Strengthening Rasch Modeling For Objective And Fair Assessment For Chemistry Teachers

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Strengthening Rasch Modeling For Objective And Fair Assessment For Chemistry Teachers

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Keywords: *chemistry teacher, rasch model, reinforcement.*

Abstract: *The competence of a good chemistry teacher will contribute to a fair assessment ability. This service aims to improve the professional competence of the sub-field of assessment for chemistry teachers at madrasahs in the Mranggen sub-district. This service is participatory by processing the results in a quantitative descriptive manner with one variable, namely the professional competence of the teacher's assessment. Service Locations in Madrasahs, Mranggen District. The number of participants in this service is 20 active chemistry teachers. Data collection techniques using closed and open questionnaires. Data validity uses content validity. Data reliability using Croncbach's Alpha technique. Data analysis techniques use the percentage formula to determine the achievement of each component through statistical data. The results of Community Service found that the professional competence of chemistry teachers at madrasas in the Mranggen sub-district was on average in the very good category, but variations in the use of assessment software were very lacking and had never been carried out. The service contribution gives a good value for changes in the ability to use the Rasch model assessment software after the service is over, but this depends on the amount of motivation the participants have.*

Abstrak

Kompetensi guru kimia yang baik akan berkontribusi terhadap kemampuan penilaian yang adil. Pengabdian ini bertujuan untuk meningkatkan kompetensi profesional sub bidang penilaian bagi guru kimia di madrasah kecamatan Mranggen. Pengabdian ini bersifat partisipasif dengan pengolahan hasil secara kuantitatif deskriptif dengan satu variabel yaitu kompetensi profesional penilaian guru. Lokasi Pengabdian di Madrasah Kecamatan Mranggen. Jumlah partisipan pengabdian ini sejumlah 20 orang guru aktif kimia. Teknik pengumpulan data menggunakan angket tertutup dan terbuka. Validitas data menggunakan validitas isi. Reliabilitas data menggunakan teknik Croncbach's Alpha. Teknik analisis data menggunakan rumus persentase untuk mengetahui pencapaian setiap komponen melalui data statistik. Hasil Pengabdian didapatkan bahwa kompetensi profesional yang dimiliki guru guru kimia di madrasah kecamatan Mranggen rata-rata berkategori sangat baik, namun penggunaan software penilaian sangat kurang bahkan belum pernah dilakukan. Kontribusi pengabdian memberikan nilai baik terhadap perubahan kemampuan penggunaan software penilaian Rasch model setelah pengabdian usai, tetapi hal ini bergantung pada besaran motivasi yang dimiliki para peserta.
Kata Kunci: guru kimia, rasch model, penguatan.

1. INTRODUCTION

A fair and objective assessment must be attempted and carried out to improve the quality of education. One of them is through increasing mentoring and strengthening teacher competence. Competency assessment, technology-based scoring can be done through training education, mentoring in the dedication of lecturer activities (Bariqi, 2018). Competence in processing scoring results is important in order to obtain objectivity and fairness in student

assessments (Pepper & Pathak, 2008). Teachers who carry out good assessment processing can contribute to the fairness of the assessment.

The processing of measurement results from a test requires the main steps that must be taken (Nisbet & Shaw, 2019). These steps are often overlooked by teachers. Steps that are ignored include scoring steps (Montgomery & Baker, 2017). Teachers often do not give good scores on test results (Davidson, 2004). The standard scoring stage is in the form of converting the raw score into a standard score in accordance with the norms followed (Darling, 2021). The next step is the teacher converts the standard scores into grades in the form of letters or numbers. The final step is the teacher analyzes the questions on the degree of validity and reliability of the questions, the level of difficulty of the questions and discriminating power. So far the teacher has not fully done this. These activities must be carried out by the teacher with extra care. These results become the basis for the processing of test results to become a decision value for a learning activity.

Good assessment processing is needed to determine student acquisition scores (Leung & Mohan, 2019). These provisions are known as scoring processing. Scoring processing is needed as a step to determine the score of student work so that a score is obtained as objectively and as fairly as possible. One recommendation for good scoring processing is Rasch modeling (Goldstein, 1979).

