

Teacher self-efficacy: a second-order confirmatory factor analysis of student engagement, instructional strategies, and classroom management among secondary school teachers

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ABSTRACT

Teacher self-efficacy plays an important role in improving teaching effectiveness and student learning outcomes; however, a validated measurement model tailored to the local educational context remains limited. Therefore, this quantitative study aims to develop a measurement model of teachers' self-efficacy in Malaysia. The proposed model consists of three dimensions: student engagement (SE), instructional strategies (IS), and classroom management (CM). Data were collected from 144 teachers using a modified questionnaire based on the teacher sense of efficacy scale (TSES). The data were analyzed using confirmatory factor analysis (CFA) through structural equation modeling (SEM) with AMOS. The findings confirmed that 12 suggested behaviors were acceptable within the model. The CFA results demonstrated satisfactory factor loadings (FL) and reliability for SE (FL=0.758–0.820, composite reliability (CR)=0.870, average variance extracted (AVE)=0.627, square root of AVE (\sqrt{AVE})=0.792), IS (FL=0.696–0.875, CR=0.895, AVE=0.683, \sqrt{AVE} =0.826), and CM (FL=0.741–0.864, CR=0.819, AVE=0.619, \sqrt{AVE} =0.871). These findings indicate that the proposed measurement model demonstrates acceptable validity and reliability and provides a useful framework for evaluating teachers' self-efficacy and supporting efforts to enhance teaching quality in the Malaysian educational context.

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1. INTRODUCTION

For more than a decade, especially among scholars, the discussion of teacher self-efficacy has not ended. Self-efficacy refers to an individual's belief in their ability to plan and execute actions required to achieve specific goals [1]. The concept of self-efficacy has gained increasing attention among contemporary researchers. Self-efficacy can be defined as the capacity to exert control over the cycle of instructional learning, inspiration, and practice [2] or a teacher's appraisal of his or her ability to prepare and carry out

school assignments to achieve the desired outcomes of enhancing school success or the ability of teachers to inspire students regardless of student experience or trust [3]. In this situation, the teacher's job is not only to instruct, but also to provide extremely self-reliant teachers with the opportunity to serve as motivators to prepare and organize the action that needs to be achieved to meet the desired aim of the mission [4], [5] and to inspire and enhance cognitive performance of students [2]. Teachers play multiple roles in society, not only as educators but also as contributors to the development of human capital. In other words, each instructor needs self-efficacy, which is an inner motivation to carry out the duties of an assignment in order to produce excellent results [6].

Nevertheless, self-efficacy of teachers is often seen as a key topic that is frequently debated in the school system [7]. Teachers with high self-efficacy demonstrate more effective instructional strategies, better classroom management, and stronger student engagement, all of which are essential for effective teaching [8], which makes teachers' trust and motivation lower and the standard of teaching in the classroom less efficient [9]. Confidence in teaching is directly linked to improved student outcomes, as it influences teachers' ability to adapt their teaching methods and foster positive learning environments [10].

However, in Malaysia, these challenges are particularly prominent, where teachers face growing demands to adapt to evolving instructional needs and educational policies. Research highlights that teachers frequently experience diminished motivation and trust in their abilities to achieve desired outcomes [8], [9]. The absence of validated self-efficacy metrics tailored to the Malaysian educational context exacerbates this issue, creating a critical research gap. Addressing these disparities is essential, as teachers with high self-efficacy demonstrate greater resilience, openness to adopting new teaching methods, and a stronger commitment to student success [6], [11]–[13].

Given the critical role of teachers as the key drivers of school excellence, this study aims to revalidate the constructs of teacher self-efficacy based on Malaysia's unique educational environment. By focusing on key elements such as instructional strategies (IS), classroom management (CM), and teacher-student interaction, this research will provide a framework to enhance teacher confidence, improve classroom outcomes, and align instructional practices with national educational goals. Moreover, the idea and concept of self-efficacy were developed by Bandura [11] based on four key elements of the social cognitive theory: knowledge of dominance, external power, vicarious awareness, and physiological status. Whereas the teacher self-efficacy model, built because of social cognitive theory, consists of student interaction elements, instructional approaches, and CM are interlinked. The participation aspect includes calculating the effectiveness of teaching sessions and also calculating the degree of self-efficacy of teachers [14]. IS are used to calculate the level of self-efficacy of teachers involves the preparation of time allocations for each teaching phase and the use of teaching aids in accordance with the needs of [15], [16].

