

Exploring Items for Measuring Self-initiated Professional Development Construct in The Context of Continuous Professional Development System Usage

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Abstract

Self-initiated professional development (SI-PD) refers to the proactive engagement of teachers in activities aimed at enhancing their own intellectual capabilities, accumulating practical knowledge and cultivating positive dispositions. This involves the deliberate design, implementation, and evaluation of the learning process, utilising educational resources as a means of support or facilitation. SI-PD is evaluated to determine its effect on the usage of the Continuous Professional Development (CPD) system by Malaysian teachers. There are twenty-six items on the SI-PD, which were adapted from prior studies that employed self-directed learning. The items in this self-directed learning construct have been modified to reflect the context of the CPD system usage. The questionnaire items were then reviewed and verified by the experts from the aspects of content validity, face validity and criterion validity. A pilot study was conducted on 100 teachers who were randomly selected from the central region of Malaysia, which includes three states: Selangor, the Federal Territory of Kuala Lumpur, and the Federal Territory of Putrajaya. Findings of Exploratory Factor Analysis (EFA) yielded five components (motivation, self-monitoring, self-efficacy, self-management, and self-regulation), and internal reliability was achieved for all five components.

Keywords: Self-initiated professional development, Exploratory Factor Analysis, Continuous Professional Development (CPD), self-directed learning, e-portfolio.

Introduction

Teaching in the era of Industrial Revolution 4.0 (IR4), requires competent teachers in various aspects. Competency in using technologies, latest pedagogical approaches, ability to rectify dynamic learners' problems are few examples of 21st century teachers' traits. Teachers need to keep up with the rapid adoption of new technologies in the educational sector, they need to acquire relevant knowledge and skills through effective management of training (EPU, 2021b). In light of the fourth shift of the Malaysia Education Blueprint (MEB) 2013-2025,

which is turning the teaching profession into a profession of choice, Continuous Professional Development (CPD) is the driving force behind raising the quality of teachers across the board by equipping them with new skills and knowledge through lifelong learning programmes (Dahri et al., 2022). The MEB 2013–2025 goal has been bolstered by the Ministry of Education's (MoE) ICT Transformation Plan (ITP) 2019–2023, which uses enabling technologies to improve competencies and self-development to produce a high-quality workforce (MoE, 2019). It is essential that teachers consistently engage in CPD (Richter et al., 2019) to ensure that their level of competence is commensurate with the quality of the system or technology provided by the ministry. One of the four policy thrusts outlined in the National 4IR Policy, which was unveiled on July 1st, 2021, is the provision of training for individuals to acquire 4IR-related expertise and competencies. In order to keep up with the quick adoption of developing technologies in education, teachers must provide themselves with the necessary knowledge and skills through effective training management (EPU, 2021). The government expects that by 2030, 80 percent of online government services will be supported and integrated with 4IR technology applications, such as artificial intelligence (AI), and all teachers will have received training on how to use 4IR technology in their teaching and learning practises (EPU, 2021).

A strong management information system and well-aligned CPD management are necessary to guarantee sustainability in teacher professional development. Training management or CPD for in-service teachers in Malaysia is administered through a system or platform known as the Ministry of Education's Training Management System or better known as SPLKPM. Several countries or organizations have different CPD systems from various disciplines (Round, 2013), using terms like electronic portfolio (e-portfolio), electronic CPD (e-CPD), electronic training (e-training), or electronic Daftar (e-Daftar) (Abdullah et al., 2016; Ahmed & Ward, 2016; Balaban et al., 2013; Balaban, 2020; Garg & Sharma, 2020; Gyamfi et al., 2023; Razali et al., 2021; Razak & Yusop, 2013; Rosly & Khalid, 2018; San Jose, 2017; Song, 2021) as part of their training management system. The CPD system helps teachers manage their training based on their participation in CPD activities across various platforms or methods. It's a convenient way for teachers to record and keep track of their professional development data, such as the courses or workshops they have attended, as well as the number of hours of self-study and the current credit points they have accrued (MoE, 2016; Zaid & Yusof, 2022). CPD documentation is vital for teachers, school administrators, and the Ministry of Education to plan their professional development, further education, and career promotion, as well as to assess their progress and skills over time (Gyamfi et al., 2023; Kwok & Hui, 2017; MoE, 2014, 2016; Nur Leenna et al., 2020a, 2020b; Segaran & Hasim, 2021; Song, 2021; Zaid & Yusof, 2022). To ensure the sustainability of teacher professional development, the Ministry of Education has implemented continuous professional development credit point (MyPPB) scoring mechanisms based on 13 CPD activities into the current system (MoE, 2018). There has been gradual progress made to address the issue of insufficient centralised data and a less structured recording strategy (MoE, 2014) in order to optimize system use. However, a preliminary study found that the current system has a system usability scale (SUS) score of 45.9, which is below the average SUS score of 68 and so indicates that it needs to be upgraded (Mohd & Azmi Murad, 2022). Self-directed learning activities, which are less recorded than those in courses or workshops and knowledge discourses, are one of the major contributors to the low system usage among users (Teacher Professionalism Division [BPG], 2020; Organization for Economic Co-operation and Development [OECD], 2014; Zaid & Yusof, 2022).

