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Validating the Indonesian Version of Reflective Thinking Questionnaire and Investigation of the Relationship Between Pre-Service Teachers' Reflective Thinking and Academic Achievement

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Abstract: Teacher training process must stimulate reflective thinking skill because this skill is crucial to improve teaching and learning capability. Indonesian version of standardized instrument to assess the development of reflective thinking skill in teacher training program is still limited. This research aimed to adapt Reflective Thinking Questionnaire (RTQ) to Indonesian version, investigate its quality, probe pre-service chemistry teachers' level of reflective thinking, investigate relationship between reflective thinking and GPA, and compare between 1st year and 4th year pre-service chemistry teachers' reflective thinking skill. RTQ is a 16 items 5 point Likert scale questionnaire purposed to measure reflective thinking in 4 subscale levels: Habitual Actions (HA), Understanding (U), Reflection (R), and Critical Reflection (CR). Each subscale was assessed by 4 questionnaire items. With the help of four science education experts who are fluent in both languages, RTQ was first translated into Indonesian and then its empirical result was substantiated. The translated RTQ was given to 147 pre-service chemistry teachers from Department of Chemistry Education, Raja Ali Haji Maritime University, Indonesia. Data were analyzed using Rasch model method. Result indicated that the instrument and all 16 items nicely fit the Rasch model. The data also showed good reliability (Cronbach alpha .84). Result of this research also indicated that Understanding received the highest mean (17.70), followed by Critical Reflection (16.50), Reflection (16.48), and the lowest mean was Habitual Action (14.60). Non-parametric analysis was used because normal data distribution is not observed. Based on Wilcoxon Test result, significant difference between all subscales levels were detected, except for CR-R. Spearman Correlation result indicated that correlation between reflective thinking and GPA was not significant. Based on Mann-Whitney Test result, significant difference between 1st year and 4th year college students' reflective thinking was only detected in CR. The implications relate to reflective thinking skill were discussed to improve the quality of learning process and its' evaluation.

Keywords: reflective thinking questionnaire, pre-service teacher, academic achievement, Rasch model

Introduction

Teacher must be a reflective thinker because they need to make continuous improvement in their competencies. Because of that, teacher training process must stimulate reflective thinking skill. Developing reflective thinking encouraged pre-service teachers to be responsible for their own learning (Rinchen, 2019). Reflective thinking also has important role in leadership preparation (Carver & Klein, 2016). Positive significant relationship between pre-service teachers' perceived self-efficacy and reflective thinking also discovered (Arma, 2016). Social problem solving abilities is important for teacher and there was a significant positive relationship between reflective thinking and that abilities (Sivaci, 2017). In higher education, reflective thinking also had positive significant relationship with critical thinking and self-monitoring (Ghanizadeh, 2017). Reflective thinking lead to self-efficacy, self-assessment and teaching awareness, all of which are traits of competent teachers (Choy, Yim & Tan, 2017). The ability to think reflectively is crucial to develop confidence and competence among teachers.

There are various instrument and method to assess reflective thinking. Reflective Thinking of Teachers Questionnaire (RTTQ) can be used to assess five constructs: lifelong learning skills (LLS), self-assessment ability (SA), self-belief (SB), teaching awareness (TA) and reflective thinking (RT) (Choy, Yim & Tan, 2017). SISRT questions can measure self-induced, self-reflective thinking (Van Velzen, 2017). Another instrument is Reflective Thinking Tendency Scale or YANDE (Semerci, 2007).

There are seven sub-dimensions of YANDE: continuous and intentional thinking; open-mindedness; inquiry and effective teaching; teaching and scientific responsibility; researcher; foresighted and friendly; and view of profession. Questions in reflective diaries have been used to guide participant to write reflectively (Töman, 2017). Reflective journal can be used to measure levels of reflective writing (Cengiz & Karataş, 2015). Instrument for determining the levels of reflective thinking among elementary school students was also developed (Bilge & Cennet, 2014). Rubric in reflective writing that analysis of seven key activities which are factual knowledge, conceptual knowledge, procedural knowledge, metacognitive knowledge, problem solving, critical thinking and applications can be used to assess refection in laboratory activities (Xu & Talanquer, 2013). Chemistry Learning and Thinking Instrument (CLTI) also have been developed, that can place each student in the "high" group (more "inclined-to-reflect" compared to the sample's mean performance) or the "low" group (less "inclined-to-reflect") (Tan & Goh, 2008). For assess reflective narrative, Narrative Reflection Assessment Rubric (NARRA) can be used (Alsina, Ayllón, & Colomer, 2019).