The administration of classrooms is an important factor before the introduction of the teaching and learning process. There are circumstances in which the classroom situation is very difficult to manage, even if the instructor has mastered different lessons, strategies and theories [17]. This aspect assesses the teacher's ability to control the classroom in such a way that the teaching process is carried out smoothly and effectively without any unnecessary interruptions [18]. In the field of education, the idea of self-efficacy of teachers is very important in carrying out the duties assigned to them to achieve a successful performance [6]. Ye *et al.* [19] discuss two main aspects of teacher self-efficacy, namely self-efficacy and teaching capacity. Self-efficacy is closely linked to the belief that a teacher has the style of skills and abilities to change the perception of his students [9] and that teaching skills are linked to the ability of a teacher to improve the academic achievement of his students [10].

Consequently, in the growth of curriculum, these two principles require each other to improve teacher trust in the teaching and learning process and to encourage students to learn [20]. The willingness of teachers to deliver successful learning is also one of the facets of high self-efficacy. It is because the excellent success of students rests not only in preparation alone, but also in the trust of teachers to carry out a systematic learning process in the classroom [18]. Past findings have shown that self-efficacy of teachers has been established as having a substantial link to enhancing student success [21]. Teachers have successfully demonstrated their own ability to influence the result of student learning. In reality, self-efficacy of teachers is based on cognitive social theory [22]. According to Bandura [11], social cognitive is an individual's confidence in his capacity to persuade other individuals to work forward to accomplish a goal. Teachers with a strong sense of self-efficacy are likely to influence their students' decision-making, learning, and behavior [7]. As a result, teachers who have the strength of self-efficacy always strive to achieve more challenging and more proactive work goals compared to low self-efficacy individuals [20].

Researchers have identified, based on previous studies, that teacher self-efficacy is a factor that differentiates the level of teachers in schools [23]. Krause *et al.* [22] found that teachers with a high level of efficiency are open to new techniques in the teaching process so that higher targets can be set for their students. This critical study is further reinforced by the findings of the study of Hatlevik and Hatlevik [23]

in which most self-certified teachers are more likely to apply the latest teaching techniques and methods in line with the development of global education. In addition, the study of Cansoy and Parlak [6] states that teachers with a high level of self-efficacy tend to challenge themselves and have a high resilience to perform a new or difficult teaching task. The results of the Tschannen-Moran *et al.* [12] found that the level of effectiveness of teachers has a significant relationship with student achievement. Improving student success can be assessed by teaching actions while in the classroom, the commitment and willingness of teachers to accomplish student goals, as well as the propensity to consider the newest innovations and to apply the latest learning concepts or strategies in the classroom [2].

The results of this research are consistent with the observations [24], where the achievement of student success rises as they are motivated by dedicated teachers with strong spirits. Essentially, the success of these teachers is seen as having a positive impact on social wellbeing as well as developing a favorable and harmonious school environment. Perhaps leaders that demonstrate ethical development by embodying qualities like empathy, equity, and the capacity to encourage their team members have the potential to significantly effect and promote meticulous performance. As a result, administrators that foster intrinsic motivation in their employees achieve effective outcomes or overall goals from their subordinates. Based on literature analysis and teacher self-efficacy problems, this study suggests three self-efficacy teacher constructs as outlined in the analytical context, as seen in Figure 1. Teachers' self-efficacy teachers' teaching abilities are factors defined by three constructs: student participation aspects, educational methods, and CM.