During the global spread of the covid-19 pandemic, home-based teaching and learning (PdPR) has been the norm. In order to achieve PdPR requirements, teachers have taken the initiative to develop their own online teaching technology skills. This approach has given teachers a sense of direction in terms of planning and monitoring their professional development activities. The Ministry of Education should take advantage of the fact that teachers' involvement in self-initiated professional development (SI-PD) can help them redefine their professions in light of this pandemic (Nur Leenna et al., 2020a). In this exploratory factor analysis (EFA), self-initiated professional development is examined for each of its elements as a factor that determines teachers' utilisation of the CPD system.

Self-Initiated Professional Development

The term self-initiated professional development (SI-PD) refers to the development of a teacher's own knowledge, skills, and attitudes, which they are in charge of and initiate themselves (Karaaslan, 2013). The term is formed from several synonymous terms such as self-directed, self-initiated, self-development, and self-regulated which are used interchangeably in the literature from various perspectives (Nur Leenna et al., 2020a, 2020b). MoE (2014), as cited in the book 'Continuous Professional Development Plan,' defines self-directed initiative as any CPD initiative or activity conducted by teachers in an effort to raise their level of professionalism. This approach is intended to promote self-directed learning and enable autonomy for professional development driven by self-planning, self-regulation, self-evaluation, and self-improvement (MoE, 2014; Segaran & Hasim, 2021).

The Ministry of Education has committed to raising the percentage of self-initiated professional development or self-directed learning activities from 16 per cent in wave 1 (2013-2015) of the MEB 2013-2025 to 40 per cent in wave 2 (2016-2020) and finally to 60 per cent by 2025. Transformation of CPD practices is anticipated to reduce Ministry-led professional development, as indicated in the Teacher Professionalism Development Master Plan (PIPPK) policy (MoE, 2014, 2016; Nur Leenna et al., 2020b, 2022). However, this aim is rather difficult to fulfil due to teachers' lack of commitment to participate in CPD (Ab Rahim et al., 2021), which resulted in just 4% of the 28% who used the e-portfolio system for the purpose of professional development (Razali et al., 2021).

OECD (2014) and Pantic and Cain (2022) estimate that approximately 70% of the teachers prefer to attend seminars and formal courses initiated by organisations, spending an average of eight and a half days in a year compared to self-directed learning activities. Some teachers without SI-PD skills struggled and preferred formal professional development including workshops, seminars, and conferences (Nur Leenna et al., 2020b). Moreover, Song (2021) argued that even though self-directed learning is rarely implemented as a formal learning activity, utilising the e-portfolio system can assist learners to enhance their self-directed learning skills. In other words, teachers' ongoing commitment to the usage of the CPD system is indicative of their initiative in developing their own professional competence.

With the rise of open and online learning, comes the necessity for, and rising interest in, studies that shed light on self-directed learning (Zhu et al., 2020) particularly in the use of the CPD system. Thus, it needs to be proven through empirical investigations using proper measuring techniques and a more comprehensive factor analysis. In general, the purpose of this study is to examine items through Exploratory Factor Analysis (EFA) to measure the teacher's SI-PD construct in the context of CPD system usage. The results of this analysis can provide evidence and empirical views about the influence of teacher SI-PD on the use of existing training management systems to develop self-professionalism.

Methodology

A quantitative approach and non-experimental design were used to conduct this study. The data was gathered cross-sectionally through the use of questionnaires. Unlike experimental studies, non-experimental quantitative studies do not influence the independent variables, and the researcher has no direct control over the independent variable since the change has already taken place (Kothari, 2004; Lodico et al., 2010; Tabachnick & Fidell, 2014). The data which were obtained through survey techniques are analyzed descriptively, inferentially and further form the development of the model. The central region of Malaysia, which consists of the state of Selangor, the Federal Territory (FT) of Kuala Lumpur, and FT Putrajaya, was selected for this study because of its large population and high rate of internet connection (Department of Statistics Malaysia, 2021). This is important since the focus of the research is on the use of internet-based systems.

