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School innovation climate as a driver of teachers' innovative work behavior: the mediating role of self-efficacy

Safiek Mokhlis[1], Abdul Hakim Abdullah[2]
[1]Faculty of Business, Economics and Social Development, Universiti Malaysia Terengganu, Kuala Nerus, Malaysia
[2]Faculty of Islamic Contemporary Studies, Universiti Sultan Zainal Abidin, Kuala Nerus, Malaysia

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ABSTRACT

Teachers' innovative work behavior (IWB) is widely recognized as a driving force behind educational improvement in the complex and demanding conditions of the 21st century. Among a wide range of factors that could affect IWB, innovation climate (IC) has emerged as a crucial determinant. However, research exploring the mechanism that mediate the link between IC and IWB is still limited. Drawing upon social cognitive theory (SCT), the present study proposes that teachers' self-efficacy (SE) acts as a mediator in the relationship between IC and IWB. The study involved 376 teachers at 12 public schools in Kuala Terengganu, Malaysia, who were determined based on a stratified random sampling technique. Analysis of data was implemented through the use of structural equation modeling (SEM) with AMOS software to test causal relationships. Results confirmed that schools' IC was positively correlated with IWB and that this relationship was partially mediated by teachers' SE. These results align with SCT, which emphasizes the interaction between individual behavior, environment (IC), and personal factors (SE). To cultivate a culture of innovation and improve educational outcomes, school leaders should actively foster an IC that enhances teachers' SE, thereby promoting their IWB.

Corresponding Author:

Safiek Mokhlis
Faculty of Business, Economics and Social Development, Universiti Malaysia Terengganu
21030 Kuala Nerus, Terengganu, Malaysia
Email: safiek@umt.edu.my

1. INTRODUCTION

With the rapidly changing trends nowadays, innovation has become a cornerstone for organizations of all types, and schools are certainly no exception. Innovation becomes the driving force behind a culture of ongoing learning and improvement, equipping schools to proactively anticipate educational challenges and readily adapt to changes with agility [1]. Moreover, innovation has the potential to streamline operational efficiency, reduce costs, and position a school ahead of its educational peers. Embracing innovation is thus imperative for educational organizations to remain resilient, responsive, and capable of harnessing the potential of emerging technologies and evolving pedagogical demands, ultimately ensuring long-term success and a positive impact on students' learning experiences [2].

Teachers undeniably hold an important part in the success of innovation in schools, given their status as the largest unit in the education sector and the primary drivers of the educational system. In this regard, teachers' engagement in innovative work behavior (IWB), marked by their willingness to explore opportunities, generating, supporting, and implementing ideas, is seen as critical to driving transformative change in schools [3], [4]. Primarily, IWB acts as a catalyst for elevating the standard of teaching and learning. Innovative teachers are proactive in looking for original ways and unique solutions to satisfy the

demands of the constantly evolving educational landscape. Their willingness to embrace innovation fills classrooms with dynamic and engaging learning experiences, motivating students to develop as critical thinkers and lifelong learners [5]–[8]. Furthermore, innovative teachers actively cultivate a culture of shared learning, fostering increased collaboration as they collectively explore novel ideas and solutions, thus enhancing educational standards through continuous improvement [9].

However, cultivating IWB among teachers is fraught with obstacles that impede its achievement. Foremost among these obstacles is the longstanding dominance of traditional educational paradigms with emphasis on standardized testing and regulatory compliance over creativity and experimentation [10], [11]. This emphasis frequently discourages teachers to take risks or go beyond the established curricular boundaries. Additionally, serving as a formidable barrier is resistance to change, prevalent among both teachers and administrators, driven by concerns about potential failures or disruptions [12]. Studies on educational innovations have shown that many innovation initiatives fail because, over time, teachers often revert to their familiar routines, abandoning the newly introduced innovative practices [13], [14].

Complicating matters further are bureaucratic and conservative administrative structures, which hinder innovation by making the implementation of innovative ideas cumbersome [15]. Another major complication is limited time and financial resources, restricting opportunities for innovative initiatives such as investing in the latest technology, facilitating professional development, or embracing novel teaching methodologies [12], [16]. Furthermore, the absence of comprehensive training and support for teachers in innovation-related competencies undermines their ability to effectively incorporate innovative practices into pedagogy [17].