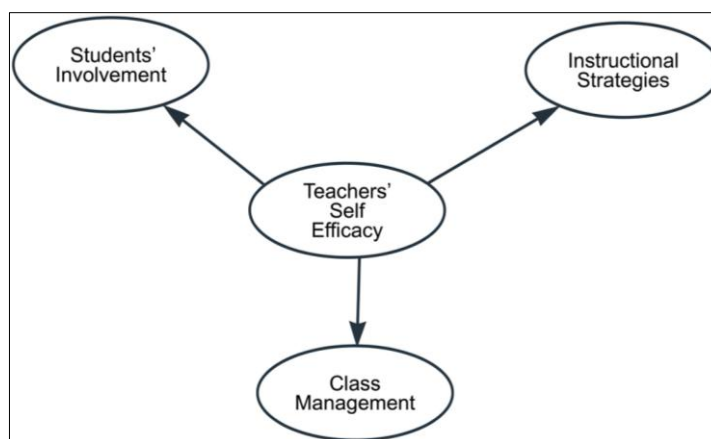


Figure 1. The final measurement model of teachers' self-efficacy

Nevertheless, the findings of the Gibson and Dembo [17] indicate that teachers with poor self-efficacy frequently discriminate against their pupils. Teachers tend to evaluate students on the basis of intelligence and academic results only [23]. Teachers are not concerned about enhancing students' shortcomings and sometimes neglect these pupils, but instead giving clever pupils fair care. The findings of Woolfolk *et al.* [25] have showed that low-performing teachers often exhibit autocratic behavior, which is more likely to exert administrative authority in the classroom, as well as to enforce punishments to ensure that students obey instruction-based teaching. The research was also endorsed by Gordon [26], showing that low-performance teachers are abusive and sometimes demonstrate frustration through excessive discipline. Consequently, the results of this study show that encouraging an increase in the level of self-efficacy of teachers is an important benchmark for the effectiveness of teachers in general in CM. Perceived self-efficacy in course satisfaction is critical for student achievement and overall pleasure in academic contexts. Their findings indicate a substantial link between students' self-efficacy and classroom satisfaction, which is critical for successful learning and academic accomplishment. As a result, preservice teachers must have high levels of self-efficacy to teach well in Malaysia's culturally varied classrooms. This emphasizes the need of developing self-efficacy in teacher education programs to improve teaching quality and student engagement (SE) [27]. Thus, strengthening teachers' self-efficacy should be a top priority for improving Malaysia's education system.

While teacher self-efficacy has been widely studied, a validated measurement model specific to Malaysia's educational context remains lacking. This study addresses this gap by using second-order confirmatory factor analysis (CFA) to validate a three-dimensional teacher self-efficacy model encompassing SE, IS, and CM. Unlike previous studies that rely on general assessments [28], this research identifies 12 key

self-efficacy behaviors, providing a structured framework for evaluating teacher confidence and effectiveness. By establishing a context-specific model with strong psychometric properties, this study introduces valuable novelty to teacher training, policy development, and instructional improvement. The findings bridge theory and practice, reinforcing efforts to enhance teacher self-efficacy in alignment with national education goals.

2. METHOD

This study employed a cross-sectional quantitative survey design to develop a measurement model of teachers' self-efficacy in Malaysia.

2.1. Sampling

The participants consisted of 144 teachers who represented secondary schools in one district in Malaysia. This study was conducted in one district in Malaysia and focused on respondents who teach in public secondary schools. Consequently, only teachers from this group were selected to provide feedback on demographic information and the implementation of professional learning community practices in their respective schools. The sample size was determined using the sample size table based on the population size framework proposed by Krejcie and Morgan [29]. According to this table, for a total population of 231 individuals, the appropriate sample size is 144. Therefore, the calculated sample size of 144 represents the minimum recommended sample size necessary to ensure statistical reliability, as suggested by Krejcie and Morgan [29]. Table 1 provides a detailed breakdown of the total population and the corresponding sample size of teachers across the participating schools. This stratified random sampling method ensures that the sample is representative of the teacher population in these schools while maintaining an adequate sample size for statistical analysis.

