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Rasch Analysis in Measuring Instruments Lifelong Learning Skills Among Design and Technology Teachers: A Pilot Study

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Abstract

This study aimed to investigate the empirical evidence regarding the validity and reliability of a questionnaire on lifelong learning skills using Rasch Model Analysis in pilot study. There is purposive sampling applied in this pilot study. Seventy (n=70) respondents in service were enrolled in this study had completed the questionnaire. The content was validated by four experts in the field of Design and Technology (DNT). Data analysis was completed using WINSTEPS software version 3.69.1.11 whereby the findings revealed that the lifelong learning instruments possessed high reliability within five constructs. Based on the Person Reliability 0.98, and Item Reliability of 0.91 it was concluded that the instruments of lifelong learning skills are reliable and can be accepted. After being subjected to Rasch Model Analysis, there are thirty-five (35) items needed to be omitted while others were retained. It is hoped that by ensuring good reliability and validity of the instruments, researches will be able to adopt or adapt this quality instrument in their research. Thus, this study shows that the Rasch Measurement model can analyse the truth result, reliable, validate the good instruments, and proceed in their actual research.

Keywords: Rasch Measurement Model, Validity, Reliability, Lifelong Learning Skills

Introduction

The definition of skills is broad based on leverage the people, situations, place and thing surroundings. Skills workers recognized as quality aspects essential for every teacher in developing their competency in teaching and learning and job performance (Lase, 2019; Saien et al., 2019; Green, 2015; Hamzah & Udin, 2011). There are different skills with a different job need to acquire based on the workplace. Teachers' is a significant person in the education sector to deliver any new or compulsory knowledge (Jarvis, 2006). The responsibility relates with community and people, such as deliver the knowledge as teaching, collaborating with other personnel in schools, and getting in touch with parents and external communities (Coolahan, 2002). Apart from teaching skill, teachers need other skills to facilitate their

working. There are some skills taking time to build up (Huss, 2019). The teacher needs to assist new teachers with only prior experience of working in schools. They might be in trouble if lacking those skills. However, workplaces can improve teacher assistants' skills (Marshall & Mill, 1993). Hence, teachers need to continue learning all their lives, ensuring their personal and professional growth and development with students' achievement (Darling-Hammond et al., 2005).

Lifelong learning skills are skills related to employability skills, generic skills, non-technical skills, soft skills and transferable skills (Demirel, Sadi, & Dağyar, 2015; Bozat, Bozat, & Hursen, 2014; Snezana Jovanova-Mitkovska, 2011). These skills are not specific to any particular job position or workplace environment but can be used widely in all jobs and tasks assigned (Evers & Rush, 1996). Many researchers relate this skill with higher education students to adopt and adapt in their study to be competent in getting the job (Meerah et al., 2011). But, some of the other students not competent because of the lack of this skill and unemployed. Is the issue either student do not know about the skills or the teacher or educator lack knowledge about the skills?

In his research, Subramaniam (2013) found that some teachers fail to integrate this skill in teaching and learning because of lack of time and finished the ministry of education syllabus. Meanwhile, the findings by Ngang, Hashim & Yunus (2015) revealed that the problematic aspects of delivering the skills are practical in real situations. The problems are large class size, academic focus, support from admirative and limited timed. His suggestions that these skills need to emphasize and explore make teaching and learning quality and other tasks.

Then, based on Ming-Chien Hsu, Purzer & Cardella (2011) study showed that teachers need the skill of lifelong learning to learn a new method, new strategies, new technology and new pedagogic for students' achievements. Besides that, Buntat et al (2013) describe that the need for lifelong learning is very imported in Malaysia's development learning community to live and work in a good performance. Thus, this study tries to reach out the lifelong learning skills among teacher to develop the framework as a guide for the teacher to added new knowledge and more skills relate to teacher routine.