Another standardized instrument to assess reflective thinking is Reflective Thinking Questionnaire (RTQ) (Kember et al, 2000). Consisting of 16 items and 5-point Likert scale, it includes four sub scale which are "habitual action", "understanding", "reflection" and "critical reflection". This classification can be used to evaluate the appropriateness of students' writings, compositions, dairies, and their answers to open ended questions to reflective thinking. Likert scale ranging from 5 Definitely Agree, 4 Agree with reservation, 3 only to be used if a Definite answer is not possible, 2 Disagree with reservation, to 1 Definitely disagree, so the lowest possible score from each sub scale is 4 and the highest is 20. Because of usefulness and easiness, RTQ have been used widely in research about reflective thinking, such as by Gencel and Saracaloğlu (2018), Asakereh and Yousofi (2018), Ghanizadeh (2017), Abdullah (2015). RTQ also have been adapted to Turkish (Basol & Evin Gencel, 2013) and Persian (Ghanizadeh & Jahedizadeh, 2017). Literature review indicated that RTQ haven't adapted into Indonesian. Indonesian version of RTQ will provide researchers an instrument to measure reflective thinking, an important feature of constructivist approach, especially for Indonesian people. This study seeks to adapt and validate RTQ among Indonesian university students. It then aims at probe pre-service chemistry teachers' level of reflective thinking, investigate relationship between reflective thinking and GPA, and compare between 1st year and 4th year college students' reflective thinking skill.

Research Method

Participants

One hundred forty seven (147) Indonesian pre-service chemistry teachers from Department of Chemistry Education, Raja Ali Haji Maritime University participated in this study (120 females and 27 males). They were varied from 1st to 4th year student (1st year = 29, 2nd year = 43, 3rd year = 36, 4th year = 39) and participated this study in April 2019.

Procedure

Descriptive survey method was used in this study. RTQ first translated to Indonesian and checked for language equity and clarity by four science education experts who are fluent in both languages (Indonesian and English). Translated RTQ then improved according to feedback from experts and rechecked until suitable for used. A pilot study about translated RTQ is given to a group of undergraduate students (N=8) in order to evaluate its appropriateness for their level. After adaptation process was completed, this Indonesian version of RTQ distributed to 149 undergraduate student which 147 were returned. The participation in this study was completely voluntary. They were also asked to indicate their grade point average (GPA) as an indication of academic achievement, their gender, and study year.

Analysis

Collected data from 147 participants was analyzed using Rasch model and Winstep Program to check the item fit, instrument fit, and reliability. Rating scale model was used because questionnaire items used more than two categories (Likert scale). Non-parametric analysis and SPSS Program was used because normal data distribution is not observed. Wilcoxon Test was used for analyzing the difference

between four subscales levels, Spearman Correlation to identify correlation between sub scale reflective thinking and GPA, and Mann-Whitney to analyze difference between 1st and 4th year students' reflective thinking.

Result and Discussion

Result

The rule of Rasch model is that items with good model-data-fit have OUTFIT MNSQ within the range of 0.5−1.5, OUTFIT ZSTD within the range of −2.0 to +2.0, or PT-MEASURE CORR within the range of 0.4 to 0.85. Item fit if minimally fulfill one of three fit criteria. Item fit order as the result from Rasch model analysis can be seen in Table 1.