Table 1. Teachers stratified random sampling

No	School	Population			%N	Teacher sampling		
		M	F	Σ	Σ	M	F	Σ
1	A	30	59	89	(89/231) X 100=38.5	(30/231) X 144=18	(59/231) X 144=37	(89/231) X 144=55
2	B	18	36	54	(54/231) X 100=23.4	(18/231) X 144=11	(36/231) X 144=23	(54/231) X 144=34
3	C	7	36	43	(43/231) X 100=18.6	(7/231) X 144=4	(36/231) X 144=23	(43/231) X 144=27
4	D	13	32	45	(45/231) X 100=19.5	(13/231) X 144=8	(32/231) X 144=20	(45/231) X 144=28
	Total	68	163	231	100	41	103	144

2.2. Instrumentation

Data for this study were collected using a modified version of the teacher sense of efficacy scale (TSES), originally developed by Tschannen-Moran *et al.* [12], to assess teachers' self-efficacy beliefs. The TSES utilizes a five-point Likert scale, ranging from "never" (the lowest level) to "very frequent" (the highest level), allowing respondents to indicate the extent to which they experience specific beliefs or behaviors. The instrument's reliability and validity have been extensively evaluated across various educational settings, consistently demonstrating strong psychometric properties. The original scale has been reported to exhibit high internal consistency, with Cronbach's alpha coefficients generally exceeding 0.90, confirming its robustness as a reliable measurement tool. The TSES is structured around three key dimensions: efficacy in SE, IS, and CM. Each dimension has consistently demonstrated strong reliability, with Cronbach's alpha values ranging from approximately 0.81 to 0.86 for efficacy in SE, 0.86 to 0.91 for efficacy in IS, and 0.86 to 0.90 for efficacy in CM. These findings support the instrument's internal consistency and construct validity across diverse populations and educational contexts.

The modifications in this study were carefully designed to maintain the reliability and validity of the instrument, ensuring alignment with the core constructs established by Tschannen-Moran *et al.* [12] while tailoring it to the specific objectives of the research. The study was approved by ethical committee in the School of Education, Universiti Utara Malaysia. The data were analyzed using structural equation modeling (SEM) with AMOS software. To validate the proposed factor for each dimension, CFA is performed. The proposed factor is acceptable if the factor loading (FL) value is 0.708. However, according to Hair *et al.* [28], the external load value ≥ 0.4 is acceptable if the average variance extracted (AVE) value reaches the recommended value of >0.5 . For composite reliability (CR) the value >0.708 is acceptable [30]. Next, the fitness of model was tested using several fit indices such as chi-square (CMIN), comparative fit index (CFI), root mean square error of approximation (RMSEA), parsimony normed fit index (PNFI), and parsimony comparative fit index (PCFI). The hypothesis model was considered fitting to the collected data when the

significant value of chi square exceeding 0.05. Hypothesized model is also considered fit when the CFI exceeding 0.90, but values between 0.80 and 0.89 is still in the acceptable margin. The RMSEA value also considered accepted if smaller than 0.08, but still acceptable if less than 0.1 [31]. The model also considered fit when PCFI and PNFI value exceeds 0.5 [32].

3. RESULTS

By using second-order factor analysis (CFA), explored and observed FL, convergent validity, composite validity (CR), and discriminating validity among these. In this case, the values of FL, mean variance extracted (AVE), CR, and the square root of AVE (\sqrt{AVE}) are observed for each dimension and variable function. Table 1 indicates the FL, CR, AVE, and \sqrt{AVE} values recorded for the self-efficacy variables of teachers. FL, CR, AVE, and \sqrt{AVE} values for SE (FL=0.758-0.820, CR=0.870, AVE=0.627, \sqrt{AVE} =0.792), IS (FL=0.696-0.875 CR=0.895, AVE=0.683, \sqrt{AVE} =0.826), and CM (FL=0.741-0.864, CR=0.819, AVE=0.619, \sqrt{AVE} =0.871). As seen in Table 2, the CFA results show acceptable overall FL values.

