

Development and validation of teacher competency perception scale in Indonesia: The Rasch analysis

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ABSTRACT

Teachers have a role in building a civilization that upholds values and norms. Students are the party that the teacher focuses on to be educated. Of course, they have perceptions of teacher competence. This study aims to develop and validate a scale of perceptions of teacher competency. The instrument has four dimensions: pedagogic, professional, personality, and social. This study uses Rasch analysis to test the construct validity of the teacher's competency perception scale. The construct validity test involved 400 students. Data analysis using WINSTEPS Rasch Software provides information about respondents' quality and instruments, easy and difficult items for respondents to agree on, fit order items, and unidimensionality. The results of the application of Rasch analysis showed that the teacher's competency perception scale is good, precise, and has item conformity with the model. The teacher competency perception scale is a reliable and valid tool to measure students' level of peace accurately. This study discusses the implications and recommendations for further research for implementing learning that optimizes the four teacher competencies.

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1. Introduction

The teaching and learning process is a systematic activity because the teacher needs to have the ability to be able to stimulate cognitive abilities (Chen et al., 2017; Uiterwijk-Luijk et al., 2019), motivational-emotional (Hornstra et al., 2015; Jennings & Greenberg, 2009), and social aspects of students (Pennington & Sinelnikov, 2018; Sarwono et al., 2020). Teacher competence is the main asset in arousing students' enthusiasm for learning (Ahn et al., 2021; Blömeke et al., 2022). Students' perceptions of teacher competence create a distinct impression that it is related to motivation, social development, and academic achievement (Kalin et al., 2017), which is essential to pay attention to so that the quality of education is always maintained. However, the reality that occurs shows that teaching evaluation often does not reflect students' perceptions (Catano & Harvey, 2011). The absence of student perceptions regarding teacher competence makes substantive changes to the quality of education implemented a greater chance of not being on target.

The strategy that can be used to determine students' perceptions of teacher competence is to use a measuring instrument. Several studies have tried to develop tools to measure student perceptions of teacher competence, but not many data analysis techniques can provide accurate data. An example is research using the ETCS (Evaluation of Teaching Competencies Scale), an instrument for measuring teacher competence based on nine competencies: communication,

availability, creativity, individual consideration, social awareness, feedback, professionalism, awareness, and problem-solving (Catano & Harvey, 2011). Another example is research using STERLinG (Teachers' Competencies to Encourage Reflective Learning in Small Groups), an instrument for measuring teacher competence based on student perceptions consisting of 3 competencies, including self-insight, the ability to create a comfortable environment, and encouraging self-regulation (Schaub-de Jong et al., 2011). Furthermore, there is research that formulates instruments to measure students' perceptions of Physical Education teachers (ZALECH, 2021). The lack of accuracy in these various measuring instruments to identify student perceptions of teacher competence has the opportunity for the Rasch model to present as an alternative to providing a more precise estimate of the credibility of the measuring instrument. Rasch analysis is one of the answers because it is a validity and reliability analysis that visualizes a lot of comprehensive information (Andrich & Marais, 2019; Bayne & Hankey, 2020).

This study aimed to develop and validate an instrument to measure students' perceptions of teacher competency using Rasch. Various dimensions contained in this instrument include pedagogical, professional, personality, and social aspects. The pedagogical element is the ability to collaborate with natural resources (books) and intangible resources (knowledge, skills, experience) as well as possible to achieve teaching efficiency (Madhavaram & Laverie, 2010; Măță et al., 2013). Professional aspects include teacher mastery in their field so that they can convey to students appropriately beliefs related to school and learning, motivation, and self-regulation (Ernawati, 2013; Kunter, Klusmann, et al., 2013). Aspects of personality include having a noble character, wise, authoritative, democratic, compassionate, fair, and tolerant (Sriekaningsih et al., 2019; Sukenti et al., 2020). The social aspect helps encourage students' social skills, such as interpersonal skills, prosocial behavior, self-control, self-confidence, and the ability to understand others (Dubovicki & Nemet, 2015). Utilizing the analysis technique of the Rasch model, this instrument can display more accurate data related to students' perceptions of teacher competency.