Table 1. Item Fit Order of Indonesian Version of RTQ

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	Item
9	556	147	.65	.11	1.57	3.7	1.68	4.4	A .48	.55	44.1	51.6	I9
2	628	147	-.37	.13	1.28	2.0	1.58	3.7	B .42	.47	58.6	58.3	I2
1	532	147	.92	.10	1.21	1.6	1.36	2.6	C .49	.57	52.4	48.7	I1
15	628	147	-.37	.13	.98	-.1	1.19	1.3	D .45	.47	58.6	58.3	I15
13	513	147	1.11	.10	1.17	1.4	1.19	1.5	E .60	.58	38.6	46.2	I13
3	582	147	.33	.12	1.04	.3	1.18	1.4	F .44	.53	54.5	54.2	I3
10	649	147	-.76	.14	1.07	.6	1.02	.2	G .48	.44	65.5	59.9	I10
14	646	147	-.70	.14	.97	-.2	1.00	.0	H .49	.44	57.9	59.1	I14
5	543	147	.80	.11	.92	-.6	.98	-.1	h .53	.56	54.5	50.1	I5
4	631	147	-.42	.13	.85	-1.2	.94	-.4	g .49	.47	55.9	58.4	I4
16	611	147	-.09	.13	.90	-.8	.92	-.6	f .52	.49	60.0	56.8	I16
6	679	147	-1.44	.16	.90	-.7	.81	-1.1	e .48	.37	73.1	67.2	I6
7	604	147	.01	.12	.85	-1.2	.87	-.9	d .57	.50	66.2	56.4	I7
12	590	147	.22	.12	.79	-1.7	.80	-1.6	c .55	.52	64.1	54.8	I12
11	611	147	-.09	.13	.76	-1.9	.73	-2.1	b .56	.49	62.8	56.8	I11
8	590	147	.22	.12	.72	-2.2	.74	-2.2	a .59	.52	59.3	54.8	I8
MEAN	599.6	147.0	.00	.12	1.00	-.1	1.06	.4			57.9	55.7	
S.D.	44.3	.0	.66	.02	.21	1.5	.27	1.9			8.1	4.9	

According to Table 1, it was seen that all 16 questionnaire items was fit with Rasch model. Almost all items fulfill all three criteria. Although Item 9 and 2 didn't meet OUTFIT MNSQ and OUTFIT ZSTD requirement, these items retained because fulfill PT-MEASURE CORR requirement. In Rasch model, an instrument has a high quality if it's INFIT and OUTFIT MNSQ close to 1.0, and it's INFIT and OUTFIT ZSTD close to 0.0. The result for instrument analysis with Rasch model can be seen in Table 2.

Table 2. Summary Statistics of Instrument

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Person RAW SCORE-TO-MEASURE CORRELATION = .93
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .84

     SUMMARY OF 16 MEASURED (NON-EXTREME) Item
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	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	599.6	147.0	.00	.12	1.00	-.1	1.06	.4
S.D.	44.3	.0	.66	.02	.21	1.5	.27	1.9
MAX.	679.0	147.0	1.11	.16	1.57	3.7	1.68	4.4
MIN.	513.0	147.0	-1.44	.10	.72	-2.2	.73	-2.2

REAL RMSE	.13	TRUE SD	.65	SEPARATION	5.02	Item	RELIABILITY	.96
MODEL RMSE	.12	TRUE SD	.65	SEPARATION	5.20	Item	RELIABILITY	.96
S.E. OF Item MEAN = .17								

According to Table 2, it was seen that Indonesian Version of RTQ meet the good instrument requirement (INFIT MNSQ = 1.00, OUTFIT MNSQ = 1.06, INFIT ZSTD = -0.1, and OUTFIT ZSTD = 0.4). Besides that, Indonesian Version of RTQ have a good reliability (Cronbach Alpha = 0.84).

Mean distribution was used to measure the level of reflective thinking skills of college students based on four subscales. The complete result can be seen in the Table 3.

Table 3. Mean Score Distribution

Year of Study	Mean			
	HA	U	R	CR
4th year	14.97	17.67	16.44	16.28
3rd year	14.67	17.64	16.61	16.75
2nd year	14.14	17.72	16.28	15.98
1st year	14.62	17.79	16.76	17.14
Overall	14.60	17.70	16.48	16.50

According to Table 3, obtained it sub scale mean score of reflective thinking skills test result indicated that Understanding (U) received the highest mean, followed by Critical Reflection (CR), Reflection (R), and the lowest mean was Habitual Action (HA).

