Journal of Education and Learning (EduLearn)
Vol. 19, No. 3, August 2025, pp. 1541~1552
ISSN: 2089-9823 DOI: 10.11591/edulearn.v19i3.21800

Identifying crucial indicators for successful homework completion: importance-performance analysis

Madina Abdul Rahman, Ahmad Zamri Khairani
School of Educational Studies, Universiti Sains Malaysia, Penang, Malaysia

Article Info

Article history:

Received Jan 28, 2024
Revised Aug 8, 2024
Accepted Aug 28, 2024

Keywords:

Expectancy
Homework effort
Homework management
Partial least squares modeling
Value

ABSTRACT

Successful homework completion necessitates engagement in self-regulated learning activities. The key challenge lies in fostering self-confidence among students to enable them to complete homework independently. Applying the importance-performance theory, the study uses a unique statistical tool to assess homework completion for practical recommendations. The objective is to offer practical recommendations benefiting students, parents, teachers, schools, and the Ministry of Education, aimed at enhancing homework completion due to its established benefits. Surveys encompassed 970 high school students in Penang's northern state. Data underwent analysis via SmartPLS software, utilizing its importance performance functionality. Outcomes highlight the significance and performance of expectancy, value, homework management, homework effort constructs, and their indicator variables. These aspects were assessed within the importance-performance map analysis (IPMA). The homework effort construct notably exhibited the most pronounced influence on homework completion. Encouragingly, students are advised against copying mathematics homework and instead encouraged to complete it autonomously. Both homework effort and value constructs received a "keep up" endorsement, while homework management and expectancy constructs garnered an "education" recommendation. This approach yields a user-friendly visual tool to evaluate homework aspects. It effectively steers stakeholders in pinpointing pivotal areas for augmenting homework completion.

Corresponding Author:

Ahmad Zamri Khairani
School of Educational Studies, Universiti Sains Malaysia
11800 Gelugor, Penang, Malaysia
Email: ahmadzamri@usm.my

1. INTRODUCTION

Homework reinforces students' acquired skills and knowledge [1]. Homework is an instructional instrument employed by educators to involve students in learning beyond the confines of the classroom, encompassing active participation from various educational stakeholders, including teachers, students, and parents [2]. According to Trautwein *et al.* [3], homework takes up a sizeable percentage of students' time working on their core topics. Homework is significant because it fosters fundamental abilities, including self-discipline, time management, resource management, and enhanced communication [4]–[6]. These abilities are considered essential life skills that allow kids to take advantage of unique opportunities and succeed in their careers. Therefore, it is expected that much research has been conducted in the past regarding homework. For instance, homework has been found to foster students' capacity for self-regulation [7], deepen and enhance newly learned material [8], [9] and help promote students' capacity to assume ownership of their learning [10], [11]. Completing

homework can help develop study habits that facilitate learning and improve academic achievement [12], [13]. More importantly, the construct has also positively affected students' achievement [14], [15].

There are, however, also some noted homework pitfalls. For instance, disputes over whether, when, and how to complete homework cause students and parents to rue wasted time and tense situations at home [16], [17]. Students who are overly focused on schoolwork also develop poor social skills and have less time for other interests [18], [19]. When students have much work to finish in a limited amount of time, they need help to complete the assignments. Students can, therefore, copy from one another. Finally, students occasionally have to complete homework that contains irrelevant material.

Researchers have become aware of these issues. One of the most common issues with self-regulated learning is the incapacity to maintain a high motivation for learning [16], [20]. Therefore, numerous recommendations are offered for dealing with problems in completing homework which involve self-regulated learning. For instance, Preu *et al.* [21] and Yang and Mindrila [22] recommend that teachers and parents should instill in pupils a positive expectancy and value of completing their homework assignments. The expectancy-value theory provides a comprehensive framework for studying achievement motivation. It proposes that motivation is made up of two major components, which are expectancy and value [23]. Motivation is a highly relevant component in the homework process, particularly in students' homework behavioral engagement [24]. One strategy to solve the leaky pipeline towards self-regulated learning and homework completion is to support students' expectancy and value beliefs [25], [26]. The effectiveness of expectancy and value in solving the issue of homework completion is supported by past research, including Dettmers *et al.* [27], Velayutham and Aldridge [28], as well as Yang and Xu [29].

As shown by the studies of Xu *et al.* [30] and Yang and Tu [4], self-regulated aspects such as homework management were also crucial determinants for a positive attitude toward homework completion. Homework management is how students can manage homework from the dimensions of arranging the environment, managing time, handling distractions, monitoring motivation, and controlling emotions [31]. Xu and Corno [32] found a significant and positive relationship between expectancy and value belief in homework management. The key findings of the literature review revealed a positive and significant relationship between the notions of homework management and homework completion in research that looks at this relationship [33]. The study adopted a variable-centered approach, revealing that the employment of homework management strategies is favorably connected with the critical outcomes of homework effort, homework completion, and achievement [34].

Scholars like Xu and Nunez [33] contend that significant effort is crucial for finishing schoolwork. According to Alderman [35], in order to help students, learn more effectively and cope with the many distractions they encounter both within and outside of the classroom, effort regulation is crucial. Students who view their homework tasks as dull are more likely to become distracted, which may trigger a more negative emotional response. Previous research has examined the relationship between expectancy, value, homework management, and homework effort with homework completion and discovered that all relationships are significant. Among the studies carried out is a study by Velayutham and Aldridge [28] on 1360 respondents who found a significant relationship between expectancy and effort. Guo *et al.* [36] conducted a study on high school students in Germany to investigate values (intrinsic value, achievement value, utility value, and cost value) and effort. Besides that, homework effort positively correlated with homework management and homework completion [37].

Since substantial arguments are related to factors that attract and repel homework completion, researchers need to know more about it by looking at importance-performance map analysis (IPMA). The objective is to identify predecessors that perform relatively poorly (low average latent variable (LV) scores) but also have a relatively high importance for the target construct (strong total effect) [38]. The research's specific objectives are to establish a conceptual model of expectancy, value, homework management, homework effort, and homework completion; assess the model's validity using various PLS-SEM modeling-appropriate validity checks; eliminate any insignificant relationships from the model (if any); and focus on constructs that significantly affect the performance of homework completion.

