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Exploratory Factor Analysis for Professional Development, Technological Skills, Teacher Competence and Self Determined Learning (Sdl)

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Abstract: Teachers have an important role in 21st-century education as the main agent or facilitators in their teaching approach. Moreover, the teacher's teaching approach is a significant part of the overall effectiveness with regard to the Teaching and Learning (TnL) process. Consequently, this research focuses on the development process as well as instruments validation to measure four constructs, namely Professional Development, Technology Skills, Teacher Competence, and Self-Determined Learning (SDL). The researcher adapted and modified all these items by referring to theories, models and opinions given by experts related to each construct. This newly developed 100-item instrument by assessing its validity and reliability through Exploratory Factor Analysis (EFA) and examining the relationships between constructs as Pearson Correlation. The instrument was given to a sample of 140 primary school teachers. After EFA analysis, 10 items were removed, leaving a total of 90 items. The EFA produced high Kaiser-Meyer Olkin (KMO) values, which were 0.803 for Professional Development, 0.898 for Technology Skills, 0.876 for Teacher Competence, and 0.883 for SDL. The instrument indicated excellent internal consistency, having Cronbach's alpha values for each construct exceeding 0.80, indicating its suitability as a data collection tool. Reliability analysis also showed acceptable consistency with regard to the instrument. Subsequently, the validation process, with a total of 90 items remained as the final items for this instrument. Note that full details of reliability analysis, validation, along with research findings, are described in this paper. The findings of this research will encourage and motivate school teachers to develop their Teaching and Learning (TnL).

Keywords: Heutagogy, Self-Determined Learning, Professional Development, Technological Skills, Teacher Competence.

1. Introduction

The twenty-first century has seen an extraordinary increase in development and transformation in the ever-changing field of education. The educational environment has evolved into a dynamic arena of information distribution, from traditional classroom settings to the virtual expanses of digital learning. Primary school teachers, who have the key to creating society's intellectual fabric, are fundamental to this shift. As we stand at the crossroads of educational growth, a critical issue arises: How can primary school teachers be properly equipped to traverse this changing terrain? At the heart of this study are four vital constructs: Professional Development, Technological Skills, Teacher Competence, and Self-Determined Learning (SDL). Professional Development serves as a beacon, helping primary school teachers to always improve their profession and adapt to transforming teaching paradigms. Technological Skills have transformed the art of education, changing classroom interactions

and student involvement. Teacher competence goes beyond academic comprehension to include the mastery of efficient teaching strategies. Among them, Self-Determined Learning emerges as the cornerstone, permitting educators to actively direct their professional development towards mastery. This study begins on an adventurous trip to uncover the complicated interaction of these components among primary school teachers. We want to shed light on the intricate linkages that underpin effective teaching by diving into the latent dimensions using exploratory factor analysis. Through this endeavor, we hope to contribute to the scholarly conversation and give actionable insights that can influence the path of primary education, allowing teachers to equip kids with the skills and knowledge required for success in an ever-changing world. The first construct of this instrument is Professional Development. It plays a crucial role in fostering SDL in educational contexts. Professional Development provides primary school teachers with an in-depth understanding of SDL, including its underlying theories, research findings, and best practices (Blaschke, 2012). This knowledge enables teachers to foster and support SDL among their students. In addition, the SDL-focused Professional Development opportunities allow teachers to improve their instructional skills (Ivaniuk et al., 2020). They can acquire teaching methodologies, evaluation procedures, and classroom management techniques that foster student autonomy and agency. Teachers can build engaging learning environments that encourage students to assume responsibility for their own learning by enhancing their teaching methods. Professional Development equips teachers with tools for cultivating SDL-friendly learning environments (Hermans et al., 2008). They are taught how to develop a pleasant classroom environment, encourage cooperation and inquiry, and foster a culture of autonomy and respect. Teachers encourage students to take risks, explore their interests, and develop SDL skills by fostering a secure and supportive environment. SDL Professional Development promotes teachers to become lifelong learners. Teachers model the significance of continual growth and development as they investigate new techniques, research, and teaching approaches. Teachers can continuously enhance their work and adapt to the changing demands of their students if they participate in their own professional learning. It should be noted that Professional Development is an essential component of promoting Self-Directed Learning in education. Teachers are provided with knowledge, skills, and a supportive environment so that they can nurture their students' autonomy and foster a culture of continuous learning in their institutions. This instrument's second construct is Technological Skills. Teachers can access large amounts of material and resources that help SDL given technology (Curran & Meuter, 2005). Teachers with Technological Skills can search for and curate relevant digital content, such as online articles, films, interactive simulations, and educational websites. Other than that, teachers may give students a wealth of resources to explore their interests and expand their understanding by utilizing technology. Teachers with technological skills can utilize digital tools and platforms to personalize training based on skills' needs, preferences, and learning styles. They can utilize adaptive learning tools, online tests, and learning management systems to supervise student progress, present timely feedback, and provide tailored learning routes. This level of personalization encourages students to bear responsibility with regard to their learning and pursue their unique interests.