As for measuring the differences between all subscale level in this study using the Wilcoxone Test, where if the asymp sig value < significance level (.05), then the conclusion is that there are significant differences. Wilcoxon Test resulted significant difference between all subscales level, except for CR-R, as can be seen in Table 4.

Table 4. Wilcoxon Test Result

Sub Scale	U - HA	R - HA	CR - HA	R - U	CR - U	CR - R
Z	-8.880[b]	-6.969[b]	-7.260[b]	-6.062[c]	-6.408[c]	-.262[b]
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000	.793

Next, to find out the relationship between reflective thinking skills and GPA, the Spearman Correlation Test was used. SPSS result of Spearman Correlation Test between subscale of reflective

thinking skills and GPA can be seen in Table 5. Spearman Correlation Test resulted no significant correlation between all subscale and GPA.

Table 5. Spearman Correlation Result

Sub Scale	HA	U	R	CR
Correlation Coefficient	.022	-.104	.093	-.049
Sig. (2-tailed)	.792	.210	.265	.558

Furthermore, to determine the difference in reflective thinking skills between 1st year and 4th year of college students, the Mann-Whitney Test was used. If the asymp sig value < .05, then there are significant differences. SPSS result of Mann-Whitney Test between 1st year and 4th year of college students in four sub scales can be seen in Table 6.

Table 6. Mann-Whitney Test Result

Sub Scale	HA	U	R	CR
Mann-Whitney U	528.000	453.000	494.000	399.500
Z	-.468	-1.426	-.902	-2.084
Asymp. Sig. (2-tailed)	.640	.154	.367	.037

Mann-Whitney Test resulted significant difference between 1st year and 4th year college students' reflective thinking in Critical Reflection subscale, while significant difference in sub scale Habitual Action, Understanding, and Reflection was not observed.

Discussion

Adaptation procedure of RTQ to Indonesian version was well implemented so that resulting a good instrument. Items and instrument empirically meet fit criteria requirement according to Rasch model and fulfill good reliability criteria. Indonesian Version of RTQ had 16 items and can be used to assess reflective thinking in four level (Habitual Action, Understanding, Reflective, and Critical Reflection. So that, each level had 4 items with the highest score is 20. Indonesian Version of RTQ suitable for Indonesian undergraduate students, but doesn't close the possibility for another grade level. Reflective thinking group comparison or reflective thinking improvement in a training process can be measured by this instrument.

From Table 3 and 4, can be seen that the mean scores for habitual action are lower than those for understanding. These should be indication that the students in the sample were less inclined to employ habitual action than understanding in the learning process. It is because there is insufficient time for curricula to require students to repeatedly perform particular actions in university. Mean scores for reflection and critical reflection are lower than those for understanding too. These should be indication that learning process need modification so that can improve reflection and critical reflection ability so that equal with understanding ability.

Significant difference of understanding, habitual action, and reflection was not observed between 1st year and 4th year student. It can be seen from Table 3 and 6. Significant difference of critical reflection was founded, but in negative pattern (mean score of 1st year student > 4th year student). Result indicated that there is no significant improvement of reflective thinking skill across learning process. This result strengthens the reason that improvement of the learning process needs to be carried out. Reflective thinking improvements can be made by utilizing Web 2.0 application (Abdullah, 2015), self-evaluation and reflective journal (Toman, Cimer & Cimer, 2014), layered curriculum (Gencel & Saracaloglu, 2018), and web based portfolio system .

From Table 5, can be seen that there is no significant correlation between reflective thinking in all subscale with academic achievement (GPA). This result is in accordance with the study carried out by Asakereh and Yousofi (2018). On the contrary, this was different from study result carried out by

Ghanizadeh and Jahedizadeh (2017) and (Ghanizadeh, 2017). This study results showed that indicators of reflective thinking have not been integrated in the evaluation of academic achievement. Reflective thinking indicator need to be integrated with the course material in academic achievement evaluation. Indicators that have been developed by Redmond (2014) can be used for this purpose.

Conclusion

Indonesian Version of Reflective Thinking Questionnaire meet the good instrument requirement so that can be used to assess Indonesian reflective thinking skill. Modification of the learning process needs to be done to improve reflective thinking skill. Reflective thinking indicator need to be integrated into academic achievement evaluation so that will be coherence with learning process improvement.

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