The critical constructs in the conceptual model are expectancy, value, homework management, homework effort, and homework completion. Value consists of four dimensions: intrinsic value, achievement value, utility value, and cost value [39]. In comparison, homework management is conceptualized into five dimensions: arranging the environment, managing time, handling distractions, monitoring motivation, and controlling emotion [40]. For the importance-performance analysis using partial least squares structural equation modelling, a conceptual model needs to be developed (Figure 1). The conceptual model, as depicted in Figure 1, is composed of five primary constructs: expectancy, value, homework management, homework effort, and homework completion. These constructs have been discerned from the volitional control framework, encompassing motivational and volitional control elements. They are anticipated to offer a comprehensive and detailed elucidation of the learning process related to self-regulation in completing homework.

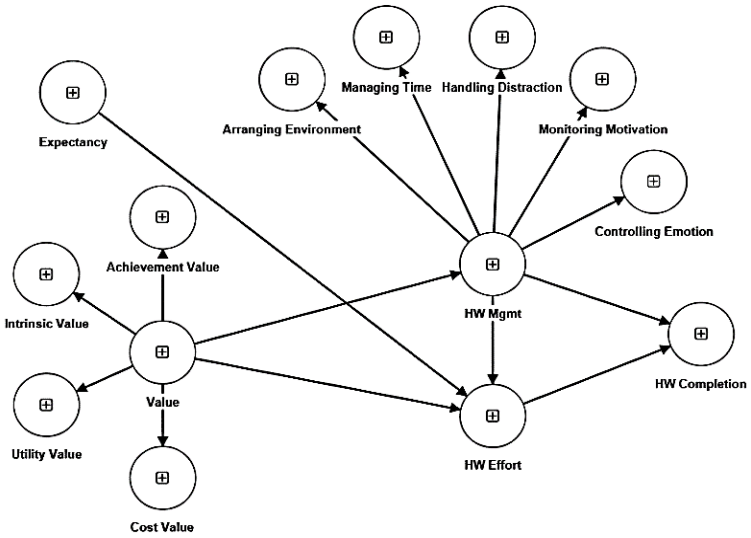

Figure 1. Conceptual model for importance-performance analysis

2. METHOD

2.1. Research design and sample

Employing a quantitative research method through a survey approach, this study utilized the instrument as a data collection technique. This study involved 970 high school students (average age=16 years) who voluntarily participated in the survey. The students came from 20 schools in Penang, Malaysia's northernmost state.

Sample selection was carried out in two stages using a stratified random sampling technique. The first stage involves the selection of schools by zone, and the second stage involves selecting students based on class. Table 1 shows the number of students who participated in this study, with 482 from the science stream accounting for 49.7% of the total and 488 from the arts stream accounting for 50.3%. Most of the students in the sample are female, with 583 (60.1%) against 387 (39.9%) male students. Malay respondents were the most numerous, with 735 people representing up to 75.8% of the total, followed by Chinese respondents, with 155 people representing up to 16.0%. Following that, Indian respondents reported the third highest number of 73 people, or up to 7.5%, and respondents from other ethnicity groups reported up to 7, or 0.7%. Table 1 contains more information on the sample.

Table 1. Sample of study

Demographic characteristics		Number of students (N=970)	Percentage (%)
Gender	Male	387	39.9%
	Female	583	60.1%
Ethnicity	Malay	735	75.8%
	Chinese	155	16.0%
	Indians	73	7.5%
	Others	7	0.7%
Stream	Science	482	49.7%
	Arts	488	50.3%

2.2. Measurement/instrument

A structured questionnaire was employed to collect data about the important components of homework, including expectancy, value (intrinsic value, achievement value, utility value, and cost value), homework management (arranging environment, managing time, handling distraction, monitoring motivation, and controlling emotion), homework effort and homework completion. Homework completion is the dependent construct. Table 2 furnishes the scales employed in this research.

The topic of scale adaptation in organizational science research has been brought up recently, with a focus on the potential validity issues that scale adaptation may cause. The overall objective is that the observed scores fairly reflect the respondents' perceptions of the concept, as research must use measures that have been well-constructed and validated [41]. In the case of this research, several adaptations to the instrument were made after receiving permission from the original authors. We employed a forward translation strategy with a panel of specialists, including a psychometric lecturer, a psychology lecturer, and language experts, to translate

the instrument into Malaysian. In this step, we compared the expert translations and agreed on the final shape of the translation. Among them is confirmation of the clarity of meaning and appropriateness of item statements. Typical partial least squares modelling validity checks, such as convergent validity, discriminant validity, and internal consistency, were then completed.

Table 2. Scale used in this study

No.	Scale	No. of item	Sample	Response category	Author
1	Expectancy	10	If I don't understand something in mathematics, I'm at a complete loss and don't know how to catch up.	1 (strongly disagree) to 4 (strongly agree)	Trautwein *et al.* [3]
2	Value	28		1 (strongly disagree) to 4 (strongly agree)	
	Intrinsic value	4	Doing mathematics homework is my favorite activity.		Gaspard [40]; Trautwein *et al.* [42]
	Achievement value	6	Doing mathematics homework helped me master mathematic subjects well.		Eccles [43]; Gaspard [40]; Trautwein *et al.* [42]
	Utility value	9	Doing mathematics homework helped me apply the skills learned.		Xu [44]
	Cost value	9	Doing mathematics homework makes me feel tired.		Gaspard [40]; Guo [36]
3	Homework Management	21		1 (never), 2 (rarely), 3 (sometimes), 4 (often) to 5 (routinely)	Xu [44]
	Arranging environment	4	Before working on my homework, I find a quiet area.		
	Time management	4	Before doing my homework, I set priority and plan ahead.		
	Handling distraction	5	While doing my homework, I chat about unrelated things with my friends.		
	Monitoring motivation	4	While working on my homework, I try to find ways to make my homework more interesting.		
	Controlling emotion	4	While doing my homework, I tell myself to calm down.		
4	Homework Effort	5	I always try to finish my mathematics homework.	1 (strongly disagree) to 4 (strongly agree)	Trautwein *et al.* [3]
5	Homework Completion	5	I always make sure mathematics homework is completed, even if it is difficult.	1 (strongly disagree) to 4 (strongly agree)	Cooper *et al.* [45]; Horn and West [46]
	Total	69			

2.3. Data analysis

Variance-based partial least squares structural equation modelling (PLS-SEM) was utilized to assess the composite model with SmartPLS software (version 4.0.9.5) [41]. When composite constructs are used in the structural (inner) model and prediction is the goal of the research, PLS-SEM has been recommended for use. The goal of PLS-SEM is to maximize the explained variance of the dependent variables, or endogenous latent construct [47]. Structural equation models consist of two sub-models: the measurement model, which specifies the relationships between constructs and their indicators, and the structural model, which contains the relationships between constructs [48].