2. Method

2.1. Research design

This study aims to develop and validate a scale instrument of students' perceptions of teacher competence. This study began with the development of item questions based on the teachers competency dimensions, which were then randomly tested on students. The results were analyzed using the Rasch model to determine the feasibility of the developed assessment. This measuring instrument covers four dimensions: perceptions of pedagogic, professional, social, and personality competencies. Rasch analysis was used to validate the teacher's competency perception scale because Rasch analysis was able to convey information based on several criteria, namely item suitability, level of difficulty, Rasch discriminatory power, and item information function. Rasch's analysis is very good at presenting the statistical analysis's accuracy level. In addition, the Rasch analysis can provide holistic information about the teacher's competency perception scale and meet the criteria that determine a reliable measuring tool.

2.2. Participants

The research subjects involved in this study were 400 Muhammadiyah Junior High School students in Yogyakarta. The research subjects involved were selected based on the cluster random sampling technique. The descriptions of the chosen research subjects are shown in Table 1.

Table 1. Distribution of research subjects

| No | Name of school | Total of student |
|-------|--------------------------------|------------------|
| 1 | SMP Muhammadiyah 9 Yogyakarta | 82 |
| 2 | SMP Muhammadiyah 5 Yogyakarta | 77 |
| 3 | SMP Muhammadiyah 7 Yogyakarta | 85 |
| 4 | SMP Muhammadiyah 2 Yogyakarta | 84 |
| 5 | SMP Muhammadiyah 10 Yogyakarta | 72 |
| Total | | 400 |

2.3. Data collection tools

The teacher competency perception scale was validated in this study using Rasch analysis. The validated instruments cover four primary indicators: perceptions of pedagogic, professional, social, and personality competencies. Table 2 describes the teacher competency perception scale before validation.

Table 2. Teacher competency perception scale

| Indicator | Statement items | |
|-------------------------|---|--|
| | <i>Favorable</i> | <i>Unfavorable</i> |
| Pedagogic competency | <ol style="list-style-type: none"> 1. The teacher knows the characteristics of each student (1) 2. Teachers can communicate fluently with students (2) 3. The teacher can carry out learning assessments and evaluations (3) | <ol style="list-style-type: none"> 1. The teacher's lack of knowledge about education (4) 2. Teachers have difficulty in designing learning (5) 3. Learning by monotonous teachers (6) |
| Professional competency | <ol style="list-style-type: none"> 1. The teacher can explain the steps of the material coherently and clearly (7) 2. When delivering material, the teacher uses a variety of learning methods (8) 3. The teacher can operate technology in learning (9) | <ol style="list-style-type: none"> 1. The teacher tells his problems to students (10) 2. When learning, the teacher plays with gadgets (11) 3. The teacher sleeps in class during the lesson (12) |
| Personality competency | <ol style="list-style-type: none"> 1. Before the lesson starts, the teacher opens by praying (13) 2. The teacher looks neat and polite when teaching (14) 3. The teacher is on time when learning starts and when learning ends (15) | <ol style="list-style-type: none"> 1. The teacher says harshly during learning (16) 2. The teacher punishes students arbitrarily (17) 3. When learning, the teacher complains in front of students (18) |
| Social competency | <ol style="list-style-type: none"> 1. Teachers can socialize with residents at school (19) 2. Teachers can respect ethnicity, religion, and gender (20) 3. When learning, the teacher can build an exciting class atmosphere (21) | <ol style="list-style-type: none"> 1. The teacher withdraws from the school environment (22) 2. Teachers have difficulty building relationships with students (23) 3. Sometimes teachers only put forward their personal opinions without listening to students' views (24) |

2.4. Research procedure

Several scientific procedures were carried out to produce a reliable measuring tool for determining the level of students' perceptions of teacher competence. In the first stage, we selected and defined the variable to be measured: teacher competency perception. In the second stage, we started to review related literature, compile an instrument grid, formulate instrument statement items, and conduct an expert assessment of statement item items. In the third stage, we conducted an instrument trial involving students filling out the instrument through Google Forms. In the fourth stage, we conduct screening and determine which data are used and which are not. In the final step, data analysis was carried out using Rasch analysis. Rasch analysis refers to the representation of fit items in measuring the perception variable of teacher competency.