Considering these challenges, there has been growing interest within academic and professional communities to identify the key factors that impact teachers' IWB with the aim of developing the most appropriate intervention strategies. Research has extensively identified a variety of environmental factors associated with teachers' IWB [18], [19]. Among the factors, school innovation climate (IC) has been the focus of several studies. IC denotes teachers' collective perceptions regarding their school's ability to create a supportive environment, providing motivation and the resources needed for teachers to engage in IWB [20]. Studies indicate that a supportive environment for innovation can cultivate all key aspects of IWB [21], [22]. A positive organizational climate, which includes elements such as structure, standards, responsibility, rewards, support, and commitment, has been linked to enhanced teachers' IWB [23]. Research indicates that both supportive and challenging organizational climates [24], as well as the overall IC in schools [25], significantly enhance teachers' IWB. When management actively supports innovation by providing the necessary resources, guidance, consultation, delegation and recognition, teachers are more prone to demonstrate higher levels of IWB [26]–[28]. Conclusively, these outcomes highlight the vital role of IC in encouraging IWB among teachers, emphasizing the need for comprehensive strategies to cultivate a conducive environment for teacher innovation.

Although the relationship between schools' IC and IWB may appear straightforward, it is important to recognize that this relationship is intricate and can be significantly influenced by various personal factors. While IC may create conditions for innovation, either supportive or inhibitive, it is often personal factors that serve as the driving force for teachers to embrace and effectively implement innovative practices. One potential key factor in this relationship is teachers' self-efficacy (SE), which is defined as their confidence in their own ability to develop and execute the tasks required to reach their goals [29]. Extensive research has demonstrated the profound impact of teachers' SE on numerous aspects of their professional practice, including instructional quality [30], classroom management efficacy [31], teacher–student interactions [32], organizational citizenship behavior [33], and job satisfaction [34]. Moreover, studies have indicated that teachers' SE is essential for instilling confidence in their ability to engage in IWB such as implementing novel teaching strategies, experimenting with new technologies, and adapting instructional methods to meet diverse student needs [5], [35]–[39]. This sense of confidence not only motivates teachers to explore new ideas and practices but also strengthens their resilience in overcoming challenges associated with adopting innovative approaches [39].

Notwithstanding the extensive research on IC, SE, and IWB, a notable gap persists in the existing literature. Although many studies have reported the effects of IC on teachers' IWB or the impact of SE on their IWB, there is a lack of focused investigation into how teachers' SE might mediate the link between IC and IWB. This crucial aspect remains insufficiently addressed, despite SE being widely recognized as a key mediating variable in the context of organizational behavior and performance. Therefore, this study sought to investigate the mediating role of teachers' SE in the association between schools' IC and IWB. By shedding light on this mediating mechanism, the study seeks to enrich the current body of knowledge and offer school leaders and policymakers useful insights. These insights may offer guidance for the effective cultivation of an innovative culture within schools and the enhancement of teachers' confidence and commitment to innovative practices, ultimately fostering improved educational outcomes for students.

Figure 1 illustrates the study's conceptual framework, outlining the relationship between IC, teachers' SE, and IWB. Social cognitive theory (SCT) serves as the theoretical underpinning of this framework [40], which holds that human behavior is a dynamic product of the interaction between environmental, personal, and behavioral factors. This theory is mainly concerned with how SE, which is based on an individual's assessment of their ability to execute a certain action, affects the development of human behavior [41], [42]. Within this framework, IC serves as the environmental factor, influencing teachers' SE as a personal factor, which, in turn, impacts their engagement in IWB as a behavioral outcome. A positive IC in schools cultivates an environment that empowers teachers, fostering a greater belief in their capacity to successfully embrace and implement innovative practices. This increased SE leads to a greater willingness to engage in IWB. Based on this framework, three hypotheses have been developed:

- H1: IC has a positive direct effect on teachers' SE.
- H2: Teachers' SE has a positive direct effect on IWB.
- H3: The relationship between IC and IWB is mediated by teachers' SE.