3. RESULTS AND DISCUSSION

3.1. Evaluation of measurement model

Table 3 displays the factor loading values for each item and the composite reliability (CR), Cronbach alpha, and average variance extracted (AVE) values for the constructs and dimensions in the measurement model. The factor loading values ranged from 0.497 to 0.893. The factor loading value of 0.497 for item HE5 is still acceptable because it is more than the value of 0.4. The overall findings show that good reliability and convergent validity have been successfully achieved at the evaluation stage of the measurement model. This can be proven through Table 3, which shows that each construct and dimension has successfully met the criteria of CR and AVE as suggested by Hair *et al.* [48]. The CR value exceeded 0.8 except for the dimension of arranging environment, which had a value of 0.797 [49]. Cronbach's alpha values were greater than 0.7, except for the dimension of arranging environment, which has a value of Cronbach's alpha of 0.662. However, this value is still acceptable based on the recommendation of Bagozzi and Yi [50], and Nunnally and Bernstein [51]. The AVE values were

above 0.5, except for the dimension of arranging environment and homework effort, which has an AVE value of 0.498. The AVE value is in the deciding range of 0.5 and above, as stated by Hair *et al.* [48]. The value of 0.498 is still acceptable because it is only marginally less than the desired value of 0.5.

Table 3. Factor loading value, CR, Cronbach's alpha, and AVE

Construct and dimension	Indicator	Factor loading	CR	Cronbach alpha	AVE
Expectancy	E1	0.719	0.866	0.807	0.565
	E2	0.780			
	E3	0.805			
	E4	0.734			
	E5	0.715			
Value:					
Intrinsic value	IV1	0.882	0.892	0.837	0.675
	IV2	0.856			
	IV3	0.835			
	IV4	0.702			
Achievement value	AV1	0.756	0.876	0.830	0.542
	AV2	0.772			
	AV3	0.764			
	AV4	0.759			
	AV5	0.725			
	AV6	0.632			
Utility value	UV1	0.730	0.900	0.875	0.501
	UV2	0.734			
	UV3	0.719			
	UV4	0.671			
	UV5	0.716			
	UV6	0.671			
	UV7	0.748			
	UV8	0.738			
	UV9	0.636			
Cost value	CV1	0.760	0.900	0.876	0.501
	CV2	0.773			
	CV3	0.710			
	CV4	0.713			
	CV5	0.713			
	CV6	0.681			
	CV7	0.663			
	CV8	0.711			
	CV9	0.636			
Homework management:					
Arranging environment	AE1	0.663	0.797	0.662	0.498
	AE2	0.593			
	AE3	0.756			
	AE4	0.792			
Managing time	MT1	0.679	0.834	0.733	0.557
	MT2	0.763			
	MT3	0.785			
	MT4	0.753			
Handling distraction	HD1	0.782	0.872	0.828	0.585
	HD2	0.893			
	HD3	0.893			
	HD4	0.571			
	HD5	0.625			
Monitoring motivation	MM1	0.643	0.861	0.783	0.612
	MM2	0.854			
	MM3	0.851			
	MM4	0.761			
Controlling emotion	CE1	0.700	0.856	0.776	0.599
	CE2	0.808			
	CE3	0.813			
	CE4	0.770			
Homework effort	HE1	0.774	0.828	0.735	0.498
	HE2	0.815			
	HE3	0.777			
	HE4	0.614			
	HE5	0.497			
Homework completion	HC1	0.794	0.839	0.762	0.514
	HC2	0.791			
	HC3	0.735			
	HC4	0.627			
	HC5	0.616			

The degree to which one LV differs from other conceptions in the model is referred to as discriminant validity [52]. The heterotrait-monotrait (HTMT) ratio has recently been shown to be a better criterion for proving discriminant validity than more conventional assessment techniques as the Fornell-Larcker criterion. Table 4 shows discriminant validity for each construct and dimension involved in this study. Based on the results, it was found that all constructs and dimensions in this study have HTMT values that are within the allowed range, which is less than the value of 0.9, as suggested by Gold [53]. The establishment of discriminant validity has been confirmed as all $HTMT_{0.90}$ criterion findings fall below the critical value of 0.9. This finding indicates that respondents recognize the distinctions between the five components explored in this study. This demonstrates that discriminant validity exists and can be demonstrated for the constructs assessed in this study. Thus, both convergent and discriminant validity were established in this study.

Table 4. Discriminant validity based on HTMT criteria

Code	1	2	3	4	5	6	7	8	9	10	11	12
1. AV												
2. AE	0.437											
3. CE	0.497	0.514										
4. CV	0.365	0.192	0.244									
5. E	0.452	0.179	0.181	0.502								
6. HC	0.537	0.332	0.390	0.437	0.645							
7. HE	0.674	0.429	0.511	0.512	0.641	0.889						
8. HD	0.276	0.153	0.125	0.485	0.507	0.467	0.545					
9. IV	0.750	0.310	0.393	0.488	0.659	0.599	0.702	0.394				
10. MT	0.527	0.637	0.682	0.242	0.190	0.465	0.577	0.201	0.399			
11. MM	0.495	0.513	0.790	0.172	0.169	0.291	0.462	0.168	0.368	0.659		
12. UV	0.752	0.472	0.460	0.352	0.280	0.446	0.570	0.227	0.512	0.579	0.471	

3.2. Evaluation of structural model

After the outer model was assessed, the structural model was assessed. The findings of the partial least squares (PLS) analysis are shown in Figure 2, where the structural model is evaluated using path coefficient (β), coefficient of determination (R^2), and t-value. Hypothesis testing is backed up to a 5% significance level with a critical t-value for one-tailed tests of 1.65 [48]. The structural model has three target constructs: homework management, homework effort, and homework completion. The R^2 values for predictive relevance were 0.348, 0.488, and 0.454, respectively. In other words, the construct of value explains 34.8% of the variance in homework management, while expectancy and value explain 48.8% of the variance in homework effort. Other than that, homework management and effort explain a 45.4% variance in homework completion.