2.5. Data analysis

The Rasch model in this research was applied with the aid of the Winstep software. The Rasch model explains the data analysis in interactions between a person and an item simultaneously. The two fundamental theorems applied in the Rasch analysis were individual ability/agreement level and agreed-on item difficulty level. The psychometric tools serving as the basis for analyzing the research data included summary statistics (i.e., the quality of the respondents, the quality of the instrument, and interactions between person and item). The instrument development and validation in this research provided item measures (items most difficult or easiest to agree with to the respondents), item fit order (item fit and misfit), and unidimensionality (the ability to measure what should be measured).

3. Results and Discussion

This study tested construct validity using Rasch analysis (Sumintono & Widhiarso, 2015). The results of the study will describe the description of (a) the quality of the respondents, the quality of the instrument, and the interaction between people and items, (b) the items that are the most difficult to agree on and the easiest for respondents to agree on, (c) items that are fit and misfit, (d) ability instruments to measure what it is supposed to measure; and (e) distribution of those item maps.

Figure 1 shows the analysis results in the form of a statistical summary. The summary statistics section describes the quality of the respondents, the instrument, and the interactions between the person and the item statement of the instrument.

| SUMMARY OF 400 MEASURED (EXTREME AND NON-EXTREME) PERSON | | | | | | | | | |
|--|-------------|---------|---------|-------------|-------|--------------------|--------|------|--|
| | TOTAL SCORE | COUNT | MEASURE | MODEL ERROR | INFIT | | OUTFIT | | |
| | | | | | MNSQ | ZSTD | MNSQ | ZSTD | |
| MEAN | 78.9 | 24.0 | 1.30 | .33 | | | | | |
| S. D. | 9.6 | .0 | .91 | .18 | | | | | |
| MAX. | 96.0 | 24.0 | 5.34 | 1.83 | | | | | |
| MIN. | 52.0 | 24.0 | -.43 | .23 | .29 | -3.5 | .32 | -3.2 | |
| REAL RMSE | .40 | TRUE SD | .82 | SEPARATION | 2.05 | PERSON RELIABILITY | .81 | | |
| MODEL RMSE | .37 | TRUE SD | .83 | SEPARATION | 2.23 | PERSON RELIABILITY | .83 | | |
| S. E. OF PERSON MEAN | = .05 | | | | | | | | |
| PERSON RAW SCORE-TO-MEASURE CORRELATION = .92 | | | | | | | | | |
| CRONBACH ALPHA (KR-20) PERSON RAW SCORE "TEST" RELIABILITY = .86 | | | | | | | | | |
| SUMMARY OF 24 MEASURED (NON-EXTREME) ITEM | | | | | | | | | |
| | TOTAL SCORE | COUNT | MEASURE | MODEL ERROR | INFIT | | OUTFIT | | |
| | | | | | MNSQ | ZSTD | MNSQ | ZSTD | |
| MEAN | 1315.0 | 400.0 | .00 | -.07 | 1.06 | .6 | 1.00 | .0 | |
| S. D. | 107.2 | .0 | .55 | .01 | .22 | 2.8 | .25 | 2.8 | |
| MAX. | 1485.0 | 400.0 | .79 | .10 | 1.61 | 7.9 | 1.77 | 8.5 | |
| MIN. | 1137.0 | 400.0 | -1.00 | .06 | .78 | -3.1 | .73 | -3.2 | |
| REAL RMSE | .08 | TRUE SD | .54 | SEPARATION | 7.00 | ITEM RELIABILITY | .98 | | |
| MODEL RMSE | .07 | TRUE SD | .54 | SEPARATION | 7.44 | ITEM RELIABILITY | .98 | | |
| S. E. OF ITEM MEAN | = .11 | | | | | | | | |
| UMEAN=-.0000 USCALE=1.0000 | | | | | | | | | |
| ITEM RAW SCORE-TO-MEASURE CORRELATION = -.99 | | | | | | | | | |
| 9528 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 17903.45 with 9106 d.f. p=.0000 | | | | | | | | | |
| Global Root-Mean-Square Residual (excluding extreme scores): .7383 | | | | | | | | | |