Teachers equipped with Technological Skills can enhance collaboration and communication between students (Matthew et al., 2022). Teachers can establish virtual places for students to communicate, share ideas, and collaborate on projects using online platforms, discussion forums, and video conferencing tools. By encouraging collaborative learning, teachers encourage students to engage in peer-to-peer interactions, exchange perspectives, and co-create knowledge, thus boosting their SDL process. Other than that, teachers with Technological Skills can combine digital tools and multimedia materials to stimulate innovation and creativity (Petrova & Belyakova, 2020). Integrating advances in computer and information technology in learning with a new approach is the latest development in the world of education. Technology will make students more innovative and effective and helped to be independent learners (Amiruddin et al., 2023). Teachers can instruct students on how to use digital creation tools, such as video editing software, graphic design programs, and coding platforms, to creatively express their ideas, solve problems, and demonstrate their learning. By introducing technology into SDL, teachers inspire students to express their creativity and think critically about how technology might enhance learning experiences. In conclusion, Technological Skills empower teachers in their efforts to enhance Self-Directed Learning through personalized resources, collaboration, and creativity, thereby fostering greater student independence (Mawas,

2018). Teacher Competence is the third construct of the instrument. Teachers' SDL competence gives them the knowledge and skills essential to lead and encourage students' independent learning (Ansong et al., 2017). They comprehensively understand the theories, instructional methodologies, and evaluation techniques that support SDL learning. This knowledge allows teachers to give students the appropriate advice, resources, and support to develop critical skills such as goal setting, self-reflection, and self-regulation. In addition, teachers' competence in SDL enables them to tailor instructions to each student's unique requirements and interests (Young, 2005). They are able to design learning experiences that empower students to make skills, pursue their passions, and take responsibility for their own learning. Through varied instruction, teachers can give students a variety of strategies to attain learning objectives, catering to each student's individual abilities and learning styles. Therefore, Teacher Competence is vital for cultivating Self-Directed Learning, facilitating educators in providing tailored guidance and creating empowering learning experiences for students in order to facilitate Self-Directed Learning within the classroom. SDL is the fourth construction of this instrument. It encourages internal motivation and active participation among students (Saeed & Zyngier, 2012). When children have the freedom to determine what and how they wish to learn, they become more invested in the process. This increases curiosity, enthusiasm, and a genuine desire to acquire knowledge and skills. By tapping into their interests and passions, students are more likely to maintain their motivation and engagement over time. Not only that, encourages student's internal motivation and active participation and involvement develop the curiosity and genuine desire for knowledge by giving them chance to determine what and how they wants to learn according to their interests. As a result, the researcher realized that more research was needed on the relationships between Professional development, technological skill, teacher competence and self-directed learning skills. Therefore, the researcher made the decision to create a single instrument to determine the link between those three key components. An instrument's content validity is examined to see if it accurately captures every relevant construct that it aims to evaluate by the experts. In this sense, a construct is a theoretical concept, subject, or idea, more particularly one that is often not instantly measurably (Golonka et al., 2023). In this research, context validation was conducted on the 100-item. Content validation refers to the process of assessing whether the items on the instrument sufficiently examine the measured construct with the assistance of experts (Ramli et al., 2020). In this study, a panel of practitioners, including two lecturers in higher education, two officers in district education, and four teachers from primary education, evaluated the content of this instrument as shown in the following Table 1.

Table 1: The expert's position and expertise involved in the study

Experts	Position	Expertise
E1	Professor in Public University	AMOS & SEM
E2	Lecturer in Public University	Information and Communication Technology
E3	Assistant Director of Information and Communication Technology	Information and Communication Technology
E4	PPD Assistant, Educational Resources & Technology Unit	Information and Communication Technology
E5	Lecturer in Teachers training collage	Language/Curriculum
E6	Lecturer in Teachers training collage	Language/Curriculum
E7	Teacher (Head of Panel)	Language expert
E8	Teacher (GC)	Language expert
E9	Teacher (Head of Panel)	Language expert
E10	Teacher (GC)	Language expert

Each item in this instrument was evaluated for its applicability, clarity, thoroughness, and significance. To evaluate the construct validity and reliability of the instrument, however, more analyses are necessary. This research has established three research objectives to serve as its guide.