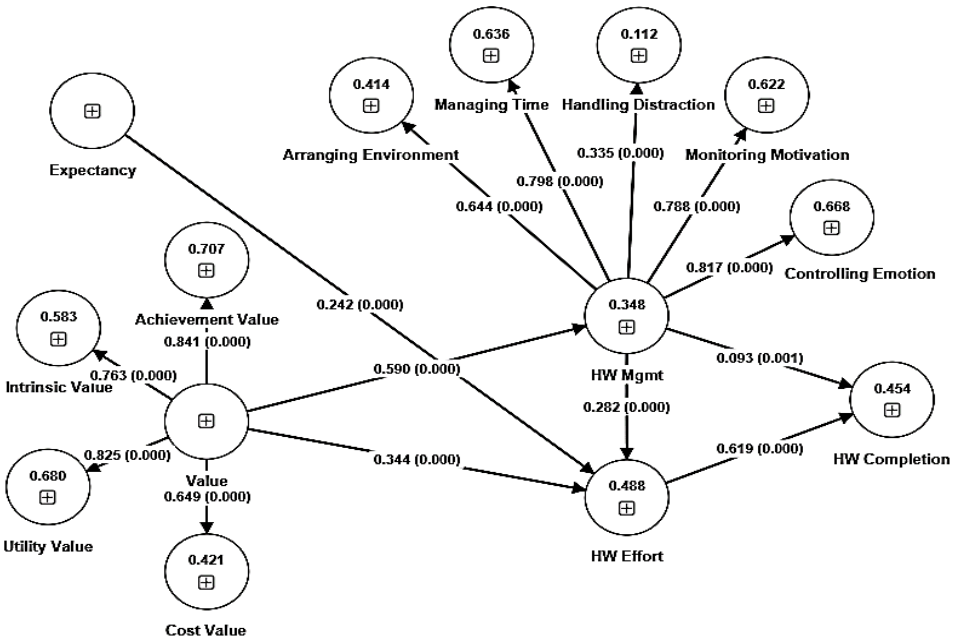

Figure 2. Results of the PLS analysis

It has been proposed that Stone-Geisser Q^2 values be used as an addition to the R^2 predictive relevance value assessment for predictive quality [54]. For the homework management, homework effort, and homework completion constructs, the blindfolding process in PLS yielded Q^2 values of 0.345, 0.432, and 0.322, respectively. These values are more than the recommended threshold value of 0, showing predictive relevance.

All path standardized coefficients are significant ($p<0.05$). Homework effort→ homework completion has the highest path coefficient (β=0.619) followed by value→homework management (β=0.590). Other than that, it was found that the relationship between expectancy→homework effort (β=0.242, $p<0.05$), value→homework effort (β=0.344, $p<0.05$), homework management→homework effort (β=0.282, $p<0.05$), and homework management→homework completion (β = 0.093, $p<0.05$) are also significant. About the value dimensions, the achievement value had the highest path coefficient (β=0.841), followed by utility value (β=0.825), intrinsic value (β=0.763), and cost value (β=0.649). The controlling emotion had the highest path coefficient (β=0.817) among the homework management dimensions, followed by managing time (β=0.798), monitoring motivation (β=0.788), arranging environment (β=0.644), and handling distraction (β=0.335). The results show that all the path standardized coefficients that predict the endogenous constructs of homework completion are significant t ($p<0.05$).

3.3. Important-performance analysis

The importance-performance theory, which uses the construct of homework completion to quantify the importance and performance of expectancy, value, homework management, and homework effort, serves as the main theoretical framework for this study. The results are usually displayed as a two-dimensional grid (Figures 3 and 4). Homework completion is the target construct for the IPMA analysis in this research. On a scale of 0 to 100, homework effort scores 66.03, indicating significant room for improvement. First, it is critical to know which items have the biggest effects. The value construct has a major impact on homework management and, to a lesser extent, homework effort, as Figure 3 illustrates.

As previously mentioned, the constructs in Figure 3 and the indicators in Figure 4 comprise the importance-performance map, which is divided into four sections depending on the average values of the importance and performance constructs and indicators [55], [56]. The four sections are "keep up," "do better," "education," and "no change" [57]. The lines that divided the four quadrants were based on the mean values.

"Keep up" is the suggested course of action because Figure 3's results show that homework completion seems to be doing fairly well in terms of homework effort and value. Value is, however, a latent summative construct; therefore, a more detailed analysis is needed. The homework management and expectancy constructs deserve an education recommendation as both performed well in performance, homework management (66.45), and expectancy (58.05). Based on Figure 3, no construct falls under "do better" and "no change." This requires a more detailed analysis based on the indicators (Figure 4).

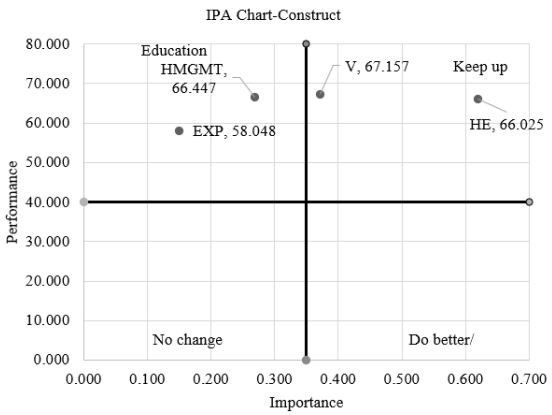

Figure 3. IPMA map on the construct level

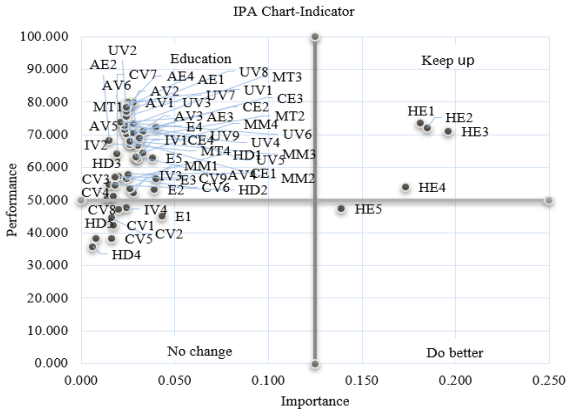

Figure 4. IPMA map on the indicator level

The scenario is explained at the construct level by the data in Figure 3. With more useful data, the importance-performance analysis can also be carried out at the indicator variable level (Figure 4, Table 5), which was performed for the expectancy, value, homework management, and homework effort constructs. The placement of the indicator variables in the importance-performance map allows for a far more extensive and practical analysis of the expectancy, value, homework management, and homework effort indicators toward

homework completion. The items that deserve the most attention is in the "do better" quadrant and include items from the homework effort construct.