Rasch modeling is a way of modern assessment. So far there are 2 assessments, namely classic (CTT) and Modern (IRT). There have been various criticisms leveled at CTT. Engelhard Jr, & Wang, (2014) criticized that the CTT reliability coefficient depends on the number of samples, the measurement scale is not linear. Compared to classical test theory (CTT), item response theory (IRT) is considered the standard model. IRT is used across disciplines, including psychology, education, nursing, and public health (Christensen, et.al, 2014).

IRT assessment competence can overcome the innate limitations of CTT. IRT becomes a statistical tool for assessing characteristic measures. Unfortunately, there are echoes of the superiority of the Rasch model which is less publicized, as a result only exists in college classrooms. A review of measurement-based research that appeared in educational measurement journals published between 2000 and 2020 indicated that less than 5% of studies used IRT analysis. Unick and Stone (2020) hypothesized that several reasons for the absence of IRT analysis from assessment journals were the lack of ease and practicality of using IRT.

The IRT assessment is based on two elements responsible for the test taker's response. The response is the competence of the test takers, and the characteristics of the items. One of the IRT models, namely the Rasch model or one-parameter logistic model. Rasch modeling

assumes that the probability of a given response is a function of a person's competence and the difficulty of the item (Engelhard, 2014). The IRT model produces estimates for these two elements by calculating the item difficulty parameter based on the total number of people who answered the item correctly, and the personal trait parameter based on the total number of items answered successfully.

These assumptions underlie the estimation of the Rasch modeling judgment (Baghei, 2018). This becomes the basis that someone who has good quality in answering questions is more likely to be successful in the test, so that success in working on the questions will support the quality of the items. Andrich (1982) extends this Rasch model not only to multiple choice models but also to essay questions. The measurement of the description item used the polytomous model. They also added estimates to account for the difficulty in crossing the threshold from one response level to the next (eg, moving from agree to strongly agree).

The use of the Rasch model requires the ability to operate basic arithmetic such as addition, subtraction, multiplication and division cannot be done because the numbers obtained are not integers but scores in the form of ordinal data (Wu & Adam, 2017). Unlike CTT which always depends on scores, IRT does not depend on a particular sample of questions/statements and the abilities of the people involved in the exam/survey.

The Rasch model can estimate the probability of a given response based on the characteristics of the items and assign latent properties to the test takers. The Rasch model produces estimates for these two elements by calculating the item difficulty parameter based on the total number of people who answered the item correctly, and the person trait parameter (Mesic, et.al, 2019).

The advantage of Rasch modeling compared to other methods, especially processing classical scores is the competence to predict missing data, which is based on a systematic response pattern head. This clearly makes the results of the assessment processing more accurate. More importantly, Rasch modeling is able to produce scoring processing values with a low standard error, in addition to freeware software that is free to download so that it can increase the accuracy of calculations (Gonzalez, et.al, 2022).

The advantages of Rasch modeling come with drawbacks. Weakness is the need for good information technology skills. Basic computer skills are a prerequisite for implementing Rasch modeling.

Rasch modeling operations training for teachers will improve teacher skills. Good competency improvement related to student assessment work can provide benefits for the progress of institutions (schools). This is the basis for mentoring and training, mentoring and

dedication to teachers. This reinforcement will familiarize teachers in using Rasch modeling based software. This step must be taken considering that not all chemistry teachers are familiar with the calculations and processing of Rasch modeling assessments. This is the basis for the service provider to carry out mentoring activities in addition to initiation as well as training, mentoring and service so that objective and fair assessments are produced for students and test participants.

2. METHOD

Assistance is carried out by dividing the group into groups. Initially divided into 2 large groups then intensively divided into small groups according to location. This is done to facilitate intensive assistance for respondents. The implementation of this program was carried out in a fun way with the condition that all respondents brought laptops. The implementation of community service always involves all participants. This is intended to engage participants and raise awareness from within the participants.