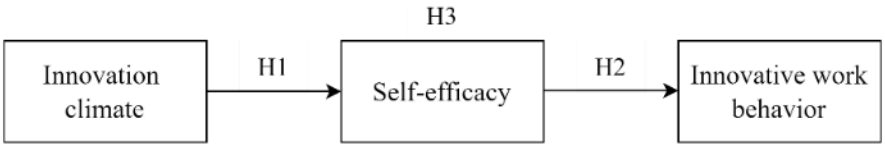

Figure 1. Conceptual framework

2. METHOD

A correlational research design was utilized in this study to explore the causal relationship between IC and IWB, while also examining the mediating role of SE. For data collection, a self-administered questionnaire, adapted from previous studies, was created, consisting of seven items on IC [20], six items on teachers' SE [43], and 20 items on IWB [4]. To assess responses, a 7-point Likert scale was utilized to, starting with 1 for "strongly disagree" and ending with 7 for "strongly agree." Demographics variables questioned include the respondents' gender, age, educational background, and years of service. Following pre-testing with nine experts to establish content validity, the instrument was piloted with 58 teachers from two public schools to assess the instrument's reliability, identify potential issues, and collect feedback for refinement. Several modifications were made to improve the clarity and relevance of the instrument.

The study's population includes permanent teachers currently teaching in public schools in Kuala Terengganu, Malaysia. Sample size was determined using a formula [44], and it was established that for a population of 4,199 teachers, a sample size of 352 would be adequate. However, to account for potential non-responses and unusable data, the sample size was enlarged to 500. A total of 12 schools were selected from a comprehensive list of public schools using a stratified random sampling approach. The schools were first categorized into two strata: primary and secondary. The proportionate technique was employed in determining how many schools would be sampled. In the second stage, the specific schools within each stratum were selected using simple random sampling. Finally, within each selected school, a proportionate technique was used to determine how many teachers would make up the sample.

Consent was first secured before the survey was conducted, specifically from the Educational Planning Research Division (EPRD), the State Education Department, and the head teachers at selected the selected schools. Drop-off and pick-up (DOPU) were the technique applied in the survey to mitigate potential non-response bias through increased response rate [45]. In this approach, a visit was made to each selected school to personally deliver the questionnaire to a designated teacher, typically appointed by the head teacher to facilitate survey administration. Subsequently, completed questionnaires were collected after a specified period. Out of the 500 questionnaires delivered, 465 were returned, and 376 were deemed usable.

The collected data were first entered into SPSS for initial data processing and descriptive analysis. Following this, structural equation modeling (SEM) was performed using AMOS version 24 software for advanced statistical analysis and model testing. The selection of the SEM approach was based on its capability to simultaneously test an entire model comprising multiple distinct hypothetical relationships. SEM also accommodates measurement error, integrates confirmatory factor analysis (CFA), and provides robust statistical methods to evaluate model fit, rendering it particularly suitable tool for investigating causal relationships and the mediating effect for the present study [46]. SEM was implemented in two stages. First, a measurement model was assessed to see how well the observed variables represent the underlying latent constructs. Secondly, a structural model was examined to evaluate the direct and indirect effects between constructs and whether the model fits the data and supports the proposed relationships.

3. RESULTS AND DISCUSSION

3.1. Demographic profile

The survey participants comprised 218 primary (58%) and 158 secondary (42%) school teachers. They were predominantly female (80.1%) and completed at least a bachelor's degree (84%). Respondents aged 41 to 50 made up the largest group (50%). Respondents with a service of over 21 years made up 50.8% of the sample, while those who had served for a period of between 11 and 20 years made up 41.5%. The percentage of respondents with below 10 years of service was 7.7%. Overall, the sample was notable due to its predominance of female teachers, high degree of experience, large concentration of mid-career teachers.