Objectives

1. To determine the reliability of professional development, technological skills, teacher competence and self-determined learning (SDL).
2. To determine the construct validity of professional development, technological skills, teacher competence and self-determined learning (SDL).
3. To determine the correlation between the construct of professional development, technological skills, teacher competence and self-determined learning (SDL).

2. Methods

To meet the goals of this research, a survey study employing quantitative research was conducted using Exploratory Factor Analysis (EFA). The reliability was employed to measure the extent of the items with regard to the constructs of professional development, technological skills, teacher competence and self-determined learning (SDL). The study was conducted among primary school teachers. The data were collected using Drop-Off and Pick-Up (DOPU) method and via Google link by online questionnaire. Additionally, this study obtained ethical approval from the Educational Research Application System (ERAS 2.0) to collect the required data. The sample of this research was 150 primary school teachers from Jempol and Kuala Pilah districts and this sample was used in the factor analysis. A total of 59 primary school teachers have responded using the given Google link (response 84%). Meanwhile, using the DOPU methods, the researcher obtained 100 respondents after giving 130 instruments to primary school teachers (response 77%). The researcher re-examined all the questionnaires collected using the DOPU method and found that a total of 9 questionnaires were not answered completely. This means, 9 sets of questionnaires could not be accepted by the researcher due to the failure of respondents not to answer questions beyond 25% (Sekaran, 2003). Therefore, researcher decided on a total of 150 respondents for data analysis of pilot study. Prior to performing the analysis, the researcher was examined for accuracy od data entry, missing values, normality and outlier. However, out of a total of 150 respondents, the researcher found that there were 10 outliers after normality test. Consequently, 140 respondent data was used to analyse the factor analysis. This study's sample size was sufficient for Exploratory Factor Analysis (EFA) (MacCallum et al. 1999; Zeynivandnezhad et al. 2019). The researcher adapted and modified all these items by referring to the theories, models and opinions given by experts regarding each construct. An instrument is used to measure the variables in this research. A good questionnaire needs to be designed properly so that it can be an effective data collection tool. A short and simple language are used in this instrument in order to helps respondents to understand the questions easily. Furthermore, it will help respondents cooperate with the researcher to answers the questionnaire with full of involvements. This instrument was developed as a 10-point Likert scale (unlabelled), having responses ranging from (1) strongly disagree to (10) strongly agree. This instrument lacked a midpoint response or neutral option. The 10-point Likert scale also enabled the collection of more specific replies and the distribution of scores to additional alternatives (Chang et al., 2022). Since a 10-point Likert scale is one of the most popular scale types, it could also inspire responders to provide more honest responses (Leso et al., 2023). The survey consists of 5 parts, namely part A, the demographic profile of the respondents; part B, 18 items covering the dimension of professional development; part C, 33 items covering the dimension of Technological Skills; part D, 25 items covering the dimension of teacher competence; and part E, 24 items covering the dimension of Self-Determined Learning (SDL). Table 2 shows the total items in this instrument.

Table 2: Item-specification of instrument

Constructs	No. of Items
Professional Development	18

Technological Skills	33
Teacher Competence	25
SDL	24
Total	100

The data were analysed using Social Science (SPSS) software version 26. In data analyse Cronbach's Alpha were used to examine the reliability and Exploratory Factor Analysis (EFA) were used to examine the construct validity. Therefore, this research study was undertaken to produce empirical evidence of the validity and reliability of the instruments of four constructs namely Professional Development, Technology Skills, Teacher Competence and Self-Determined Learning (SDL) using Exploratory Factor Analysis (EFA) and Cronbach's alpha.

3. Results

The data analysis includes 100 items in the 4 constructs, specifically 18 items in Professional Development, 33 in Technological Skills, 25 in Teacher Competence, and 24 in SDL. Cronbach's alpha and EFA results are shown in tables using Kaiser-Meyer-Olkin (KMO) as well as Bartlett's Tests, eigenvalues and factor loadings for the constructs. Based on the analysis results, all items are related to the studied item because they meet the requirements. The results of the factor analysis will be presented in greater depth.

