of teachers' viewpoints, allowing for a deeper understanding beyond the predefined challenges and strategies identified in this study. Furthermore, conducting a comparative analysis between secondary and primary schools could uncover nuanced differences in STEM education implementation across educational levels, shed light on factors influencing effectiveness, and highlight best practices. By embracing these recommendations, future research endeavors can contribute to the ongoing refinement and advancement of STEM education initiatives, ultimately fostering a more inclusive, engaging, and impactful learning environment for students.

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AUTHORS' CONTRIBUTION

Riduan, M. A., conceived and planned the experiments and also carried out the experiments and carried out the simulations. Othman, Z. S., contributed to the interpretation of the results and took the lead in writing the manuscript. All authors provided critical feedback and helped shape the research, analysis, and manuscript.

CONFLICT OF INTEREST DECLARATION

I/We certify that the article is the Authors' and Co-Authors' original work. The article has not received prior publication and is not under consideration for publication elsewhere. This research/manuscript has not been submitted for publication nor has it been published in whole or in part elsewhere. We testify to the fact that all Authors have contributed significantly to the work, validity and legitimacy of the data and its interpretation for submission to Jurnal Intelek.

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