By using a multistage cluster sampling technique, this study recruited a sample of primary school teachers who also served as Secretary of In-Service Training or (SULDP) in the central region of Malaysia. Creswell and Creswell (2018) add to this notion by stating that the researcher must first identify a cluster (a group or organisation), then identify the individuals inside that cluster, and finally obtain a representative sample from that cluster. The SULDP is responsible for overseeing and administering the implementation of MoE's Training Management System (SPLKPM) at the school level (MoE, 2018). Using SPLKPM, the primary function of SULDP in schools is to update training data and information for schools, teachers, and staff. To further ensure the reliability of the study's results, primary school teachers are selected based on homogeneity criteria and the fact that there are more primary schools in the central region (863) than secondary schools (393). A total of 100 respondents were chosen for this study, following the recommendations of Awang et al., 2018; Hair et al., 2019; Muda et al., 2018; and Shkeer & Awang, 2019, where it is necessary to have at least 100 sample respondents in order to carry out Exploratory Factor Analysis (EFA).

Research Instrument

The questionnaire consists of two primary sections, the first of which (Section A) takes demographic data from respondents, including gender, age, and work experience. The SI-PD construct was measured in the second section (Section B), which contained a total of 26 items adapted from prior studies and devised by Abd-El-Fattah (2010). The model by Garrisons (1987), which was used in his instrument, is suitable for this study. This is due to the fact that the three components used, self-management (SMT), self-monitoring (SMO), and motivation (MO), are required to evaluate the behaviour of teachers handling self-directed learning activities intended for self-initiated professional development. This instrument is a self-administered survey and is measured on a 10-point interval scale ranging from 1 (strongly disagree) to 10 (strongly agree). This 10-point interval scale gives respondents more flexibility in choice and avoids the necessity for forced measurement (Muda et al., 2018). Before executing the pilot study, pre-testing is done to evaluate the survey instrument. This method of pre-testing begins with the hiring of three types of experts to assess the instrument's content validity (by subject matter expert), face validity (by language expert), and criterion validity (by measurement expert) (Awang, Z., & Mohamad, M., 2016; Awang et al., 2018; Muda et al., 2018; Rubio et al., 2003; Shkeer & Awang, 2019; Stockemer, 2019). A panel of experts in CPD, Management Information Systems (MIS), and educational technology was chosen to determine the content validity of the instrument for this study. To guarantee face validity, the researcher also administered the instrument to a separate group of 10 individuals

with the same demographics as the study sample (Shkeer & Awang, 2019). Stockemer (2019) emphasises the importance of doing a pretest on a small sample of respondents representing the population being studied to uncover questionnaire mistakes before the survey is made public. Prior to that, the instrument that was translated back and forth between English and Bahasa Melayu by a bilingual expert is delivered to the Bahasa Melayu expert to be reviewed. To check the criterion validity, the researcher hired an expert in Structural Equation Modelling (SEM) measurement analysis to confirm that the measuring scale and questionnaire items are accurate and fit for the purpose. In response to expert comments, corrections and changes were made to ensure that the pilot study proceeds smoothly and efficiently.

Exploratory Factor Analysis (Efa) Results

Factor analysis is a statistical method for breaking down a large number of independent variables (such as test scores or items, questionnaire responses, social media usage patterns, and digital tracking) into smaller, more manageable groups called factors or component sets (Hair et al., 2019). There are two forms of factor analysis: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) (Tabachnick & Fidell, 2014; Taherdoost et al., 2014). EFA validates the dimensionality and factor loading of each item from each construct using data from a pilot study. While CFA evaluates construct validity and reliability using field study data (Awang et al., 2018). The EFA was used to measure the dimensionality of the construct-assessing items using the collected data. It is possible that the items' dimensionality will shift if they are adapted from one field of research to another. The dimensionality may also be affected by the population's cultural background, socioeconomic status, and duration between studies (Alkhawaja et al., 2020).

EFA for Self-Initiated Professional Development

This questionnaire has 26 items that measure the Self-Initiated Professional Development construct. Self-management (SMT), self-monitoring (SMO), and motivation (MO) are the three components used to measure how teachers handle self-directed learning tasks that lead to their own professional development. The EFA results for this construct are displayed in Table 1, along with descriptive data for each metric employed. Table 1 displays the descriptive statistics containing the mean and standard deviation based on the EFA results. Each item used to evaluate the construct is measured on a 10-point interval scale ranging from 1 (strongly disagree) to 10 (strongly agree).