Cronbach's Alpha: Reliability refers to the degree of measurement to measure the instrument's consistency (Garson, 2012). Note that a high-reliability value symbolizes a level of confidence. In addition, the instrument's reliability was examined using Cronbach's alpha coefficient for a Likert scale questionnaire. A Cronbach's alpha value greater than 0.70 is deemed acceptable consistent, and stable (Pallant, 2011; Taherdoost, 2016). Meanwhile, Bartlett et al., (2001) stated that a Cronbach's alpha value of 0.60 was acceptable. Table 3 represents the accepted alpha values by Sekaran (2003) whereby followed in this research study.

Table 3: The value of Cronbach's Alpha

Cronbach's alpha	Internal Consistency
$a \geq 0.9$	Excellent
$0.9 > a \geq 0.8$	Good
$0.8 > a \geq 0.7$	Acceptable
$0.7 > a \geq 0.6$	Questionable
$0.6 > a \geq 0.5$	Poor
$0.5 > a$	Unacceptable

The value of Cronbach's alpha is greater than 0.80 for each construct. Precisely, Cronbach's alpha value with regard to the Professional Development construct is 0.893, Technological Skills is 0.950, and followed by Teacher Competence is 0.952 and SDL 0.950. Given that Cronbach's alpha value of each dimension is greater than 0.70, each construct in the instrument has a high-reliability value. Since Cronbach's alpha values fall within the discrimination power index range that differentiates $0.70 < r11 < 0.90$, all items within each dimension also possess a high level of discriminating power (Table 4). This signifies that all the items in each construct meet the criteria and may be utilized as a data collection tool.

Table 4: Cronbach's alpha value of all the Construct

Construct	Number of Items	Cronbach's alpha	Interpretation of Differentiating Power
Professional Development	18	0.893	Good
Technological Skills	33	0.950	Excellent
Teacher Competence	25	0.952	Excellent
SDL	24	0.950	Excellent

Exploratory Factor Analysis (EFA): EFA is a strong tool used in research and statistics to find underlying factors or dimensions within a set of observed variables. Frequently, these observed variables are included in a questionnaire designed to assess the construct validity of the variables. According Fraenkel and Wallen (1996) in Ghazali et al.(2016), as a tool that enables data inference, validity is defined as an appropriateness, truthfulness, meaningfulness and valuable. The primary objective of EFA is to assess the underlying structure of the data and establish how observed variables are grouped into meaningful components. In this study, 100 items were subjected to EFA to obtain (1) KMO value and Bartlett's Tests, (2) eigenvalues, and (3) factor loading score for each construct.

Kaiser-Meyer-Olkin (KMO) value and Bartlett's Tests: In this study, the KMO value and Bartlett's Tests results (Table 5) indicated that the intercorrelation between samples was adequate, with values of 0.803 for the Professional Development construct, 0.906 for the Technological Skills construct, 0.876 for the Teacher Competence construct, and 0.883 for the SDL construct. It may be deduced from these results that all objects have a KMO value of 0.6 ($\lambda \leq 0.6$) and Bartlett's value of $p < 0.05$.

Table 5: KMO and Bartlett's Tests

KMO Measure of Sampling Adequacy (Professional Development)	.803
Bartlett's Test of Sphericity (Approx. Chi-Square)	1884.857
Df	153
Sig.	.000
KMO Measure of Sampling Adequacy (Technological Skills)	.898
Bartlett's Test of Sphericity (Approx. Chi-Square)	5222.060
Df	528
Sig.	.000
KMO Measure of Sampling Adequacy (Teacher Competence)	.876
Bartlett's Test of Sphericity (Approx. Chi-Square)	4281.656
Df	300
Sig.	.000
KMO Measure of Sampling Adequacy (SDL)	.883
Bartlett's Test of Sphericity (Approx. Chi-Square)	2994.859
Df	276
Sig.	.000

Eigenvalues: Overall, the eigenvalues based on Varimax rotation possess an overall value of greater than 1. The cumulative eigenvalues (%) have a value greater than 60%, precisely 77.77% for the Professional Development construct, 78.87% for the Technological Skills construct, 81.68% for the Teacher Competence construct and 79.12% for the SDL construct (Table 6). From these results, it can be deduced that every item has a value of

greater than 1 and a cumulative eigenvalue > 60%. Hence, depending on the eigenvalue results, all items in this construct may be utilized as a data collection tool.