In Malaysia Blueprint 2013 to 2025 was highlighted the importance to develop the lifelong learning skills for teacher development as follow: i) the stress relating to the formal education in both teachers and students, ii) the preparations of new readiness and development to be professional for teachers, iii) the focus on teachers to have various kinds of character and quality in the Classroom, iv) the stimulation and encouragement for teachers in learning management so that they would have necessary knowledge and skill to enter the 21st Century, v) the creation for school with an organizational management system for the success of students and teachers (MOE & PADU, 2013). In the literature review, the teacher's lifelong learning skills include personal skills and professional skills such as teaching skills, social skills, and life skills (Su-Hie et al., 2015; Okogbaa, 2017). All the skills are essential to be an effective teacher. As a teacher, practical teaching and learning impact students' achievement, motivation, and a strong desire to succeed.

Problem Statements

The importance of these skills for teachers in personal and professional development can be challenging in education. According to Holmqvist (2019); Ismail, Nopiah & Sattar (2018); Hammack (2018); Ghavifekr et al (2016), the teacher in DNT subject lack of some skills in teaching such as mismatch background study with teaching option, lack motivation, lack of skills, lack to identify student's needs, difficult in writing an article and lack of preservice and in-service training. Related to this issue, researchers develop a lifelong learning skill framework to guide and give information about the primary skills teachers must require in their learning process journey. Holmqvist (2019) explaining that the teachers should be move from the basis's role as dispensers of information to foundations of learning and support students turning information into knowledge and knowledge into wisdom. According to Meerah et al (2011), there are not many instruments able to measure lifelong learning skills among teacher in Malaysia. Then, based on the preliminary study, these instruments were developed. Thus, the items' validity and reliability in research instruments can also be determined using the Rasch measurement model. Rasch Measurement Model is to check the validity and reliability of instruments, ensure the ability of each of the respondents who answered the questionnaire and test each item's difficulty (Tahir, & Rosmin, 2018; Rasch, 1980)

Method

Purposive sampling applied in this pilot study. There are seventy (n=70) teacher teaching in Design and Technology (DNT) in primary school with different experience and age involved in this survey study. The excellent cooperation has given by the administration in the school, which has distributed questionnaires to the teacher involved. The researcher could not meet face-to-face with the respondents because the Covid-19 pandemic affected. Then, researcher leaving the questionnaire at the office. However, clear instructions, telephone numbers given, and e-mail have already for respondents who have a problem or need to know more about questionnaire's terms. Respondent was given one to two weeks to fill out the questionnaire, and then the researcher takes back the questionnaire in each school. Before performing the data analysis, the questionnaire's review checking implements. To ensure that all questionnaire answered according to the provided instructions. The questionnaire was develop based on an employability questionnaire and life skills models with several steps. The step is developing construct instruments, operational definitions, expert reviews, and face and content validity.

Research Instruments

In this research, the instruments as questionnaires contain two parts. There are parts A and parts B. Part A consists of background related to the participants, such as gender, experience, age, option and non-option teachers.

Meanwhile, in Part B, there are comprised of 96 dichotomous related items that measure lifelong learning skills. The items have been done check by four experts in the content and face validity process. There are comprising five constructs and twenty-one (21) sub- constructs. Table 1 shows the distribution construct and sub construct, and figure 1 showed the level of agreement using the five-point Likert Scale. In Rasch, the model can

calculate each participant's score in the form of interval data, even data collected using a Five-point Likert scale.