Table 5. Importance-performance data on the indicator level toward homework completion

Construct/dimension	Code	Importance	Performance	Action
Homework effort	HE5	.139	47.285	Do better
Arranging environment	AE1	.025	78.789	Education
Arranging environment	AE2	.015	68.119	Education
Arranging environment	AE3	.021	73.737	Education
Arranging environment	AE4	.024	78.299	Education
Achievement value	AV1	.027	79.828	Education
Achievement value	AV2	.028	79.931	Education
Achievement value	AV3	.028	69.656	Education
Achievement value	AV4	.029	63.436	Education
Achievement value	AV5	.026	67.904	Education
Achievement value	AV6	.024	70.309	Education
Controlling emotion	CE1	.025	57.861	Education
Controlling emotion	CE2	.033	71.108	Education
Controlling emotion	CE3	.028	70.644	Education
Controlling emotion	CE4	.031	68.531	Education
Cost value	CV3	.014	50.790	Education
Cost value	CV4	.017	51.237	Education
Cost value	CV6	.024	56.564	Education
Cost value	CV7	.019	64.261	Education
Cost value	CV9	.020	57.216	Education
Expectancy	E2	.039	53.333	Education
Expectancy	E3	.040	56.667	Education
Expectancy	E4	.040	72.199	Education
Expectancy	E5	.038	62.887	Education
Handling distraction	HD1	.015	54.742	Education
Handling distraction	HD2	.018	54.562	Education
Handling distraction	HD3	.018	57.036	Education
Intrinsic value	IV1	.030	62.680	Education
Intrinsic value	IV2	.030	66.598	Education
Intrinsic value	IV3	.028	52.302	Education
Monitoring motivation	MM1	.026	53.608	Education
Monitoring motivation	MM2	.027	67.732	Education
Monitoring motivation	MM3	.026	68.067	Education
Monitoring motivation	MM4	.033	64.510	Education
Managing time	MT1	.029	63.222	Education
Managing time	MT2	.031	69.124	Education
Managing time	MT3	.026	66.881	Education
Managing time	MT3	.028	73.222	Education
Utility value	UV1	.024	79.794	Education
Utility value	UV2	.024	79.141	Education
Utility value	UV3	.025	80.034	Education
Utility value	UV4	.023	71.615	Education
Utility value	UV5	.024	73.849	Education
Utility value	UV6	.023	73.780	Education
Utility value	UV7	.024	75.498	Education
Utility value	UV8	.024	77.079	Education
Utility value	UV9	.023	72.818	Education
Homework effort	HE1	.181	73.574	Keep up
Homework effort	HE2	.185	72.096	Keep up
Homework effort	HE3	.196	71.065	Keep up
Homework effort	HE4	.173	53.986	Keep up
Cost value	CV1	.017	42.302	No change
Cost value	CV2	.016	44.536	No change
Cost value	CV5	.016	38.351	No change
Cost value	CV8	.020	47.113	No change
Expectancy	E1	.043	45.120	No change
Handling distraction	HD4	.006	35.722	No change
Handling distraction	HD5	.008	38.247	No change
Intrinsic value	IV4	.024	47.526	No change

According to Figure 4, the HE5 indicator (I am often distracted when completing my mathematics homework-negative worded) is in the "do better" quadrant, indicating higher than average importance, but at the same time lower than average performance. Since improving these characteristics of homework effort results in a noticeable gain in performance, students should pay close attention to this and concentrate on

completing their homework without being sidetracked. As stated by Corno [58], homework effort is the tendency to maintain focus and effort towards goals despite potential distraction. Regarding the homework effort construct, HE1, HE2, HE3, and HE4 indicators fall under the "keep up" quadrant. The indicators in the "keep up" quadrant have high importance and performance; therefore, the objective should be to keep the performance of indicators in this quadrant at a minimum.

The indicators in the quadrant "No change" have a low priority; therefore, improving them has little impact on the overall performance of homework completion. Indicators in this area included eight items, which are under the construct of expectancy (E1) and the dimensions of intrinsic value (IV4), cost value (CV1, CV2, CV5, and CV8), and handling distraction (HD4, HD5).

The items in the "Education" quadrant, which show superior relative performance, should be acknowledged by parents, teachers, students, and higher education authorities. However, their relative relevance is less than average when compared to other indicators. Prior studies have highlighted the need of reliable education as a basis for a competitive advantage [57], [59]. Finally, the importance-performance analysis shows a comprehensive set of recommendations for students, teachers, parents, schools, higher education authorities, and other decision-makers as they go about completing mathematics homework.

3.4. Theoretical and managerial implications

The research paper uses a few instruments as a measurement tool in the importance-performance framework to investigate the constructs of expectancy, value, homework management, homework effort, and homework completion. The value construct incorporated in the study includes four dimensions: intrinsic value, achievement value, utility value, and cost value. In comparison, the homework management construct consists of five dimensions: arranging environment, managing time, handling distraction, monitoring motivation, and controlling emotion.

With models informed by the volitional control and expectancy-value model, an endogenous-exogenous model of homework, and prior empirical studies pertaining to homework completion, this paper addresses the demand made by earlier studies to evaluate the empirical model of high school homework completion [60]. In conclusion, this study's findings showed that each of the six relationships are positive and significant. The results add to the body of research by demonstrating the relative significance of expectancy, value, homework management, and homework effort in connection to self-regulation in completing homework. The homework effort construct is by far the most significant construct influencing homework completion, according to the study's findings. Value and homework management constructs come next. Expectancy construct was rated as having the lowest importance. In addition, this research reveals the relative perceived performance of the expectancy, value, homework management, and homework effort construct so that the performance was perceived to be the best in terms of self-regulation in completing mathematics homework. The importance-performance framework gives a "keep up (keep up the good work)," "do better (concentrate here)," "education (possible overkill)," and "no change (low priority)" recommendation for expectancy, value, homework management, homework effort constructs, and indicator variables. One of the homework effort indicators (HE5) received a "do better" recommendation in this setting. However, to obtain useful and relevant information, the decision-makers should carry out the crucial performance analysis at the individual student level. Four indicators got a "Keep up" rating, indicating that it should be well maintained. These quality attributes are essential for achieving high performance in homework completion. Eight indicators got a "No change" rating, indicating that no changes are needed for their improvement as their importance is relatively low. It is crucial to understand that the averages of the responses were used as dividing lines between the four categories ("do better," "no change," "education," and "keep up"). The decision-makers may, however, set the dividing lines differently, thereby changing the managerial policies. The IPMA results provide new information to researchers, parents, teachers, schools, policymakers, and the Ministry of Education to focus more on planning and implementing improvements in improving the performance of significant variables but have low performance in raising the level of homework completion.