Table 6: Results of Initial Eigenvalue

Construct	Initial Eigenvalue			
	Component	Total (%)	Variance (%)	Cumulative (%)
Professional Development (PP)	1	6.613	36.737	36.737
	2	2.770	15.389	52.126
	3	1.797	9.986	62.112
	4	1.505	8.359	70.470
	5	1.313	7.297	77.767
Technological Skills (KT)	1	14.411	43.671	43.671
	2	3.590	10.879	54.550
	3	2.681	8.124	62.674
	4	1.624	4.923	67.597
	5	1.392	4.217	71.814
	6	1.223	3.705	75.519
	7	1.104	3.346	78.865
Teacher Competence (KG)	1	11.944	47.777	47.777
	2	2.954	11.817	59.594
	3	2.511	10.045	69.639
	4	1.659	6.635	76.274
	5	1.352	5.410	81.683
Self-Determined Learning (SDL)	1	11.386	47.442	47.442
	2	2.066	8.609	56.052
	3	1.769	7.373	63.424
	4	1.418	5.907	69.331
	5	1.310	5.458	74.789
	6	1.040	4.334	79.122

Factor Loading

Factor loading, in the context of EFA, is a statistical measure that indicates the direction as well as strength of the relationship between observed constructs. EFA is a statistical technique used to identify the underlying constructs that describe the patterns of correlation among a set of observed variables. Table 7 shows the Rotated Component

Matrix of the constructs. Professional Development construct load in five factor loading components, Technological Skills construct load in seven factor loading components, Teacher Competence construct load in five factor loading components, and SDL construct load in six factor loading components. The EFA analysis has placed factor loading at the level of 0.6 ($\lambda \leq 0.6$) to identify the generation of loading factors. Based on the generation, there are 10 items (PPK1, PPL4, TK5, PK3, TPK3, PG1, KP4, NL5, MR1, PS4) that have a factor loading value (λ) less than 0.6 ($\lambda < 0.6$).

Table 7: Rotated Component Matrix

Construct	Factor Loading Components							
	Item	1	2	3	4	5	6	7
Professional Development (PP)	PPK1							
	PPK2			.881				
	PPK3			.885				
	PPK4			.813				
	PPP1	.857						
	PPP2	.893						
	PPP3	.932						
	PPP4	.914						
	PPL1		.882					
	PPL2		.901					
	PPL3		.812					
	PPL4							
	PPI1				.878			
	PPI2				.688			
	PPI3				.814			
	PPM1					.710		
	PPM2					.879		
	PPM3					.876		
Technological skills (KT)	TK1		.714					
	TK2		.859					
	TK3		.890					
	TK4		.834					
	TK5							
	TK6		.746					
	CK1				.798			
	CK2				.818			

	CK3				.813			
	CK4				.844			
	PK1			.876				
	PK2			.787				
	PK3							
	PK4			.744				
	PK5			.870				
	TCK1							.854
	TCK2							.463
	TCK3							.873
	TCK4							.826
	TPK1						.736	
	TPK2						.749	
	TPK3							
	TPK4						.602	
	TPK5						.612	
	PCK1	.671						
	PCK2	.858						
	PCK3	.860						
	PCK4	.830						
	PCK5	.813						
	TPA1					.759		
	TPA2					.768		
	TPA3					.726		
	TPA4					.754		
Teacher competence (KG)	KM1		.833					
	KM2		.865					
	KM3		.841					
	KM4		.821					
	KM5		.828					
	PG1							
	PG2				.805			
	PG3				.719			

	PG4				.748			
	PG5				.727			
	SK1	.878						
	SK2	.866						
	SK3	.880						
	SK4	.888						
	SK5	.879						
	KP1					.748		
	KP2					.789		
	KP3					.850		
	KP4							
	KP5					.864		
	NL1			.728				
	NL2			.831				
	NL3			.860				
	NL4			.824				
	NL5							
Self-determined learning (SDL)	MR1							
	MR2						.805	
	MR3						.645	
	MR4						.874	
	MC1		.794					
	MC2		.779					
	MC3		.785					
	MC4		.709					
	KB1	.799						
	KB2	.861						
	KB3	.813						
	KB4	.794						
	PS1					.754		
	PS2					.765		
	PS3					.850		
	PS4							

	RF1				.732			
	RF2				.788			
	RF3				.787			
	RF4				.735			
	BH1			.809				
	BH2			.804				
	BH3			.727				
	BH4			.775				