Table 2. FL, CR, AVE, and \sqrt{AVE} values for teachers' teaching competency

Constructs	Indicators	FL	CR	AVE	\sqrt{AVE}
SE	s1	0.792	0.87	0.627	0.792
	s2	0.796			
	s3	0.820			
	s4	0.758			
IS	s5	0.86	0.895	0.683	0.826
	s6	0.875			
	s7	0.861			
	s8	0.696			
CM	s9	0.779	0.819	0.619	0.871
	s10	0.884			
	s11	0.741			
	s12	0.864			

Another important finding show that teacher's efficacy contributed significantly to SE (β =0.163, CR=8.855, P<0.00), IS (β =0.832, CR=8.855, P<0.00), and CM (β =0.904, CR=9.656, P<0.00) as shown in Table 2. The most interesting result was that his research successfully confirmed 12 behaviors in teacher self-efficacy represented by four behaviors for SE, teaching methods, and CM, respectively. The regression coefficients are presented in Table 3. Meanwhile, Table 4 summarizes the CFA analysis for teachers' teaching competency, including the suggested and accepted behaviors for each construct. Finally, Figure 2 shows the final measurement model of teachers' efficacy among teachers in Malaysia. The hypothesis model was considered fitting to the collected data when all fit indices are acceptable (CFI=0.894, RMSEA=0.141, PNFI=0.667, and PCFI=0.691).

Table 3. Regression coefficients

Constructs	Variable	Estimate	SE	CR	P	Label
SE	<--- Teachers' self-efficacy	0.673	0.076	8.855	p<0.001	Significant
IS	<--- Teachers' self-efficacy	0.832	0.168	8.855	p<0.001	Significant
CM	<--- Teachers' self-efficacy	0.904	0.094	9.656	p<0.001	Significant

Table 4. Summary CFA analysis for teachers' teaching competency

Variable	Constructs	Suggested behavior	Accepted behavior
Teachers' self-efficacy	SE	4	4
	IS	4	4
	CM	4	4
	Total	12	12

This study aimed to validate the constructs of teacher self-efficacy and analyze its relationship with three dimensions of teaching competency: SE, IS, and CM. Using second-order CFA, the FL, CR, AVE, and the \sqrt{AVE} were examined to ensure reliability and validity. The results of the CFA indicate that all proposed constructs achieved acceptable FL values. Specifically, the FL for SE ranged from 0.758 to 0.820, with a CR of 0.870 and an AVE of 0.627. For IS, the FL were between 0.696 and 0.875, with a CR of 0.895 and

an AVE of 0.683. Similarly, CM demonstrated FL between 0.741 and 0.864, a CR value of 0.819, and an AVE of 0.619. The square root of the AVE ($\sqrt{\text{AVE}}$) for each construct was greater than the correlations with other constructs, ensuring discriminant validity. These results confirm that the constructs of teacher self-efficacy comprising SE, IS, and CM are reliable and valid.