Table 1: Item Distribution

Construct	Sub construct	No. of items
Self- Management Skills	Five sub-constructs	AA1 to AE22
Communication Skills	Four sub-constructs	BA 23 to BD 40
Learning Skills	Five sub-constructs	CA 41 to CE 62
Thinking Skills	Three sub-constructs	DA 63 to DC 76
Digital Skills	Four sub-constructs	EA 77 to EC 96

1	2	3	4	5
Strongly Disagree	Disagree	Less Agree	Agree	Strongly Agree

Fig.1: Level of Agreement

Findings and Discussion

This study employed the five- point liker scale for the lifelong learning skill of questionnaires. Before the item analysis was done, person analysis was performed and the results revealed that 10 respondents needed to be dropped while 60 others were retained. A discussion of the findings has been formulated according to: i) item fit, ii) Standardized Residual Correlation, iii) unidimensionality and iv) the Statistical summary. Researcher need to test the functionality of every item in Rasch Measurements Model

Item fit

To determine the instruments can be continued to actual research, examine the Alpha Cronbach, it is not enough. Researcher need to checking the item fit in the Rasch Analysis report. Item fit provides accurate measurement for every item. Item fit include the i) infit value (MNSQ and ZSTD) ii) polarity item. Table 2, showed the results of the infit values check. According to Wright & Linacre (1994), the rating scale value of infit MNSQ should be within the range of $0.4 < X > 1.5$, while the ZSTD range within -2 to $+2$. If there is an item not in this range, the items should be omitted. Thus, referring to the results, 25 items need to be omitted.

Table 2: Item Fit

Entry number	Infit (MNSQ)	Infit (ZSTD)	Items	Results
91	2.47	6.4	S91	Omitted
89	2.26	5.2	S89	Omitted
90	2.10	4.8	S90	Omitted
11	2.36	5.5	S11	Omitted
10	2.31	5.3	S10	Omitted
88	2.01	4.8	S88	Omitted
57	1.95	4.0	S57	Omitted
49	1.91	3.9	S49	Omitted
12	1.89	3.9	S12	Omitted
96	1.69	3.1	S96	Omitted
13	1.51	2.4	S13	Omitted
87	1.34	1.70	S87	Retained
8	1.30	1.6	S8	Retained
59	1.27	1.4	S59	Retained
72	.63	-2.2	S72	Omitted
71	.65	-2.0	S71	Retained
55	.65	-2.1	S55	Omitted
22	.65	-2.1	S22	Omitted
34	.61	-2.4	S34	Omitted
35	.65	-2.1	S35	Omitted
25	.64	-2.2	S25	Omitted
32	.64	-2.2	S32	Omitted
73	.61	-2.4	S73	Omitted
52	.61	-2.4	S52	Omitted
69	.60	-2.5	S69	Omitted
51	.58	-2.6	S51	Omitted
66	.56	-2.8	S66	Omitted
24	.55	-2.8	S24	Omitted
23	.40	-3.6	S23	Omitted

Polarity Item

To check the polarity item value, the researcher must observe the point measure value either negative (-) or positive (+). According to Linacre (2010), if the value showed positive means, all the item is good and acceptable. From the analysis, all the measure item showed a positive point- measure. No item to be retained or omitted.

Measure Value

The researcher must check the item measure value. Based on (Aziz, Masodi, & Zaharim, 2013), when the item has the same measure value, one of the items need to drooped based on the infit (MNSQ) value near one and infit (ZSTD) value near 0. Table 3 showed the item measure value. The results showed that four items needed to be omitted

Table 3: Item Measure

Entry number	Measure	Infit (MNSQ)	Infit (ZSTD)	Item	Results
86	1.58	1.05	.3	S86	Retained
87	1.58	1.34	1.7	S87	Omitted
80	.65	.81	-1.0	S80	Omitted
82	.65	.93	-.3	S82	Retained
26	-.51	.67	-2.0	S26	Omitted
27	-.51	.75	-1.04	S27	Retained
43	-.85	.88	-.6	S43	Omitted
44	-.85	1.02	.4	S44	Retained

Standardize Residual Correlation

The standardized measurement of the residual correlation value is to determine whether there are items that overlap. The high residual correlation for the two items showed the item is not independent, either because the item has the same characteristics or combined several other shared dimensions. As suggested by (Aziz et al., 2013), the correlation value should be <70. When the Value>70, the items can be omitted. To omit the items, a researcher can check the infit MNSQ near to 1 or ZSTD near to 0. Table 4 showed the items results.