At the beginning of the meeting (training, mentoring and service and mentoring begins with introductions and setting up the rules of the game. Role play to encourage participants to be active and involved in a collaborative learning process. Introductions are carried out by the service team for each service participant in an attractive way.

This interactive activity aims to make the participants closer to the facilitating team, open in the group process. After the ice breaking process, the main facilitator provides material on Rasch modeling for assessment and evaluation in the learning process. Then several service participants were asked to practice how rasch modeling works, installation, installation on the system and running the initial program. In the training session until the last session, participants reviewed what had been done

Measuring the impact of community service aims to determine the usefulness of the program, so it is necessary to process and analyze it first so that it can be used as a basis for making decisions about the implementation of community service. The goal is to interpret and draw conclusions from the collected data. Analysis of service data using regression analysis using SPSS software (Freund, et.al, 2016). In the process of multiple regression analysis, a data competency test is also carried out which consists of a validity test and a reliability test. Then the classic assumption test which consists of a multicollinearity test, normality test and heteroscedasticity test. To test the hypothesis consists of F test and t test. Followed by analysis and interpretation resulting in conclusions and suggestions.

3. RESULT and DISCUSSION

The results of the service are processed based on the referenced methodology including the training, mentoring and service phases. Informants as well as training participants were asked for responses to the implementation of the service. The results of the responses to the implementation of the training, mentoring and dedication assessment in presentation are shown in Table 1.

Table 1. Respondents' Responses

Altenative	respondent's answer	Percentage (%)
a. Very good	20	100 %
b. good	0	0 %
c. good enaugh	0	0 %
Totale	20	100%

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Looking at the respondents' answers, the implementation of service is categorized as very good because of material requirements, adequate facilities, space used for training, mentoring and service that is very supportive and the trainers, mentoring and service are very good and competent in delivering training material.

Learning The process of training, mentoring and dedication is measured through usability instruments. After participating in the participant training, did the service provide benefits to you? The answers to the participant response patterns are in Table 2.

Table 2 Use of Training

Altenative	Respondent Answer	Percentage (%)
a. Provides usability	20	100 %
b. Unprovides usability	0	0%
Totale	20	100%

Looking at the respondents' answers, it can be categorized that training, mentoring and service provide positive or good use because they feel they are gaining insight into knowledge about objective and fair judgments.

Statistical tests were used to determine the effect of respondents' motivation in participating in training and measuring competency improvement. The results of the descriptive statistics test show the mean, minimum, maximum, and standard deviation in service can be seen in Table 3.

Table 3 results of the descriptive service test

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Motivation	20	18	29	23.00	2.4
Competency	20	25	44	33.82	3.9
Valid N (listwise)	20				

From table 3 it is known that N = 20 The variable of motivation has a maximum value of 29, a minimum value of 18 and an average of 23.00. The competency variable has a maximum value of 44, a minimum value of 25 and an average of 33.82. The next test is the Devotion Hypothesis Test where the effect of motivation and competence will be tested after attending the training.

The coefficient of determination is used to show how much the independent variable influences the dependent variable in this service. So that the value of Adjusted R2 is close to 1, so that the independent variable has the competence to provide the information needed to predict the dependent variable. The following are the results of the R2 test

Table 4. Determination tes

Model Summary

Model	R[a]	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.809	.654	.602	1.5 20	1.927

a. Predictors: (Constant), Motivasi,

b.	Dependent Variable: kompetensi

The coefficient of determination from table 4 is 0.602 or 60.2%. This shows that the competency of the service results (the ability to operate the Rasch modeling is influenced by the variables of competence, motivation, competence by 60.2% while 20.8% is influenced by other variables not examined in this service

Simultaneous Significance Test (F test), Simultaneous significant test is used to determine the effect of the independent variable namely motivation on the dependent variable namely competence whether it influences or not. The results of the simultaneous test can be seen in table 5.