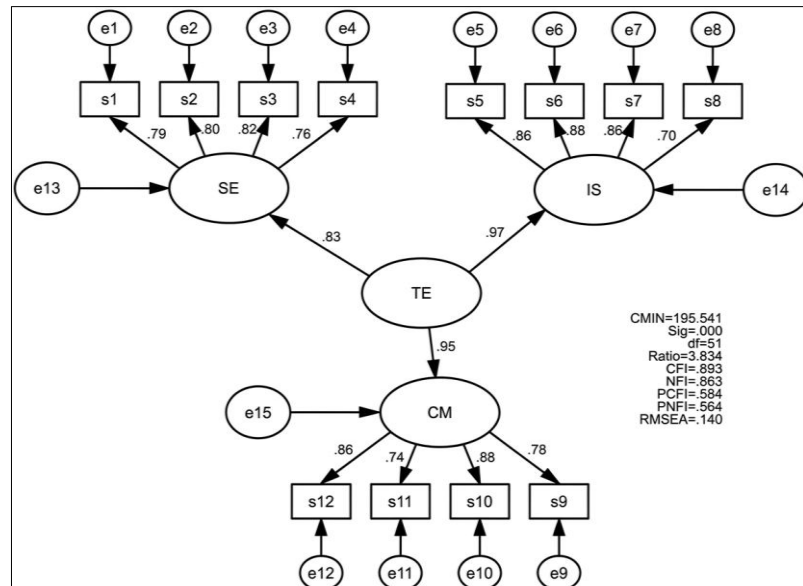


Figure 2. The final measurement model of teachers' self-efficacy

Further analysis using regression coefficients revealed the significant contribution of teacher self-efficacy to the three dimensions of teaching competency. The results demonstrated that teacher self-efficacy had a direct and positive effect on SE ($\beta=0.673$, $CR=8.855$, $P<0.001$), IS ($\beta=0.832$, $CR=8.855$, $P<0.001$), and CM ($\beta=0.904$, $CR=9.656$, $P<0.001$). These findings highlight the critical role of self-efficacy in shaping teachers' ability to engage students, implement effective IS, and manage classrooms efficiently. Notably, CM showed the highest contribution, suggesting that teachers with higher self-efficacy are particularly effective in maintaining a conducive learning environment. The study's final measurement model was further validated through fit indices, which demonstrated acceptable values: $CFI=0.894$, $RMSEA=0.141$, $PNFI=0.667$, and $PCFI=0.691$. While some indices, such as RMSEA, indicate a degree of improvement may be required, the overall results confirm that the proposed model is a good fit for the collected data.

A significant finding of this research is the confirmation of 12 teacher self-efficacy behaviors, with four behaviors assigned to each construct which are SE, IS, and CM. These results align with existing studies such as Tschannen-Moran *et al.* [12], which highlight that teachers with higher self-efficacy are more committed to achieving instructional goals, adapting innovative strategies, and maintaining resilience in challenging situations. Additionally, findings by Cansoy and Parlar [6] reinforce the idea that teachers with strong self-efficacy are more open to new methods and perform tasks effectively despite difficulties. However, this study provides a localized perspective by focusing on Malaysian teachers and their self-efficacy constructs, thereby addressing a critical research gap.

In comparison to previous studies, this research contributes significant empirical evidence through the use of second-order CFA and regression analysis. Unlike earlier works that primarily focused on theoretical models, this study emphasizes practical validation of teacher self-efficacy constructs and their direct impact on teaching competency dimensions. The findings underscore the importance of enhancing teachers' self-efficacy to improve classroom practices, as teachers serve as key drivers of student success and school excellence.

In conclusion, the results confirm that teacher self-efficacy plays a vital role in determining teaching performance, particularly in SE, IS, and CM. The study demonstrates that strengthening teachers' self-efficacy can lead to more effective teaching outcomes and improved student performance, aligning with Malaysia's educational excellence agenda. Future efforts should focus on creating targeted professional development programs that enhance teacher self-efficacy and ensure sustainable improvements in teaching quality.

4. DISCUSSION

These results strongly indicate that student participation, curriculum policies, and CM are not isolated factors, but rather interconnected elements that influence one another [20]. Teachers who have a high degree of self-efficacy are more likely to test themselves and have a high degree of endurance to undertake a new or challenging teaching task. This is because the ability of self-efficacy is closely related to a person's confidence in changing student perceptions, and the ability to teach is related to a teacher's ability to improve the academic achievement of his students [9], [10]. Ultimately, this research successfully established an effective three-dimensional and 12-dimensional measurement model for instructor self-efficacy, including SE, teaching approaches, and CM.

The findings of this study provide a comprehensive understanding of the influence of teacher self-efficacy on key teaching competencies, including SE, IS, and CM. The results demonstrate that teacher self-efficacy is not just a personal attribute but a critical determinant of teachers' ability to create meaningful, engaging, and well-managed learning environments [33]. This study successfully validated 12 key behaviors under the three dimensions, providing empirical evidence for the robustness of teacher self-efficacy constructs within the Malaysian educational context.

The significant contribution of teacher self-efficacy to SE highlights the role of teacher confidence in fostering active student participation and engagement. Teachers with high self-efficacy inspire students to take ownership of their learning, build motivation, and create positive classroom dynamics [2], [24]. This dimension is particularly critical in promoting student-centered learning environments that align with 21st-century educational goals.