Table 1.

The descriptive analysis for items measuring Self-Initiated Professional Development construct.

Item	Item Statement	Mean	Std. Deviation ^a
1	I am well-organized in my learning (SMT1)	9.1800	.84543
2	I set up strict timeframes to learn something new (SMT2)	9.0500	.98857
3	I have good management skills (SMT3)	8.8200	1.12259
4	I set up planned solutions to solve my problems (SMT4)	9.3100	.70632
5	I can decide about the priority of my work (SMT5)	8.3900	1.42059
6	I can manage pursuing my own learning (SMT6)	8.7400	1.06950
7	I prefer to plan my own learning (SMT7)	8.9100	1.30341
8	I am efficient in managing my time (SMT8)	8.3000	1.53412
9	I take the challenge to learn (MO1)	7.7300	1.79705
10	I am a 'why' person (MO2)	7.1400	2.22937
11	I critically evaluate new ideas and knowledge (MO3)	6.9200	2.10185
12	I would like to evaluate the level of my learning progress (MO4)	7.8300	1.72360
13	I would like to learn from my mistakes (MO5)	8.5100	1.43896
14	I believe in effort to improve my performance (MO6)	8.5000	1.80067
15	I enjoy learning new things (MO7)	8.3900	1.85807
16	I trust my abilities to learn new things (MO8)	8.7900	1.34311
17	I have positive expectations about what I am learning (MO9)	8.9100	1.31114
18	I am aware of my own weaknesses (SMO1)	8.6200	1.26953
19	I can link pieces of information when I am learning (SMO2)	8.3700	1.46097
20	I pay attention to all details before taking a decision (SMO3)	8.7400	1.40432
21	I would like to set up my goals (SMO4)	8.8300	1.23137
22	I correct myself when I make mistakes (SMO5)	9.1300	1.01160
23	I am a responsible person (SMO6)	8.5200	1.12349
24	I judge my abilities fairly (SMO7)	8.8300	1.04500
25	I think deeply when solving a problem (SMO8)	8.7000	1.16775
26	I prefer to set up my criteria to evaluate my performance (SMO9)	8.4400	1.32817

The findings of the KMO and Bartlett's Test for the construct of self-initiated professional development are presented in Table 2. The KMO value for this construct is 0.839, while the p value is 0.000. The KMO standard value need to be greater than 0.70, and the p value should be less than 0.05 (Muda et al., 2018). As the data satisfy the predetermined conditions, both the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO=0.839) and the Bartlett's Test of Sphericity (sig. 0.000) are good and very significant.

Table 2.

Results of KMO and Bartlett's Test for Self-Initiated Professional Development

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.839
Bartlett's Test of Sphericity	Approx. Chi-Square	2115.443
	df	325
	Sig.	.000

Figure 1 depicts the components that resulted from the EFA procedure's scree plot. This process resulted in the 26 items being divided into five components. Each component represents a set of measurement items.

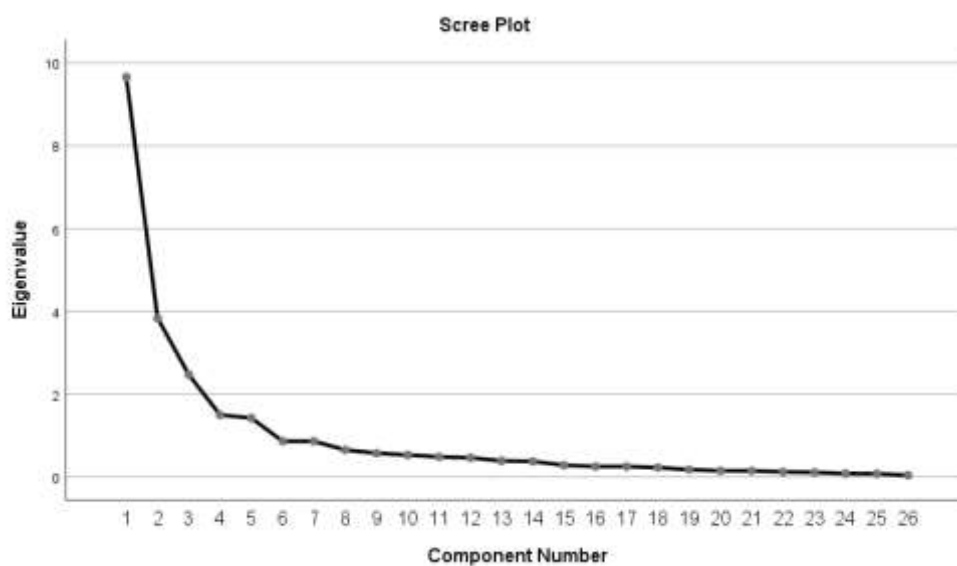


Figure 1. The Scree Plot shows five components from EFA.