Fig. 1. Summary Statistics

Based on the analysis of the summary statistics above, the Person Measure shows the average value of the respondents in the teacher's competency perception instrument. Based on the image above, it can be seen that the Logit Person Measure value obtained is +1.30. Referring to the provisions in the Rasch Model, if the Person Measure value is more than logit 0.0, respondents tend to agree more with statements on various items in this study. Cronbach's alpha aims to measure reliability, namely the interaction between the person and the item as a whole. Based on the picture above, it can be seen that the Cronbach Alpha value obtained is 0.86. Referring to the Cronbach Alpha score criteria in the Rasch Model, this value is included in the very good category, > 0.8 . Person Reliability shows the consistency of answers from respondents. Based on Figure 1, it can be seen that the obtained Person Reliability value is 0.81. Referring to the Person Reliability value criteria in the Rasch Model, this value is included in the good category, which ranges from 0.81 to 0.90. That is, the consistency of respondents in answering the teacher's competency perception instrument can be said to be good. Item Reliability shows the quality of the items used in the instrument. Based on the image above, it can be seen that the Item Reliability value obtained is 0.98. Referring to the Item Reliability value criteria in the Rasch Model, the score in the special category is > 0.94 . That is, the quality of the items used in this instrument is special.

The following analysis in Figure 2 presents the results of the Item Measure, which focuses on the most difficult and easy items for respondents to agree on.