Table 5. Simultaneous Test

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	157.820	5	29.564	12.47	.000
	Residual	79.180	33	2.269		
	T otal	226.000	38			

Based on table 5 it is known that the significance value is 0.000, which means that the motivational variable affects the competence of the respondents in the Rasch modeling learning outcomes.

Further testing of the hypothesis partially is by using the t test. Because the t test can be used to determine the effect of the independent variable, namely motivation (X). on variable (Y). So that the sig value is smaller than alpha 0.05 so that it can be said that there is a significant effect. The results of the t test can be seen in Table 5.

Table 5 T test results

Coefficients							
	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model	B	Std. Error	Beta	T	Sig.	Tolerance	VIF
1 (Constant)	.837	3.604		.232	.818		
Motivasi	.093	.124	.087	.745	.002	.776	1.288
a. Dependent Variable: Kompetensi							

Based on the test results using the regression analysis tool with SPSS, the results can be obtained as in table 5. based on the table above, so that the regression equation obtained is

$$Y = 0{,}837 + 0{,}93\ X2 + e$$

Based on table 5, it can be seen from the results of hypothesis testing, whether there is an effect of training motivation on the Rasch modeling competence of teachers as service respondents. Table 5 shows that the significant value of the motivation variable is 0.462 and the regression coefficient (B) is 0.93. The result of the significance is greater than alpha 0.05, so it can be said that motivation influences teacher competency in Rasch modeling.

Based on quantitative calculations of the results of community service, it was found that motivation influences competence in Rasch modeling. Effect of Motivation on Rasch modeling competence. This means that the size of the motivation of the service participants has an influence on the competence of the teacher. Motivation is an encouragement or a state in which a person's efforts and willingness are directed towards a particular goal (Weiner, & Mander, 2018). In this dedication, the motivation in question is the motivation that comes from the teacher and friends of the MGMP chemistry teacher in Demak district.

According to Harackiewicz (2014) every person's willingness to mobilize their competencies optimally is due to the motivation that the teacher has from within himself, this is because motivation is not the dominant thing to increase teacher competence. The results of this service are consistent with research conducted by Ryan, et.al (2018) which found that motivation influences teacher performance (competence).

The service problems faced by chemistry teachers in the Mranggen sub-district include planning and implementation. A good solution is to pay attention to some principles and assessment procedures. The principle of objective and fair assessment. These principles include; (1) In assessing learning outcomes, it must be clear what abilities must be assessed, assessment materials, assessment tools, and interpretation of assessment results. (2) Assessment of learning outcomes and the use of Rasch modeling should be an integral part of the teaching-learning process. (3) the acquisition of objective learning outcomes will describe student achievement and competence well.

There are steps that can be used as a guide in an objective and fair assessment, namely (1) Formulating teaching objectives (Duffield, & Spencer, 2022). (2) Reviewing chemical material based on the curriculum and subject syllabus. (3) Develop chemistry assessment tools, both tests and non-tests. This test must be adjusted to the type of assessment carried out. (4) teachers must act fairly without favoritism. The words "fair" and "objective" are easy to say, but difficult to implement. Even so, the human obligation is to make an effort. All students must be treated

without "discrimination". Teachers should also act objectively, as it is in accordance with the competence of students. Therefore, like and dislike attitudes, negative feelings, desires, and prejudices must be kept away. Evaluation must be based on actual facts (data and facts), not the result of manipulation or engineering. This will be fulfilled with the help of software where the taste and empathy of the examiner is not a consideration and judgement.

Barriers related to human resources, this service requires participants' computer competence above average. This was overcome by recruiting teachers participating in the service, which was only devoted to young teachers who were familiar with computers, at least they knew the excel program. This resulted in a reduction of participants from all planned 25 people but due to lack of computer mastery, only 20 chemistry teachers were used in this service with the hope that they would become pioneers to introduce the assessment software given to other teacher friends.

4. CONCLUSION

From this community service activity it can be concluded that:

Knowledge and understanding of the use of objective and fair based assessments for chemistry teachers participating in the service has increased. This increase is in line with the magnitude of the motivation of the training participants.

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