All the 26 items for the Self-Initiated Professional Development construct were extracted from data using PCA with varimax rotation. According to the findings in Table 3, the EFA approach divided the items into five components, each of which had an eigenvalue larger than 1.0 and explained 72.628 percent of the total variance. This value is greater than the minimum required value of 60% (Awang et al., 2018).

Table 3.

The Total Variance Explained for Self-Initiated Professional Development

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
	1	9.659	37.150	37.150	5.884	22.633
2	3.836	14.753	51.903	3.856	14.832	37.464
3	2.469	9.495	61.398	3.344	12.861	50.325
4	1.497	5.758	67.156	2.985	11.482	61.807
5	1.423	5.472	72.628	2.813	10.820	72.628

A rotated component matrix was derived after determining the total variance for the Self-Initiated Professional Development construct. According to Table 4, all 26 items correspond to five components. There are nine items in the first component, and five items in the second component. The third, fourth and fifth components consist of four items each. As per the literature, it is recommended to remove items from the construct that exhibit low factor loading values, specifically those that are less than 0.6 (Awang et al., 2018; Muda et al., 2018; Shkeer & Awang, 2019). In this questionnaire, however, no items were eliminated since all items exceeded the minimum set value of 0.6. After the EFA was determined, themes for two additional components were generated to match the items involved.

Table 4.

The Rotated Component Matrix for Self-Initiated Professional Development

Rotated Component Matrix^a

	Component				
	1	2	3	4	5
SMT1					.775
SMT2					.781
SMT3					.681
SMT4					.602
SMT5				.847	
SMT6				.690	
SMT7				.738	
SMT8				.850	
MO1	.824				
MO2	.864				
MO3	.868				
MO4	.707				
MO5	.658				
MO6	.798				
MO7	.810				
MO8	.614				
MO9	.648				
SMO1			.763		
SMO2			.881		
SMO3			.650		
SMO4			.826		
SMO5		.755			
SMO6		.789			
SMO7		.876			
SMO8		.735			
SMO9		.661			

The Instrument Internal Reliability

After the EFA findings are collected, the internal reliability value of each component of the Self-Initiated Professional Development construct is determined. Internal reliability determines the usefulness of item sets in assessing their constructs (Alkhawaja et al., 2020). Since there are five components used to quantify this construct, it is necessary to determine

the Cronbach's Alpha for each component as depicted in Table 5. Each of the five components has a Cronbach's Alpha greater than 0.70. The total of the Cronbach's Alpha value for all 26 items is 0.920, which also surpasses the 0.7 threshold (Alkhawaja et al., 2020; Dehisat & Awang, 2020, Shkeer & Awang, 2019). Therefore, the results demonstrate that all reliability estimates for the five components of the Self-Initiated Professional Development construct have exceeded the minimum value. Thus, the derived components with their respective items are reliable and suitable for estimating the construct. Two additional components (component 3 & 5) that emerged after EFA procedure were recognized to be aligned with the measured items. The items assessed for component 3 share similarities with the self-efficacy variable in terms of how they judge their coping deficiencies, their efficacy beliefs are multidimensional rather than a single disposition, and how they influence the types of anticipatory scenarios they create, set goals for themselves, and formulate action plans to achieve desired outcomes (Bandura, 2009). Meanwhile, the characteristics of the items evaluated in component 5 demonstrate similarities with regards to self-regulation factors, namely in terms of the capacity to effectively manage time, systematically organise self-directed learning, and employ problem-solving strategies, as mentioned by Zimmerman (1986).

Table 5.