| ITEM STATISTICS: MEASURE ORDER | | | | | | | | | | | | | | |
|--------------------------------|-------------|-------------|---------|-------|------|-------|------|--------|-------|------------|------|------------|------------|------|
| ENTRY NUMBER | TOTAL SCORE | TOTAL COUNT | MEASURE | MODEL | | INFIT | | OUTFIT | | PT-MEASURE | | EXACT OBS% | MATCH EXP% | ITEM |
| | | | | S. E. | MNSQ | ZSTD | MNSQ | ZSTD | CORR. | EXP. | | | | |
| 15 | 1137 | 400 | .79 | .06 | .96 | -.7 | 1.06 | .8 | .40 | .53 | 40.8 | 42.7 | 15 | |
| 1 | 1165 | 400 | .69 | .06 | 1.03 | .5 | 1.06 | .9 | .41 | .52 | 42.6 | 43.8 | 1 | |
| 22 | 1167 | 400 | .68 | .06 | 1.59 | 7.9 | 1.75 | 8.5 | .35 | .52 | 33.0 | 43.8 | 22 | |
| 6 | 1192 | 400 | .59 | .06 | .87 | -2.1 | .96 | -.5 | .40 | .51 | 53.9 | 44.0 | 6 | |
| 10 | 1208 | 400 | .52 | .06 | .89 | -1.7 | 1.06 | .8 | .40 | .50 | 49.4 | 44.8 | 10 | |
| 4 | 1227 | 400 | .45 | .06 | 1.61 | 7.8 | 1.77 | 8.1 | .35 | .49 | 36.0 | 44.9 | 4 | |
| 9 | 1227 | 400 | .45 | .06 | .92 | -1.2 | .93 | -.9 | .45 | .49 | 48.6 | 44.9 | 9 | |
| 8 | 1235 | 400 | .42 | .06 | .89 | -1.7 | .86 | -1.8 | .52 | .49 | 51.1 | 46.2 | 8 | |
| 21 | 1251 | 400 | .35 | .06 | .99 | -.1 | .94 | -.7 | .46 | .48 | 47.6 | 46.3 | 21 | |
| 11 | 1252 | 400 | .35 | .06 | .88 | -1.8 | .86 | -1.8 | .48 | .48 | 52.4 | 46.3 | 11 | |
| 2 | 1324 | 400 | .03 | .07 | .88 | -1.7 | .78 | -2.6 | .50 | .45 | 57.4 | 49.7 | 2 | |
| 19 | 1325 | 400 | .03 | .07 | 1.03 | .4 | 1.01 | .2 | .39 | .44 | 51.6 | 49.7 | 19 | |
| 23 | 1325 | 400 | .03 | .07 | .88 | -1.6 | .82 | -2.1 | .53 | .44 | 56.7 | 49.7 | 23 | |
| 18 | 1326 | 400 | .02 | .07 | .96 | -.5 | .89 | -1.2 | .48 | .44 | 49.6 | 49.7 | 18 | |
| 3 | 1331 | 400 | .00 | .07 | .92 | -1.1 | .83 | -1.9 | .48 | .44 | 56.2 | 51.3 | 3 | |
| 7 | 1340 | 400 | -.04 | .07 | .78 | -3.1 | .73 | -3.2 | .51 | .44 | 59.7 | 51.5 | 7 | |
| 24 | 1352 | 400 | -.10 | .07 | 1.24 | 2.9 | 1.15 | 1.5 | .48 | .43 | 54.4 | 52.8 | 24 | |
| 5 | 1395 | 400 | -.34 | .08 | .96 | -.4 | .89 | -1.7 | .50 | .40 | 66.2 | 58.7 | 5 | |
| 17 | 1442 | 400 | -.65 | .09 | 1.18 | 1.8 | .96 | -.3 | .45 | .36 | 71.8 | 67.2 | 17 | |
| 16 | 1451 | 400 | -.71 | .09 | 1.37 | 3.5 | 1.10 | .8 | .45 | .35 | 76.8 | 68.5 | 16 | |
| 12 | 1462 | 400 | -.80 | .09 | 1.43 | 3.9 | 1.04 | .4 | .44 | .34 | 78.6 | 70.1 | 12 | |
| 20 | 1462 | 400 | -.80 | .09 | 1.10 | 1.0 | .88 | -.9 | .43 | .34 | 72.3 | 70.1 | 20 | |
| 14 | 1480 | 400 | -.95 | .10 | 1.12 | 1.2 | .76 | -1.9 | .47 | .32 | 79.1 | 73.1 | 14 | |
| 13 | 1485 | 400 | -1.00 | .10 | 1.07 | .7 | .89 | -.8 | .43 | .32 | 77.1 | 73.8 | 13 | |
| MEAN | 1315.0 | 400.0 | .00 | .07 | 1.06 | .6 | 1.00 | .0 | | | 56.8 | 53.5 | | |
| S. D. | 107.2 | .0 | .55 | .01 | .22 | 2.8 | .25 | 2.8 | | | 13.2 | 10.5 | | |

Fig. 2. Item Measure

Based on the Item Measure analysis above, it can be seen from the measure column that item 15, with a logit value of +0.79, is the most difficult item for respondents to agree on in the given teacher competency perception instrument. At the same time, item number 13, with a value of -1.00 logit, and number 14, with a value of -0.95 logit, are the easiest items for respondents to agree with.