Based on the result of EFA, there were three items that loaded onto Factor 3 measure readiness, four items that loaded onto Factor 1 measure planning, three items that loaded onto Factor 2 measure training, three items that loaded onto Factor 4 measure implementation and three more items that loaded onto Factor 5 measure maintenance in professional development construct. In the construct of technology skills, there were five items that loaded onto Factor 2 measure technological knowledge (TK), four items that loaded onto Factor 4 measure content knowledge (CK), four items that loaded onto Factor 3 measure pedagogical knowledge (PK), four items that loaded onto Factor 7 measure technological content knowledge (TCK), four items that loaded onto Factor 6 measure technological pedagogical knowledge (TPK), five items that loaded onto Factor 1 measure pedagogical content knowledge (PCK) and four more items that loaded onto Factor 5 measure technological pedagogical content knowledge (TPACK). Besides that, there were five items that loaded onto Factor 2 measure skills, four items that loaded onto Factor 4 measure knowledge, five items that loaded onto Factor 1 measure attitude, four items that loaded onto Factor 5 measure personality and four more items that loaded onto Factor 3 measure moral value in teacher competence construct. Moreover, in the construct of SDL, there were three items that loaded onto Factor 6 measure explore, four items that loaded onto Factor 2 measure create, four items that loaded onto Factor 1 measure collaboration, three items that loaded onto Factor 5 measure share, four more items that loaded onto Factor 4 measure reflection and four more items that loaded onto Factor 3 measure connect. Based on the Rotated Component Matrix, a total of 10 items were eliminated from these instruments because the 10 items failed to meet factor loading at the level of 0.6 ($\lambda \leq 0.6$) and did not contribute to a simple factor structure. Hence, based on the EFA analysis, a total of 90 items will be retained in this construct.

Correlation: Researchers frequently utilize correlation analysis to find links and assess the strength of the association between the researched variables. Correlation refers to the relationship between the researched variables, whereas the correlation coefficient (r) represents the degree of the correlation in a study. Reading and interpreting Pearson correlations involves understanding the relationship's direction, strength, and significance between two continuous variables. Moreover, Pearson's correlation test is conducted to examine whether two continuous variables are related (Sheridan et al., 2010). On a scale of -1 to +1, the in-test assesses the association that reflects the strength of the linear relationship between two variables. When the correlation is positive, the relationship between the variables is positive. In other words, an increase in the value of one variable will increase the values of other variables. A negative value, on the other hand, implies a negative association between the two variables. In the meantime, the magnitude value (r) represents the strength of the variables' linear relationship (Alan & Barbara, 1999). The correlation coefficient value below 0.09 is very weak, and above 0.70 is very strong. In this study, correlation strength is determined by the size of the correlation coefficient suggested by Davies (1971) and displayed in Table 8.

Table 8: Strength of correlation coefficient

Correlation Coefficient Value (r)	Internal Consistency
0.70 – 1.00	Very Strong
0.50 – 0.69	Strong
0.30 – 0.49	Moderate
0.10 – 0.29	Weak
0.01 – 0.09	Very weak

Table 9 presents the findings of a Pearson correlation test that determined the strength of the association between Professional to determine the relationship between Professional Development, Technological Skills, Teacher Competence, and SDL among primary school teachers.l Development, Technological Skills, Teacher Competence, and SDL as reflected by the correlation coefficient for 140 samples, r. All factors demonstrate significant relationships, with p-values less than 0.01 for all constructs. Professional Development has a very strong association with Technological Skills. In comparison, Teacher Competence has a moderate correlation with Professional Development and a very strong positive correlation with Technological Skills. SDL has a moderate correlation with Professional Development and a very strong positive correlation with Technological Skills and Teacher Competence. These results show a positive, significant relationship between Professional Development and Technological Skills (r =.580, p< 0.01). Professional Development also possesses a positive moderate significant relationship with Teacher Competence (r =.417, p< 0.01). Apart from that, there is a positive, strong significant relationship between Technological Skills and Teacher Competence (r =.606, p< 0.01). Professional Development also has a positive moderate significant relationship with Self-Determined Learning (r =.374, p< 0.01). Moreover, Technological Skills also have a positive, strong significant relationship with Self-Determined Learning (r =.609, p< 0.01). Teacher Competence also has a positive, significant relationship with Self-Determined Learning (r =.627, p<0.01).

Table 9: Correlations

N=140			Correlation	
Constructs	PP	KT	KG	SDL
Professional Development (PP)	1			
Technological Skills (KT)	r =.580** (p =.000)	1		
Teacher Competence (KG)	r=.417** (p=.000)	r=.606** (p=.000)	1	
Self-Determined Learning (SDL)	r=.374** (p=.000)	r=.609** (p=.000)	r=.627** (p=.000)	1

A summary of Cronbach's alpha values and EFA results, including KMO, Bartlett's Tests, eigenvalues, and factor loadings, determined that all construct components met the loading factor criterion except for 10 items (PPK1, PPL4, TK5, PK3, TPK3, PG1, KP4, NL5, MR1, PS4), which did not meet the loading factor criteria. After removing the items that do not fulfil the requirements, others in each construct can be used to determine the relationship between Professional Development, Technological Skills, Teacher Competence and SDL among primary school teachers. Meanwhile, in the summary of the Pearson correlation, all four constructs exhibit a positively significant relationship with each other.