The Internal Reliability for Self-Initiated Professional Development

Constructs	No. of items	Cronbach's Alpha
Self-Initiated Professional Development (SI-PD)		
• Component 1 - Motivation	9	.936
• Component 2 - Self-monitoring	5	.901
• Component 3 - Self-efficacy	4	.883
• Component 4 - Self-management	4	.846
• Component 5 - Self-regulation	4	.786
All items	26	.920

Conclusion

This study contributes to the subject of continuous professional development by focusing on the usage of training management systems or CPD systems among school teachers through the empowerment of Self-Initiated Professional Development practices. The elements that measure the Self-Initiated Professional Development construct are evaluated constructively using items from instruments adapted from prior studies in the EFA approach. Five components (motivation, self-monitoring, self-efficacy, self-management, and self-regulation) were identified by EFA, and all five of them attained internal reliability. In addition, these components were measured with 26 items, and the reliability measures for the five components of Self-Initiated Professional Development yielded high Cronbach's alpha values, which met the Bartlett test requirements as well as KMO scores (> 0.7) and factor loadings that were higher than the required minimum value of 0.6. The findings indicated that the studied items were appropriate, as evidenced by the outcomes. Items for this construct are altered and modified to match the field of CPD systems. Face validation, content validity, and reliability were used to validate the instrument. This instrument can be used as a reference and a guide for the study of the use of CPD systems, training management systems, or e-portfolio systems by professionals from various fields and backgrounds.

References

- Abd-El-Fattah, S. M. (2010). Garrison's Model of Self-Directed Learning: Preliminary Validation and Relationship to Academic Achievement. *The Spanish Journal of Psychology*, 13(2), 586–596. <https://doi.org/10.1017/S1138741600002262>
- Abdullah, F., Ward, R., & Ahmed, E. (2016). Investigating the Influence of The Most Commonly Used External Variables of TAM on Students' Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) of E-Portfolios. *Computers in Human Behavior*, 63, 75–90. <https://doi.org/10.1016/j.chb.2016.05.014>
- Ab Rahim, S. A., Ghani, M. F. A., Hamid, H. S. A., Samsudin, N., Ismail, Z., & Yusof, M. A. M. (2021). Cabaran Pelaksanaan Program Pembangunan Profesionalisme Pemimpin Guru Sekolah Berprestasi Tinggi. *Jurnal Kepimpinan Pendidikan*, 8(2), 25–40.
- Ahmed, E., & Ward, R. (2016). Analysis of Factors Influencing Acceptance of Personal, Academic, and Professional Development E-Portfolios. *Computers in Human Behavior*, 63, 152–161. <https://doi.org/10.1016/j.chb.2016.05.043>
- Alkhwaja, M. I., Sobihah, M., & Awang, Z. (2020). Exploring and Developing an Instrument for Measuring System Quality Construct in The Context of E-Learning. *International Journal of Academic Research in Business and Social Sciences*. 10(11), 403-413. <http://dx.doi.org/10.6007/IJARBS/v10-i11/7953>
- Awang, Z., & Mohamad, M. (2016). *Postgraduate research proposal: A step-by-step guide in writing proposal for postgraduate students*. MPWS Rich Publication.
- Awang, Z., Lim, S.H., Zainudin, N.F.S. (2018). *Pendekatan Mudah SEM-Structural Equation Modelling*. Bandar Baru Bangi: MPWS Rich Resources
- Awang, Z., Afthanorhan, W.M.A.W., Lim, S.H., Zainudin, N.F.S. (2023). *SEM-Made Simple 2.0: A Gentle Approach of Structural Equation Modelling* Kuala Terengganu: Universiti Sultan Zainal Abidin.
- Bahagian Pendidikan Guru. (2020). *Laporan Tahunan BPG 2019*. Putrajaya: Kementerian Pendidikan Malaysia.
- Balaban, I., Mu, E., & Divjak, B. (2013). Development of an Electronic Portfolio system Success Model: An Information Systems Approach. *Computers and Education*, 60(1), 396–411. <https://doi.org/10.1016/j.compedu.2012.06.013>
- Balaban, I. (2020). An Empirical Evaluation of E-Portfolio Critical Success Factors. *International Journal of Emerging Technologies in Learning*, 15(4), 37–52. <https://doi.org/10.3991/ijet.v15i04.11757>
- Bandura A. (1995). *Self-Efficacy in Changing Societies*. Cambridge University Press.
- Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. (5th ed.). Los Angeles: SAGE Publications
- Dahri, N. A., Vighio, M. S., Al-Rahmi, W. M., & Alismaiel, O. A. (2022). Usability Evaluation of Mobile App for the Sustainable Professional Development of Teachers. *International Journal of Interactive Mobile Technologies iJIM*, 16(16),5. <https://doi.org/10.3991/ijim.v16i16.32015>
- Dehisat, M. M., & Awang, Z. (2020). Exploring items and developing instrument for measuring organizational performance among small medium enterprises in Jordan. *International Review of Management and Marketing*, 10(6), 51. <https://doi.org/10.32479/irmm.10531>
- Department of Statistics Malaysia (2021, June 20). *Internet and Social Media Statistics 2019*. Retrieved from