4. CONCLUSION

This study, employing the importance-performance analysis as its theoretical framework, aimed to identify predecessors that are relatively high in importance for homework completion while exhibiting lower performance. The study's findings provide practical recommendations for effectively managing mathematics homework completion. The study also uncovered that all six relationships examined are positive and statistically significant.

The results of the importance-performance analysis reveal that four of the homework effort indicators (HE1, HE2, HE3, and HE4) got a "keep up" recommendation, indicating their high importance and high performance as compared to other indicators from other constructs. Besides that, one of the homework effort indicators, HE5, got a "do better" recommendation, indicating its high importance but below-average

performance. For students to improve their learning abilities, maintain focus, and manage the myriad distractions they encounter both inside and outside of the classroom, homework effort is essential. Allocating more homework effort to completing homework is paramount for secondary school students as it reinforces their understanding of academic material and enhances their ability to retain and apply knowledge. It allows students to delve into subjects at a deeper level, fostering a sense of ownership over their learning experience.

Based on our findings, we assumed that students' homework effort is essential to completing mathematics homework. Homework effort had the most substantial impact, followed by value, homework management, and expectancy. As a result, students should exert more significant homework effort when completing their mathematics homework, as homework effort has been a critical factor contributing to homework completion.

This study provided a clear image of mathematics homework expectancy, value, management, effort, and completion. This study, however, only included high school students. There is a need to investigate students' expectancy, value, homework management, homework effort, and homework completion at various developmental levels (primary school, middle school, or college) and in various learning environments (for example, online homework). Thus, examining the effect of homework completion on the IPMA ratings at students' various developmental levels, learning contexts, and schools would be an intriguing area for future research.

REFERENCES

[1] I. Negru and S. Sava, "Homework's implications for the well-being of primary school pupils—perceptions of children, parents, and teachers," *Education Sciences*, vol. 13, no. 10, p. 996, Sep. 2023, doi: 10.3390/educsci13100996.

[2] V. C. Tam, P. Chu, and V. Tsang, "Engaging in self-directed leisure activities during a homework-free holiday: impacts on primary school children in Hong Kong," *Journal of Global Education and Research*, vol. 7, no. 1, pp. 64–80, Mar. 2023, doi: 10.5038/2577-509X.7.1.1193.

[3] U. Trautwein, O. Lüdtke, I. Schnyder, and A. Niggli, "Predicting homework effort: support for a domain-specific, multilevel homework model," *Journal of Educational Psychology*, vol. 98, no. 2, pp. 438–456, May 2006, doi: 10.1037/0022-0663.98.2.438.

[4] F. Yang and M. Tu, "Self-regulation of homework behaviour: relating grade, gender, and achievement to homework management," *Educational Psychology*, vol. 40, no. 4, pp. 392–408, Apr. 2020, doi: 10.1080/01443410.2019.1674784.

[5] G. Keane and M. Heinz, "Differentiated homework: impact on student engagement," *Journal of Practitioner Research*, vol. 4, no. 2, Oct. 2019, doi: 10.5038/2164-0866.4.2.1111.

[6] J. Cunha, P. Rosário, J. C. Núñez, G. Vallejo, J. Martins, and J. Högemann, "Does teacher homework feedback matter to 6th graders' school engagement?: a mixed methods study," *Metacognition and Learning*, vol. 14, pp. 89–129, Aug. 2019, doi: 10.1007/s11409-019-09200-z.

[7] J. Cadima, K. Verschueren, T. Leal, and C. Guedes, "Classroom interactions, dyadic teacher–child relationships, and self–regulation in socially disadvantaged young children," *Journal of Abnormal Child Psychology*, vol. 44, pp. 7–17, Jan. 2016, doi: 10.1007/s10802-015-0060-5.

[8] H. Alkharusi, S. Aldhafri, I. Al-Harthy, H. Albarashdi, M. Alrajhi, and A. Alhadabi, "Development and initial validation of the teachers' self-efficacy for homework management scale," *Electronic Journal of Research in Educational Psychology*, vol. 19, no. 3, pp. 671–686, 2021, doi: 10.25115/EJREP.V19I55.3756.

[9] C. Fuertes and A. M. De, "The role of prior achievement as an antecedent to student homework engagement," *Frontiers in Psychology*, vol. 10, Feb. 2019, doi: 10.3389/fpsyg.2019.00140.

[10] H. Dumont, U. Trautwein, G. Nagy, and B. Nagengast, "Quality of parental homework involvement: predictors and reciprocal relations with academic functioning in the reading domain," *Journal of Educational Psychology*, vol. 106, no. 1, pp. 144–161, Feb. 2014, doi: 10.1037/a0034100.

[11] P. Rosário, J. Cunha, A. R. Nunes, T. Moreira, J. C. Núñez, and J. Xu, "'Did you do your homework?' Mathematics teachers' homework follow-up practices at middle school level," *Psychology in the Schools*, vol. 56, no. 1, pp. 92–108, Jan. 2019, doi: 10.1002/pits.22198.

[12] H. Cooper, J. C. Robinson, and E. A. Patall, "Does homework improve academic achievement? a synthesis of research, 1987–2003," *Review of Educational Research*, vol. 76, no. 1, pp. 1–62, Mar. 2006, doi: 10.3102/00346543076001001.

[13] C.-M. Fernández-García, M. Rodríguez-Álvarez, and M.-P. Viñuela-Hernández, "University students and their perception of teaching effectiveness: effects on students' engagement," *Revista de Psicodidáctica (English ed.)*, vol. 26, no. 1, pp. 62–69, Jan. 2021, doi: 10.1016/j.psicoe.2020.11.006.

[14] F. Yang and J. Xu, "Examining the psychometric properties of the homework management scale for high school students in China," *Journal of Psychoeducational Assessment*, vol. 33, no. 3, pp. 268–277, Jun. 2015, doi: 10.1177/0734282914548326.