The strong relationship between teacher self-efficacy and IS underscores the importance of teachers' confidence in planning and implementing effective teaching methods [34]. Teachers with high self-efficacy are more adaptable, innovative, and proactive in addressing the diverse needs of their students. They are willing to experiment with modern teaching techniques, adopt technological tools, and personalize their approaches to optimize student learning outcomes. This finding reinforces the idea that enhancing self-efficacy is key to promoting instructional excellence and improving overall teaching quality [35].

The study's most notable finding is the significant impact of teacher self-efficacy on CM, which emerged as the strongest predictor among the three dimensions. Effective CM is foundational to the success of teaching and learning processes, as it ensures minimal disruptions, fosters discipline, and maximizes instructional time [36]. Teachers with strong self-efficacy are more capable of establishing clear rules, addressing behavioral challenges confidently, and building respectful, supportive teacher-student relationships [32]. This finding aligns with earlier studies and highlights CM as a core competency that reflects a teacher's ability to maintain a conducive learning environment [37]. Furthermore, the study's validation of 12 teacher self-efficacy behaviors provides a structured framework for understanding and evaluating teachers' confidence across multiple domains. This comprehensive approach allows for targeted interventions aimed at strengthening teachers' self-efficacy, ensuring that they are well-prepared to address challenges in the classroom and achieve desired educational outcomes.

The implications of this study are far-reaching. School leaders and policymakers must recognize the pivotal role of teacher self-efficacy in driving instructional success and student achievement [38]. Professional development programs should prioritize strategies that enhance teachers' confidence, focusing on SE techniques, innovative instructional methods, and CM skills. Schools must also foster supportive environments that empower teachers to take risks, adopt new approaches, and develop resilience in the face of challenges [7], [39].

Moreover, the findings underscore the need for collaborative efforts between teachers, administrators, and policymakers to address barriers that impact self-efficacy, such as workload stress, lack of resources, and inadequate support systems. By enhancing teacher self-efficacy, schools can create a culture of continuous improvement, where teachers feel empowered to inspire, motivate, and positively influence their students' learning outcomes [40]. This study offers compelling empirical evidence that teacher self-efficacy significantly enhances teaching competencies, reaffirming its critical role in achieving educational excellence. By focusing on teacher self-efficacy, schools can ensure better instructional quality, more effective CM, and improved SE, ultimately contributing to the long-term success of the education system. Moving forward, education stakeholders must prioritize efforts to strengthen teacher self-efficacy as a key strategy for achieving national and global educational goals [41]. In addition, the results reveal the importance of incorporating sustainable leadership practices into institutional culture and decision-making processes to ensure long-term success and competitive advantage [42]. In addition, future research should explore the integration of artificial intelligence (AI) in education, as keeping current with the latest AI advancements may further enhance the quality of teaching and learning [43].

5. CONCLUSION

The results of this study highlight the importance of improving teachers' self-efficacy, as it can have a significant impact on the educational climate, particularly in Malaysia. In addition, increasing teachers' levels of self-efficacy is an important benchmark for overall teaching effectiveness, especially in CM, which ultimately influences students' achievement and performance. The findings provide empirical evidence that may inform policy development and professional training programs aimed at strengthening teachers' self-efficacy.

Previous studies suggest that teachers with low levels of self-efficacy may show less concern in addressing students' learning difficulties and may pay more attention to high-achieving students while overlooking those who require additional support. Therefore, strengthening teachers' self-efficacy is essential to ensure more effective and equitable teaching practices. Furthermore, the findings of this study are expected to guide future researchers in developing teacher self-efficacy models that are aligned with the educational environment in Malaysia.

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AUTHOR CONTRIBUTIONS STATEMENT

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C : **C**onceptualization

M : **M**ethodology

So : **S**oftware

Va : **V**alidation

Fo : **F**ormal analysis

I : **I**nvestigation

R : **R**esources

D : **D**ata Curation

O : **O** : Writing - **O**riginal Draft

E : **E** : Writing - Review & **E**ding

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

DATA AVAILABILITY

The data that support the findings of this study are available on request from the corresponding author, [MFMY].

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