- https://www.dosm.gov.my/v1/index.php?r=column/cthree&menu_id=WmdGXFWQnJXWEIzbnkl0VEsrbWxtZz09
- Economic Planning Unit (2021). *National Fourth Industrial Revolution (4IR) Policy*. Putrajaya. Economic Planning Unit, Prime Minister's Department.
- Garg, S., & Sharma, S. (2020). User Satisfaction and Continuance Intention for Using E-Training: A Structural Equation Model. *Vision*, 24(4), 441–451.
<https://doi.org/10.1177/0972262920926827>
- Garrison, D. R. (1997). Self-Directed Learning: Toward A Comprehensive Model. *Adult Education Quarterly*, 48(1), 18–33. <https://doi.org/10.1177/074171369704800103>
- Gyamfi, A., Yeboah, A., Ntoaduro, A., Langee, P. and Yeboah, G. (2023). Perceived Impact of Continuous Professional Development on Performance of Senior High School Heads: Does Gender Matter? *Open Journal of Social Sciences*, 11, 52-63.
<https://doi.org/10.4236/jss.2023.111006>
- Hair Jr, J. F., Black, W. C., Babin, B. J., Anderson, R. E., Black, W. C., & Anderson, R. E. (2019). *Multivariate Data Analysis*. (8th ed.). United Kingdom: Cengage
- Karaaslan, A. D. (2003). Teachers' perceptions of self-initiated professional development: A case study on Başkent University English language teachers (Unpublished master's thesis), Middle East Technical University, Turkey.
- Kementerian Pendidikan Malaysia. (2014). *Pelan Pembangunan Profesionalisme Berterusan*. Putrajaya: Kementerian Pendidikan Malaysia.
- Kementerian Pendidikan Malaysia. (2016). *Dokumen Awal Pelan Induk Pembangunan Profesionalisme Keguruan*. Putrajaya: Kementerian Pendidikan Malaysia.
- Kementerian Pendidikan Malaysia. (2018, December 31). Surat Siaran KPM Bilangan 12 Tahun 2018. Retrieved from https://splkpm.moe.gov.my/bahan/Surat_Siaran_MyPPB.pdf
- Kementerian Pendidikan Malaysia. (2019). *Ringkasan Eksekutif Pelan Transformasi ICT 2019-2023*. Putrajaya: Kementerian Pendidikan Malaysia.
- Kothari C. R. (2004). *Research Methodology: Methods and Techniques*. (2nd Revised Ed.). New Delhi: New Age International Publishers.
- Kwok, L. F., & Hui, Y. K. (2017). The Role of e-Portfolio for Smart Lifelong Learning. *Smart Universities*, 327–356. <https://doi.org/10.1007/978-3-319-9454-511>
- Lodico, M. G., Spaulding, D. T., & Voegtler, K. H. (2010). *Methods in Educational Research: From Theory to Practice*. (2nd ed.). United States of America: John Wiley & Sons.
- Muda, H., Loganathan, N., Awang, Z., Jusoh, H., & Baba, Z.S. (2018). *Application Of Theory, Methodology, and Analysis in Conducting Research: A Practical Guide to Quantitative Research and Thesis Writing*. Kuala Terengganu: Universiti Sultan Zainal Abidin.
- Nur Leenna Abdul Rahman, Mahani Mokhtar & Dayana Farzeeha Ali (2020a). Enhancing Self-Initiated Professional Development (SI-PD) Through Technology During COVID-19 Pandemic. *Innovative Teaching and Learning Journal*, 4(2), 30–36.
- Nur Leenna Abdul Rahman, Mahani Mokhtar & Dayana Farzeeha Ali (2020b). Self-Initiated Professional Development among Malaysian TVET Teachers in Vocational Colleges. *International Journal of Psychosocial Rehabilitation*, 24(05), 1000–1009.
<https://doi.org/10.37200/IJPR/V24I5/PR201773>
- OECD (2014). *Indicator D7: How Extensive are Professional Development Activities for Teachers? In Education at A Glance 2014: OECD Indicators* (pp.516-533) OECD Publishing. <https://dx.doi.org/10.1787/888933120461OECD>