4. Discussion

This instrument is specifically designed to identify the construct validity as well as reliability of the instrument for the constructs of Professional Development, Technological Skills, Teacher Competence, SDL and the correlation between these constructs. The instrument has 100 items that cover four constructs such as (a) Professional Development, (b) Technological Skills, (c) Teacher Competence, and (d) SDL among teachers. The items and structures of this instrument were created based on exhaustive reviews of previous research and theoretical debates. Through face validation, content validation, as well as pilot testing, this instrument has sustained several rounds with regard to improvement. Moreover, to evaluate the construct validity as well as internal consistency of this assessment instrument, it was uploaded online and distributed to primary school teachers. Based on excellent reliability values that range from 0.893 to 0.952, it may be concluded that the instrument may be duplicated by other sets of teachers in Malaysia. In the meantime, the EFA analysis was conducted to examine the underlying structure and adjustments among the items. The study's results determined that not all the items in the instruments met the loading factor. Hence, there are 10 items (PPK1, PPL4, TK5, PK3, TPK3, PG1, KP4, NL5, MR1, PS4) that have a factor loading value (λ) less than 0.6 ($\lambda<0.6$) and not meet the factor loading. Moreover, these items cannot be utilized as a measuring tool for acquiring research data in the future. According to Hair et al., (2010) and Pallant, (2016), the items for the research instruments in the factor analysis should possess a loading factor of 0.05. It also identifies items that load onto specific factors and eliminates items that did not load onto any extracted factors. The analysis revealed that this instrument is valid and reliable and may be used to examine the relationship between Professional Development, Technological Skills, Teacher Competence and SDL among primary school teachers. The Professional Development construct offers teachers a variety of perspectives to organize and design an activity that enhances their professional development in a variety of ways. Teachers can also train themselves with various new strategies and approaches they have learned in professional development programs, share them with their coworkers, and apply them in their lessons. Apart from that, the Professional Developments construct also can provide a good overview whereby the primary school teachers have a solid foundation in Professional Development. They make educated judgments about instructional methods, adapt their teaching to fit different learning styles, and plan lessons that foster greater student knowledge and involvement. In addition, they are able to successfully control classroom dynamics and provide students with meaningful feedback, which promotes their growth and development. This result is consistent with the teachers of previous research indicating that a solid foundation in Professional Development enables primary school teachers to make informed decisions regarding instructional methods, adapt their teaching to accommodate different learning styles, and design lessons that promote deeper student understanding and engagement (Nguyen et al., 2022; Parker et al., 2022). As a conclusion, the Professional Development construct equips teachers with diverse perspectives and strategies to enhance their professional growth, enabling them to share knowledge with colleagues, adapt to various learning styles, and design impactful lessons. This solid foundation empowers primary school educators to make informed decisions, maintain effective classroom dynamics, and provide valuable feedback to foster student development, aligning with findings from previous research.

The following construct is Technological Skills, through which teachers can modify learning experiences to meet these variances utilizing technology. They can offer varied difficulty levels, modify the instructional speed, and provide additional support or enrichment based on the talents and development of each student. Teachers can create a more inclusive and student-centered learning environment using individualized education utilizing Technological Skills. Students receive individualized attention and are allowed to build on their abilities while