[15] P. Rosario, J. Cunha, T. Nunes, A. R. Nunes, T. Moreira, and J. C. Núñez, "'Homework should be...but we do not live in an ideal world': mathematics teachers' perspectives on quality homework and on homework assigned in elementary and middle schools," *Frontiers in Psychology*, vol. 10, p. Article 224, 2019, doi: 10.3389/fpsyg.2019.00224.

[16] P. S. Muljana, C. S. Dabas, and T. Luo, "Examining the relationships among self-regulated learning, homework timeliness, and course achievement: a context of female students learning quantitative topics," *Journal of Research on Technology in Education*, vol. 55, no. 2, pp. 143–162, Mar. 2023, doi: 10.1080/15391523.2021.1936703.

[17] H. Cooper, *The battle over homework (3rd ed.)*. Corwin Press, 2001.

[18] J. Xu, "Why do students have difficulties completing homework? the need for homework management," *Journal of Education and Training Studies*, vol. 1, no. 1, Feb. 2013, doi: 10.11114/jets.v1i1.78.

[19] S. Anwar, S. I. Khan, and S. Fazal, "Homework as an assignment: parents' perceptions and involvement," *Sir Syed Journal of Education & Social Research (SJESR)*, vol. 5, no. 4, pp. 29–39, Nov. 2022, doi: 10.36902/sjesr-vol5-iss4-2022(29-39).

[20] C. T. Murniati, H. Hartono, and A. Cahyo Nugroho, "The challenges, supports, and strategies of self-directed learning among college students," *Journal of Education and Learning (EduLearn)*, vol. 17, no. 3, pp. 365–373, 2023, doi: 10.11591/edulearn.v17i3.20744.

[21] J. S. Preu, J. Zimmerman, and K. Jonkmann, "Academic self-efficacy and value beliefs of international stem and non-stem university students in Germany from an intersectional perspective," *Education Sciences*, vol. 13, no. 786, pp. 1–22, 2023, doi: 10.3390/educsci13080786.
[22] Y. Yang and D. Mindrila, "Probing the underlying structure of modern expectancy-value theory in multicultural education: a Bayesian exploratory factor analysis," *International Journal of Educational Psychology*, vol. 9, no. 1, pp. 55–81, 2020, doi: 10.17583/ijep.2020.4261.
[23] A. Wigfield, J. S. Eccles, U. Schiefele, R. Roeser, and P. Davis-Kean, "Development of achievement motivation. In N. Eisenberg (Ed.). Social, emotional, and personality development. Volume 3 of the handbook of child psychology," 6th ed., Wiley Editors-in-Chief: W. Damon & R. M. Lerner, 2006, pp. 933–1002.
[24] S. Rodriguez, J. C. Nunez, A. Valle, C. Freire, M. del M. Ferradas, and C. Rodriguez-Llorente, "Relationship between students' prior academic achievement and homework behavioral engagement: the mediating/moderating role of learning motivation," *Frontiers in Psychology*, vol. 10, no. 1047, pp. 1–10, 2019, doi: 10.3389/fpsyg.2019.01047.
[25] J. C. Núñez, B. Regueiro, N. Suárez, I. Piñeiro, M. L. Rodicio, and A. Valle, "Student perception of teacher and parent involvement in homework and student engagement: the mediating role of motivation," *Frontiers in Psychology*, vol. 10, 2019, doi: 10.3389/fpsyg.2019.01384.
[26] A. Valle, B. Regueiro, J. C. Núñez, S. Rodríguez, I. Piñeiro, and P. Rosário, "Academic goals, student homework engagement, and academic achievement in elementary school," *Frontiers in Psychology*, vol. 7, Mar. 2016, doi: 10.3389/fpsyg.2016.00463.
[27] S. Dettmers, U. Trautwein, O. Lüdtke, M. Kunter, and J. Baumert, "Homework works if homework quality is high: using multilevel modeling to predict the development of achievement in mathematics," *Journal of Educational Psychology*, vol. 102, no. 2, pp. 467–482, May 2010, doi: 10.1037/a0018453.
[28] S. Velayutham and J. M. Aldridge, "Influence of psychosocial classroom environment on students' motivation and self-regulation in science learning: a structural equation modeling approach," *Research in Science Education*, vol. 43, no. 2, pp. 507–527, Apr. 2013, doi: 10.1007/s11165-011-9273-y.
[29] F. Yang and J. Xu, "Homework expectancy value scale: measurement invariance and latent mean differences across gender," *Journal of Psychoeducational Assessment*, vol. 36, no. 8, pp. 863–868, Dec. 2018, doi: 10.1177/0734282917714905.
[30] J. Xu, J. Du, and X. Fan, "Self-regulation of mathematics homework behavior: an empirical investigation," *The Journal of Educational Research*, vol. 110, no. 5, pp. 467–477, Sep. 2017, doi: 10.1080/00220671.2015.1125837.
[31] J. Xu, "Validation of scores on the homework management scale for high school students," *Educational and Psychological Measurement*, vol. 68, no. 2, pp. 304–324, 2008, doi: 10.1177%2F0013164407301531.
[32] J. Xu and L. Corno, "Extending a model of homework: a multilevel analysis with Chinese middle school students," *Metacognition and Learning*, vol. 17, no. 2, pp. 531–563, 2022, doi: 10.1007/s11409-022-09296-w.
[33] J. Xu and J. C. Nunez, "Homework purposes in eighth grade students: identifying student profiles and their relationship with homework effort, completion, and achievement," *Psicothema*, vol. 35, no. 2, pp. 111–118, 2023, doi: 10.7334/psicothema2022.334.
[34] D. Wu *et al.*, "Primary students' online homework completion and learning achievement," *Interactive Learning Environments*, vol. 32, no. 8, pp. 4469–4483, Sep. 2024, doi: 10.1080/10494820.2023.2201343.
[35] M. K. Alderman, *Motivation for achievement: possibilities for teaching and learning*, Lawrence Erlbaum Associates Publishers, 1999.
[36] J. Guo *et al.*, "Probing the unique contributions of self-concept, task values, and their interactions using multiple value facets and multiple academic outcomes," *AERA Open*, vol. 2, no. 1, Jan. 2016, doi: 10.1177/2332858415626884.
[37] E. Rosario *et al.*, "Homework purposes, homework behaviors, and academic achievement: examining the mediating role of students' perceived homework quality," *Contemporary Educational Psychology*, vol. 53, pp. 168–180, 2018, doi: 10.1016/j.cedpsych.2018.04.001.
[38] C. M. Ringle and M. Sarstedt, "Gain more insight from your PLS-SEM results: the importance-performance map analysis," *Industrial Management and Data Systems*, vol. 116, no. 9, pp. 1865–1886, 2016, doi: 10.1108/IMDS-10-2015-0449.
[39] J. S. Eccles, "Expectancies, values and academic behaviors. In J. T. Spence (Ed.). Achievement and achievement motives: Psychological and sociological approaches," Freeman, 1983, pp. 75–146.
[40] H. Gaspard, "Promoting value beliefs in mathematics: a multidimensional perspective and the role of gender," (Thesis, University of Tubingen), 2015.
[41] E. D. Heggestad, D. J. Scheaf, G. C. Banks, M. Monroe Hausfeld, S. Tonidandel, and E. B. Williams, "Scale adaptation in organizational science research: a review and best-practice recommendations," *Journal of Management*, vol. 45, no. 6, pp. 2596–2627, 2019, doi: 10.1177/0149206319850280.
[42] U. Trautwein, H. W. Marsh, B. Nagengast, O. Lüdtke, G. Nagy, and K. Jonkmann, "Probing for the multiplicative term in modern expectancy–value theory : A latent interaction modeling study," *Journal of Educational Psychology*, vol. 104, no. 3, pp. 763–777, 2012, doi: 10.1037/a0027470.
[43] J. S. Eccles, "Who am I and what am I going to do with my life? Personal and collective identities as motivators of action," *Educational Psychologist*, vol. 44, no. 2, pp. 78–89, 2009.
[44] J. Xu, "Homework purpose scale for high school students: a validation study," *Educational and Psychological Measurement*, vol. 70, no. 3, pp. 459–476, 2010, doi: 10.1177/0013164409344517.
[45] H. Cooper, J. J. Lindsay, B. Nye, and S. Greathouse, "Relationships among attitudes about homework, amount of homework assigned and completed, and student achievement," *Journal of Educational Psychology*, vol. 90, no. 1, pp. 70–83, 1998.
[46] L. Horn and J. West, "National Education Longitudinal Study of 1988: a profile of parents of eighth graders. Washington, DC: US Department of Education, Office of Educational Research and Improvement," 1992.
[47] M. Sarstedt, C. M. Ringle, and J. F. Hair, "Partial least squares structural equation modeling," in *Handbook of Market Research*, Cham: Springer International Publishing, 2022, pp. 587–632, doi: 10.1007/978-3-319-57413-4_15.
[48] J. F. Hair, G. T. M. Hult, C. M. Ringle, and M. Sarstedt, *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage Publications, 2014.
[49] T. Ramayah, J. Cheah, F. Chuah, H. Ting, and M. A. Memon, "Partial least squares structural equation modeling (PLS-SEM) using SmartPLS 3.0: An updated guide and practical guide to sstatistical analysis," 2018.
[50] R. P. Bagozzi and Y. Yi, "Specification, evaluation, and interpretation of structural equation models," *Journal of the Academy of Marketing Science*, vol. 40, no. 1, pp. 8–34, 2011, doi: 10.1007/s11747-011-0278-x.
[51] J. C. Nunnally and I. H. Bernstein, *Psychometric theory*, 3rd editio. New York: McGraw-Hill, 1994.
[52] J. Henseler, C. M. Ringle, and M. Sarstedt, "A new criterion for assessing discriminant validity in variance-based structural equation modeling," *Journal of the Academy of Marketing Science*, vol. 43, pp. 115–135, Jan. 2015, doi: 10.1007/s11747-014-0403-8.
[53] A. H. Gold, A. Malhotra, and A. H. Segars, "Knowledge management: an organizational capabilities perspective," *Journal of Management*, vol. 18, no. 1, pp. 185–214, 2001.