3.2. Measurement model

The initial stage in SEM approach involves the validation of the measurement model. To accomplish this, a pooled CFA using maximum-likelihood (ML) estimation was conducted to simultaneously assess the validity of all constructs [46]. Four commonly used fit indices, namely χ^2/df (<0.50), Tucker-Lewis's index (TLI>0.90), comparative fit index (CFI>0.90) and root mean square error of approximation (RMSEA<0.08), were used to determine the overall model fit [46]. The initial model failed to meet three of these criteria, with the following fit indices: χ^2/df=3.626, TLI=0.866, CFI=0.876, and RMSEA=0.084. To improve the model fit, observed variables with factor loadings below 0.50 and items with modification indices greater than 15 were removed [46]. As a result, 12 items were eliminated from the model. While this reduction might initially seem to compromise the breadth of the constructs, it was a necessary step to refine the model, enhancing the focus, relevance, and conceptual clarity of the measures. The remaining items retained the core dimensions of the constructs, ensuring that the scales remain valid and reliable representations of the underlying theoretical concepts. In fact, these adjustments resulted in improved fit indices: χ^2/df=2.724, TLI=0.936, CFI=0.945, and RMSEA=0.068.

Convergent validity was assessed to determine whether indicators purposed to measure the same construct are strongly correlated and effectively capture the underlying concept [46]. This was established by analyzing the item loading on their respective constructs. As displayed in Table 1, the standardized factor loading estimates for all items ranged from 0.71 to 0.94 and thus exceeded the 0.50 cut-off value. Furthermore, the values of construct's composite reliability (CR) and average variance extracted (AVE) appeared to be higher than the cut-off points of 0.70 and 0.50, respectively [46].

After establishing the convergent validity, the √AVE and the correlation between constructs were compared to assess the discriminant validity [46], [47]. Table 2 shows that all the √AVEs exceeded the correlation coefficients between the constructs, demonstrating that the construct's correlation with its own item was stronger than that with the other constructs' items. Furthermore, the correlations between constructs were not greater than 0.85 [48], further confirming that the constructs within the full model exhibited discriminant validity.

Table 1. Factor loading, CR, and AVE

First order	Second order	Item	Loading	CR	AVE
Opportunity exploration (OE)		OE3	0.745	0.831	0.621
		OE4	0.813		
		OE5	0.805		
Idea generation (IG)		IG1	0.710	0.848	0.653
		IG3	0.853		
		IG4	0.852		
Idea promotion (IP)		IP3	0.841	0.923	0.800
		IP4	0.943		
		IP5	0.897		
Idea realization (IR)		IR1	0.823	0.869	0.689
		IR2	0.862		
		IR3	0.804		
	IWB	OE	0.841	0.890	0.670
		IG	0.878		
		IP	0.740		
		IR	0.809		
IC		IC4	0.834	0.905	0.704
		IC5	0.763		
		IC6	0.913		
		IC7	0.839		
SE		SE2	0.791	0.894	0.631
		SE3	0.630		
		SE4	0.862		
		SE5	0.833		
		SE6	0.835		

Table 2. Discriminant validity

Item	IWB	IC	SE
IWB	0.819*		
IC	0.754	0.839*	
SE	0.671	0.644	0.794*

*exceeded the correlation coefficients between the constructs

Achieving univariate and multivariate normality of the data is essential for conducting SEM analysis [48]. To evaluate univariate normality, each variable's skewness and kurtosis values were examined. Skewness values were between -0.549 and 0.032, and kurtosis values were between -0.424 and 1.037. These results indicated a normal distribution, as all values fell within the acceptable ranges of ± 2 for skewness and ± 7 for kurtosis [48]. Mardia's coefficient, which measures multivariate normality, is supposed to be lower than p (p+2), where p represents the number of observed variables [49]. The model for the current study contained 21 observed variables; therefore, the threshold value was 483. With the obtained Mardia's coefficient of 165.26, we were able to confirm that multivariate normality was achieved.

3.3. Structural model

Once the measurement model's reliability and validity were verified, proposed hypotheses were tested with SEM using ML estimation. Three models were tested: i) the full model; ii) the indirect model (IC→IWB=0, constraining coefficient of the path from IC to IWB as zero); and iii) the direct model (IC→SE=0, SE→IWB=0, constraining coefficients of the path from IC to SE and that from SE to IWB as zero). The SEM fit indices for three competing models were deemed satisfactory, as illustrated in Table 3. These results signified the presence of a statistically significant model capable of describing the relationships among the variables that predicted IWB.