receiving assistance in areas where they may struggle. Students' involvement, motivation, and academic growth are enhanced by this method. This outcome is consistent with previous studies indicating that teachers' capacity to execute differentiated education through Technological Skills is essential (Alshareef et al., 2022; Ilmiddinovich, 2022). It enables them to meet the different needs of their students, foster individualized learning experiences, and ultimately improve student success and accomplishment. This is explain that, Technological Skills enable teachers to customize learning experiences using technology, fostering individualized education that boosts student engagement, motivation, and academic growth with is aligns with prior research emphasizing the importance of teachers' capacity to improved student success and achievement. The Teacher Competence construct consists of the teachers' skills, knowledge, attitude, personality and moral value. When teachers have a high level of Teacher Competence, they can present material efficiently, engage students, as well as foster a deeper comprehension with regard to the subject matter. By adopting a variety of instructional techniques, for example, active learning, cooperative learning, inquiry-based learning, and differentiated instruction, teachers may accommodate a variety of learning styles and increase student engagement. They are able to adapt their teaching approaches to the requirements and interests of their students, ensuring that each student receives the required assistance and direction for academic development. This result is consistent with the teachers of previous research, according to which Teacher Competence is vital because it directly influences instructional effectiveness and student learning outcomes (Dervenis et al., 2022; Liu et al., 2022). This statement emphasizes that when teachers possess great Teacher Competence, they are able to provide high-quality education, engage students in meaningful ways, and foster a climate conducive to student achievement. As a conclusion, a high level of Teacher Competence, encompassing skills, knowledge, attitude, personality, and moral values, enables teachers to effectively present material, engage students through various instructional techniques, and adapt to diverse learning styles. The final construct is SDL, which empowers student autonomy by enhancing students to take charge of their learning experience. Other than that, it empowers children to make decisions, set goals, as well as actively engage in educational decision-making. By adopting SDL, teachers can foster an environment that enhances students to play an active role in their own learning path. In addition, SDL also helps students explore the learning materials and create creative learning outcomes during the lessons. Students can also share their knowledge and collaborate with classmates, enabling them to provide reflections on learning outcomes. Additionally, students have the opportunity to connect with the learning environment and community, which enhances their motivation for learning. Furthermore, in the SDL approach, the teacher assumes the role of a facilitator throughout the learning process, offering assistance, feedback, and guidance to students. They give scaffolding and resources that correspond to the interests and learning needs of the students. The teacher provides students with positive feedback, assists them in assessing their development, and encourages them to modify and improve their work. They also provide timely and specific feedback that helps students monitor their learning and make necessary adjustments. This result aligns with previous results whereby the teacher's role in enhancing SDL in the heutagogy approach involves creating a supportive environment, nurturing student agency, promoting metacognitive skills, facilitating inquiry-based learning, providing guidance and feedback, and fostering collaboration (Engelbrecht & Oates 2022; Soydan Oktay & Yüzer 2023). This statement explains that through the teacher's facilitation and support, the teacher empowers students to become active learners, capable of self-direction, critical thinking, and lifelong learning. This outcome is consistent with the findings of previous studies. Moreover SDL empowers students to take control of their learning, make decisions, set goals, and actively engage in educational decision-making. This approach fosters a collaborative learning environment, encourages creativity, enhances motivation, and positions teachers as facilitators offering guidance and feedback. Moreover, based on the correlation result analysis, the researcher concluded that in the population of primary school teachers in Jempol and Kuala Pilah districts of Negeri Sembilan Malaysia, Professional Development has a strong relationship with Technology Skills. Meanwhile, Technology Skills have a strong relationship with Teacher Competence and the SDL approach. Besides that, the SDL also has a strong relationship with Teacher Competence. This means that the teachers in the Jempol and Kuala Pilah districts have enhanced their skills in Professional Development, Technology Skills, Teacher Competence and SDL. Surely, Professional Development, Technology Skills, Teacher Competence and SDL play an important role in the effectiveness of the Teaching and Learning (TnL) process.

5. Conclusion

In conclusion, this instrument is proven to be a valid and reliable instrument to determine the construct reliability as well as the validity of the instrument of Professional Development, Technological Skills, Teacher Competence, and SDL among primary school teachers using EFA. A sample of 140 respondents, consisting of primary school teachers, were selected randomly. Data were collected online and by the DOPU method. The findings revealed 100 items for four constructs, whereby 18 items were in Professional Development, 33 in Technological Skills, 25 in Teacher Competence and 24 in SDL. Based on the analysis results, 10 items do not fulfil the requirements with regard to the criteria; hence its necessary to reduce the items' number following the EFA results. Overall, this instrument's development has been accomplished in generating an instrument that can test the relationship between Professional Development, Technology Skills, and Teacher Competence towards SDL through some steps in the development as well as the validation process. The results of the EFA analysis are predicted to add more knowledge in the field of Professional Development, Technology Skills, Teacher Competence and SDL as well as in teachers' teaching approaches, particularly in the context of Malaysia. The findings of this research can be used as a guide for the MOE, JPN and PPD to organize various programs that are compatible with SDL, professional developments, teacher competence and technology skills that will encourage and motivate primary school teachers to develop their Teaching and Learning (TnL) process. In this way, the school administration can empower school performance and student achievement by improving the quality and efficiency of the national education system. Further research is highly recommended to explore the SDL of other factors that can influence primary education.

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