[54] J. F. Hair, C. M. Ringle, and M. Sarstedt, "PLS-SEM: indeed a silver bullet," *Journal of Marketing Theory and Practice*, vol. 19, no. 2, pp. 139–152, Apr. 2011, doi: 10.2753/MTP1069-6679190202.
[55] J. A. Martilla and J. C. James, "Importance-performance analysis," *Journal of Marketing*, vol. 41, no. 1, pp. 77–79, 1977, doi: 10.1177/002224297704100011.
[56] M. Haverila, K. Haverila, and J. C. Twyford, "Identification of key variables and constructs in the context of wine tasting room: importance-performance analysis," *International Journal of Wine Business Research*, vol. 33, no. 1, pp. 80–101, 2021, doi: 10.1108/IJWBR-02-2020-0006.
[57] S.-H. Hsu, "Developing an index for online customer satisfaction: adaptation of American customer satisfaction index," *Expert Systems with Applications*, vol. 34, no. 4, pp. 3033–3042, 2008, doi: 10.1016/j.eswa.2007.06.036.
[58] L. Corno, "Student volition and education: outcomes, influences, and practices," in *Self-regulation of Learning and Performance*, 1994.
[59] J. Rosenbusch, Ida Rosnita Ismail, and C. M. Ringle, "The agony of choice for medical tourists: a patient satisfaction index model," *Journal of Hospitality and Tourism Technology*, vol. 9, no. 3, pp. 267–279, 2018, doi: 10.1108/JHTT-10-2017-0107.
[60] J. Xu, "Homework completion at the secondary school level: a multilevel analysis," *The Journal of Educational Research*, vol. 104, no. 3, pp. 171–182, 2011, doi: 10.1080/00220671003636752.

BIOGRAPHIES OF AUTHORS

Madina Abdul Rahman is a Ph.D. student at Universiti Sains Malaysia. She holds a master of arts (education) in psychometric and educational measurement. She is an experienced teacher with a 15-year track record in the primary school academic setting. Possesses considerable expertise in instructing both mainstream and specialized rehabilitation classes. Her research interests include educational measurement, assessment and evaluation, and psychology. She can be contacted at email: madina81@student.usm.my.

Ahmad Zamri Khairani is an associate professor at the School of Educational Studies, Universiti Sains Malaysia. He holds a Ph.D. in psychometric and educational evaluation from the International Islamic Universiti Malaysia. His research interests include educational testing, measurement, assessment and evaluation, mathematics education, and teacher education/professional development. He can be contacted at email: ahmadzamri@usm.my.