Table 4: Results of the Standardized Residual Correlation items

Correlation	Entry number	Item	Infit MNSQ	Infit ZSTD	Results
.89	38	S38	1.25	1.3	Retained
.89	39	S39	1.08	.5	Omitted
.78	8	S8	1.30	1.6	Retained
.78	7	S7	.83	-.9	Omitted
.77	1	S1	.76	-1.3	Retained
.77	2	S2	.86	-1.8	Omitted
.74	46	S46	.93	-.3	Retained
.74	47	S47	.95	-.2	Retained
.73	3	S3	.77	-1.3	Omitted
.73	4	S4	.95	-.2	Retained
.71	63	S63	.94	-.3	Omitted
.71	64	S64	.87	-.7	Retained

From the analysis apparent, the results show that five items require omitted and the other five items retained. There are essential for researcher checking the Standardise Residual Correlation Items.

Unidimensionality

The primary measure of using the Rasch Measurement Model is the unidimensionality of items. To ensure the instruments is achievable to answer the specific objective in research. The Principal Component Analysis (PCA) was applying to described the Variance was measured by the instrument. The excellent range in the measure the Variance is raw Variance

explained by measure must >40% and unexplained in 1st contrast of <15% are acceptable (Fisher, 2007). The results showed in Table 5.

Table 5: Unidimensionality Results -PCA

Raw Variance explained by measure.	41.9 %
Unexplained Variance in 1st Contrast	9.0%

Results showed that the raw Variance explained by measure is 41.9% and unexplained Variance in 1st contrast 9.0%. It can conclude that the findings of unidimensionality its excellent and achievable in actual research.

Statistical Summary

The last phase of analyses is to check the statistical summary. In statistical summary, the researcher needs to consider i) person reliability and person separation, ii) item reliability and item separation iii) Cronbach’s Alpha (refer to table 6)

The results of Cronbach's Alpha in this study are 0.99 is very high and excellent. Then, the person reliability is 0.98, and the item reliability is 0.91 it is good and acceptable excellent. Meanwhile, the person separation is 6.72, and the item separation is 3.24 means the Value good and excellent. This value is according to Bond & Fox (2007) recommendation value for acceptable. All values as shown in Table 6 are collectively a good indication of instruments lifelong learning skills for use in a large-scale study. In Table 7 displays the internal consistency of Cronbach’s Alpha.

Table 6: Summary Statistics

Summary Statistics	Value omitted
Cronbach Alpha	0.99
Person Reliability	0.98
Person Separation	6.72
Item Reliability	0.91
Item Separation	3.24

Table 7: Internal Consistency of Cronbach's Alpha

CRONBACH ALPHA	INTERNAL CONSISTENCY
< 0.5	Unacceptable
0.5-0.6	Poor
0.6-0.7	Questionable
0.7-0.8	Acceptable
0.8- 0.9	Good
0.9- 0.1	Excellent

Recommendation and Suggestions

This study develops the instruments only for teacher teaching DNT only. In the future, it would be interesting if the sample included several other teachers in technical and vocational fields. There is some limitation in this study regarding how this instrument's focuses develop only for workplace skills. Other research can continue to study foundation skills and social skills for the teacher in the future of the digital education era.

Conclusion

Based on this analysis using the Rasch Measurement Model, it can conclude that the standardized instrument must construct before running the actual research in this study. Nor Aisyah et al. (2018) emphasize that the Rasch measurement model is powerful tools to identify the item fit, person fit, and unidimensionality of instruments. By implementing this measurement model, some of the iteration items can early identify. In this study, the findings showed that the validity and reliability of 60 items are high and good. Therefore, the instruments can be accepted and considered to measure the actual research's lifelong learning skills framework. This Rasch Measurement Model can apply to those in a particular method to ensure accurate pilot study data quality.

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