- Pantic, K., & Cain, R. (2022). Designing Professional Development for Sustainable Educational Technology Usage: Lessons Learnt from Utah K-12 Teachers. *Journal of the International Society for Teacher Education*, 26(2), 38-54.
- Razak, R. A., & Yusop, F. D. (2013). Designing Framework of Electronic Continued Professional Development for Teachers (e-CPD). *Management and Technology in Knowledge, Service, Tourism and Hospitality*, 2013, 55–57. <https://doi.org/10.1201/b16700-13>
- Razali, N. F. Y. M., Hamid, J., & Hashim, H. (2021). E-portfolio Implementation in Malaysian School: A Need Analysis. *International Journal of Academic Research in Progressive Education and Development*, 10(4), 60–71. <http://dx.doi.org/10.6007/IJARPED/v10-i4/11842>
- Richter, D., Kleinknecht, M., & Gröschner, A. (2019). What motivates teachers to participate in professional development? An empirical investigation of motivational orientations and the uptake of formal learning opportunities. *Teaching and Teacher Education*, 86, 102929. <https://doi.org/10.1016/j.tate.2019.102929>
- Rosly, R. M., & Khalid, F. (2018). Evaluation of the “e-Daftar” System Using the Technology Acceptance Model (TAM). *Creative Education*, 9, 675-686. <https://doi.org/10.4236/ce.2018.95049>
- Round W. H. (2013). Continuing Professional Development Systems for Medical Physicists: A Global Survey and Analysis. *Physica medica: PM: An international journal devoted to the applications of physics to medicine and biology: Official journal of the Italian Association of Biomedical Physics (AIFB)*, 29(3), 261–272. <https://doi.org/10.1016/j.ejmp.2012.03.006>
- Rubio, D.M., Berg-Weger, M., Tebb, S.S., Lee, E.S., & Rauch, S. (2003). Objectifying Content Validity: Conducting A Content Validity Study in Social Work Research. *Social Work Research*, 27(2), 94-104. <https://doi.org/10.1093/swr/27.2.94>
- San Jose, D. L. (2017). Evaluating, Comparing, and Best Practice in Electronic Portfolio System Use. *Journal of Educational Technology Systems*, 45(4), 476–498. <https://doi.org/10.1177/0047239516672049>
- Segaran, M. K., & Hasim, Z. (2021). Self-Regulated Learning Through ePortfolio: A Meta-Analysis. *Malaysian Journal of Learning and Instruction*, 18(1), 131-156. <https://doi.org/10.32890/mjli2021.18.1.6>
- Shkeer, A. S., & Awang, Z. (2019). Exploring the Items for Measuring the Marketing Information System Construct: An Exploratory Factor Analysis. *International Review of Management and Marketing*, 9(6), 87. <https://doi.org/10.32479/irmm.8622>
- Song, B. K. (2021). E-portfolio Implementation: Examining Learners’ Perception of Usefulness, Self-Directed Learning Process, and Value of Learning. *Australasian Journal of Educational Technology*, 37(1), 68–81. <https://doi.org/10.14742/ajet.6126>
- Stockemer, D. (2019). *Quantitative Methods for the Social Sciences*. Springer, Cham. <https://doi.org/10.1007/978-3-319-99118-4>
- Tabachnick, B. G., & Fidell, L. S. (2014). *Using multivariate statistics* (6th Ed.). Harlow: Pearson Education.
- Taherdoost, H., Sahibuddin, S., & Jalaliyoon, N. (2014). Exploratory Factor Analysis; Concepts and Theory. Jerzy Balicki. *Advances in Applied and Pure Mathematics, Mathematics and Computers in Science and Engineering Series*, 27, 375–382.
- Zaid, N. & Yusof, M. M. (2022). Penilaian Penerapan Sistem Pengurusan Latihan di Sektor Awam: Satu Kajian Kes. *Jurnal Teknologi Maklumat dan Multimedia Asia-Pasifik*, 11(2), 18 – 39. <https://doi.org/10.17576/apjitm-2022-1102-02>

Zimmerman, B. J. (1986). Becoming a Self-Regulated Learner: Which Are the Key Subprocesses? *Contemporary educational psychology*, 11(4), 307-313.

Zhu, M., Bonk, C. J., & Doo, M. Y. (2020). Self-Directed Learning in MOOCs: Exploring the Relationships Among Motivation, Self-Monitoring, and Self-Management. *Educational Technology Research and Development*, 68(5), 2073–2093. <https://doi.org/10.1007/s11423-020-09747-8>