Table 3. Fit indices for full, indirect and direct models

Indices	χ^2/df	TLI	CFI	RMSEA
Level of acceptance	<5.0	>0.90	>0.90	<0.08
Full	2.724	0.936	0.945	0.068
Indirect	2.858	0.931	0.940	0.070
Direct	4.089	0.886	0.900	0.091

A summary of the results is presented in Table 4. As hypothesized, IC was positively related to SE (β=0.644, p<0.001), lending support to H1. Teachers who held a strong perception of IC had a higher likelihood to possess greater levels of SE. Furthermore, a positive and significant relationship between SE and IWB (β=0.549, p<0.001) suggests that the teachers who highly perceived their SE were more likely to engage in IWB. Thus, H2 was also supported. In examining the influence of both IC and SE on IWB, it became evident that SE had a more substantial impact. The beta value for the direct effect of SE on IWB (β=0.549) was notably higher compared to the beta value for the direct effect of IC on IWB (β=0.317). This suggests that SE was a more influential factor in predicting IWB than the IC itself. Therefore, while both IC and SE contributed to IWB, SE played a more critical and direct role in driving teachers' engagement in innovative practices. This finding emphasizes the importance of promoting SE among teachers to enhance their IWB.

H3 proposed that teachers' SE plays a mediating role in the relationship between IC and IWB. Mediation is demonstrated when there is an alteration in the direct relationship between an exogenous variable (IC) and an endogenous variable IWB after a mediator variable is introduced. Specifically, mediation is indicated by a diminution in the direct path coefficient from the exogenous variable (IC) to the endogenous variable IWB after accounting for the mediator (SE) in the model [46]. As shown in Table 4, the relationship between IC and IWB in the direct model was statistically significant (β=0.671, p<0.001). However, in the full model, while this path remained significant, there was a notable diminution in the regression weight for the relationship between IC and IWB (β=0.317, p<0.001). This diminution in the direct effect indicated that part of the relationship between IC and IWB was explained through SE. The partial mediation effect suggested that while IC directly influenced IWB, a significant portion of this effect was channeled through SE. In other words, IC impacted IWB not only directly but also indirectly by enhancing teachers' SE, which in turn promoted their IWB. This supported H3, providing empirical evidence that the effect of IC on IWB was partially mediated by SE.

Table 4. Path coefficients

Path	Full	Indirect	Direct
IC->SE	0.644 ***	0.666 ***	
SE->IWB	0.549 ***	0.770 ***	
IC->IWB	0.317 ***		0.671 ***

*** p<0.001

3.4. Discussion

The analysis confirmed all three hypotheses proposed. IC directly influences teachers' IWB and indirectly through SE as a mediator highlights the dual role of both environmental and personal factors in fostering IWB among teachers. A supportive IC appears to not only encourage teachers to engage in IWB but also strengthens their belief in their own abilities to do so. This enhanced SE, in turn, further motivates them to take initiative, experiment with new ideas, and persist in the face of challenges. The mediating role of SE suggests that while external support is crucial, internal confidence plays a significant part in translating a positive climate into actual innovative actions.

From a theoretical standpoint, the study's findings support the fundamental ideas of SCT that emphasize the concept of reciprocal determinism, which refers to the dynamic interaction between an individual's behavior, environment, and personal factors [40]. The finding that schools' IC predicted teachers' SE illuminates the influential role of external factors in shaping an individual's self-belief, a core element of SE theory. Furthermore, the fact that teachers' SE mediated the relationship between the IC and IWB aligns with the theory's emphasis on SE as a cognitive mechanism through which individuals interpret and act upon their surroundings. This implies that teachers' perceptions of their SE play a crucial role in translating the innovation-supportive environment into actual innovative work practices.

The study's results have significant implications for school leaders as well as educational policymakers. Firstly, school leaders should focus on creating a positive IC by fostering a supportive and inclusive culture that encourages creativity, risk-taking, and collaboration among teachers and staff. By providing opportunities for professional growth, training, and resources, school leaders can enhance IC, which, in turn, can positively influence teachers' SE beliefs and their willingness to engage in innovative practices. One effective approach is to implement regular brainstorming sessions where teachers are encouraged to share and develop new ideas without fear of criticism. Such an environment can be further supported by adopting a "fail-forward" mindset, which views mistakes as valuable learning opportunities rather than impediments. Schools could also introduce initiatives such as a grant program that provides financial support for innovative projects, thereby reducing the risks associated with trying new methods.

Another key component in fostering a positive IC is collaboration. Here, schools could establish interdisciplinary teaching teams, where teachers from various subjects collaborate to design and execute cross-curricular projects. This approach not only stimulates creativity but also allows teachers to learn from each other's expertise. Moreover, investing in professional growth opportunities is crucial. For example, organizing regular seminars and workshops focused on emerging educational technologies and pedagogical strategies can help teachers stay current and feel more confident in implementing new practices. Partnering with universities or educational organizations for these development opportunities can further enhance the support provided to teachers.

For educational policymakers, it is essential to prioritize the development of programmers and policies that support teachers' SE. Recognizing the role of SE in driving IWB, policymakers should ensure that teachers have access to professional development programmers that enhance their confidence in adopting and implementing innovative teaching methods. For example, putting in place coaching and mentorship programmers, in which experienced teachers offer support and guidance to their less experienced colleagues, can significantly enhance teachers' SE. These programs provide practical strategies and moral support, helping newer teachers gain confidence in their abilities.

Another effective policy tool is recognition and reward systems. Establishing programmers that celebrate and reward teachers for successfully implementing innovative practices can enhance motivation and SE. For example, public acknowledgment of these achievements and tangible rewards can further encourage teachers to embrace new approaches. Additionally, supportive policies that grant teachers adequate planning time and resources for exploring and integrating new methods are crucial. Policies that provide dedicated time during the school day for collaborative planning and sharing of innovative practices can help create a more dynamic and responsive educational environment. By focusing on these strategies, school leaders and policymakers can significantly impact teaching and learning effectiveness in schools.

4. CONCLUSION

This study examined the mediating role of teachers' SE on the relationship between IC and IWB. The results revealed a significant effect of IC on teachers' SE, as well as the effect of teachers' SE on their IWB. Additionally, the partial mediating role of SE was also confirmed by study's results. This study contributes to the literature in terms of comprehending the mechanism of how SE plays a role in the relationship between IC and IWB. Practically, these results indicate that school leaders and policymakers should foster an environment that supports innovation and invest in programs designed to enhance teachers' confidence and skills. Such initiatives can improve educational outcomes and better prepare students for future challenges. By prioritizing the development of a supportive and innovative culture, educational leaders can encourage IWB among teachers, leading to more effective teaching practices. Future research is warranted to explore additional factors that determine teachers' IWB, as well as mediating and moderating variables that may affect this process.

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AUTHOR CONTRIBUTIONS STATEMENT

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Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Safiek Mokhlis	✓	✓	✓		✓	✓		✓	✓	✓	✓		✓	✓
Abdul Hakim Abdullah	✓	✓		✓			✓			✓		✓		

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

INFORMED CONSENT

Informed consent was obtained from all subjects involved in the study.

DATA AVAILABILITY

The data that support the findings of this study are available on request from the corresponding author, [SM]. The data, which contains information that could compromise the privacy of research participants, is not publicly available due to certain restrictions.

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BIOGRAPHIES OF AUTHORS

Safiek Mokhlis is an associate professor attached to the Faculty of Business, Economics and Social Development, Universiti Malaysia Terengganu. He has over 18 years of teaching experience at both the undergraduate and postgraduate levels. His research interests include education management and educational psychology. He is currently pursuing an EdD at Open University Malaysia. He can be contacted at email: safiek@umt.edu.my.

Abdul Hakim Abdullah is a professor in the Faculty of Islamic Contemporary Studies, Universiti Sultan Zainal Abidin, Malaysia. He obtained his PhD in 2004 and actively involved in teaching, postgraduate supervision, research and publication particularly in the field of education. His research interests are curriculum development, teaching innovation, and teachers' competency. He can be contacted at email: hakimabd@unisza.edu.my.