The Rasch model can also analyze Item Fit Order to determine fit and misfit items. The following shows the results of the Item Fit Order in Figure 3.

| ITEM STATISTICS: MISFIT ORDER | | | | | | | | | | | | | | |
|-------------------------------|-------------|-------------|---------|-------|------|-------|------|--------|-------|------------|------|------------|------------|------|
| ENTRY NUMBER | TOTAL SCORE | TOTAL COUNT | MEASURE | MODEL | | INFIT | | OUTFIT | | PT-MEASURE | | EXACT OBS% | MATCH EXP% | ITEM |
| | | | | S. E. | MNSQ | ZSTD | MNSQ | ZSTD | CORR. | EXP. | | | | |
| 4 | 1227 | 400 | .45 | .06 | 1.61 | 7.8 | 1.77 | 8.1 | .35 | .49 | 36.0 | 44.9 | 4 | |
| 22 | 1167 | 400 | .68 | .06 | 1.59 | 7.9 | 1.75 | 8.5 | .35 | .52 | 33.0 | 43.8 | 22 | |
| 12 | 1462 | 400 | -.80 | .09 | 1.43 | 3.9 | 1.04 | .4 | .44 | .34 | 78.6 | 70.1 | 12 | |
| 16 | 1451 | 400 | -.71 | .09 | 1.37 | 3.5 | 1.10 | .8 | .45 | .35 | 76.8 | 68.5 | 16 | |
| 24 | 1352 | 400 | -.10 | .07 | 1.24 | 2.9 | 1.15 | 1.5 | .48 | .43 | 54.4 | 52.8 | 24 | |
| 17 | 1442 | 400 | -.65 | .09 | 1.18 | 1.8 | .96 | -.3 | .45 | .36 | 71.8 | 67.2 | 17 | |
| 14 | 1480 | 400 | -.95 | .10 | 1.12 | 1.2 | .76 | -1.9 | .47 | .32 | 79.1 | 73.1 | 14 | |
| 20 | 1462 | 400 | -.80 | .09 | 1.10 | 1.0 | .88 | -.9 | .43 | .34 | 72.3 | 70.1 | 20 | |
| 13 | 1485 | 400 | -1.00 | .10 | 1.07 | .7 | .89 | -.8 | .43 | .32 | 77.1 | 73.8 | 13 | |
| 1 | 1165 | 400 | .69 | .06 | 1.03 | .5 | 1.06 | .9 | .41 | .52 | 42.6 | 43.8 | 1 | |
| 10 | 1208 | 400 | .52 | .06 | .89 | -1.7 | 1.06 | .8 | .40 | .50 | 49.4 | 44.8 | 10 | |
| 15 | 1137 | 400 | .79 | .06 | .96 | -.7 | 1.06 | .8 | .40 | .53 | 40.8 | 42.7 | 15 | |
| 19 | 1325 | 400 | .03 | .07 | 1.03 | .4 | 1.01 | .2 | .39 | .44 | 51.6 | 49.7 | 19 | |
| 21 | 1251 | 400 | .35 | .06 | .99 | -.1 | .94 | -.7 | .46 | .48 | 47.6 | 46.3 | 21 | |
| 5 | 1395 | 400 | -.34 | .08 | .96 | -.4 | .83 | -1.7 | .50 | .40 | 66.2 | 58.7 | 5 | |
| 6 | 1192 | 400 | .59 | .06 | .87 | -2.1 | .96 | -.5 | .40 | .51 | 53.9 | 44.0 | 6 | |
| 18 | 1326 | 400 | .02 | .07 | .96 | -.5 | .89 | -1.2 | .48 | .44 | 49.6 | 49.7 | 18 | |
| 9 | 1227 | 400 | .45 | .06 | .92 | -1.2 | .93 | -.9 | .45 | .49 | 48.6 | 44.9 | 9 | |
| 3 | 1331 | 400 | .00 | .07 | .92 | -1.1 | .83 | -1.9 | .48 | .44 | 56.2 | 51.3 | 3 | |
| 8 | 1235 | 400 | .42 | .06 | .89 | -1.7 | .86 | -1.8 | .52 | .49 | 51.1 | 46.2 | 8 | |
| 23 | 1325 | 400 | .03 | .07 | .88 | -1.6 | .82 | -2.1 | .53 | .44 | 56.7 | 49.7 | 23 | |
| 11 | 1252 | 400 | .35 | .06 | .88 | -1.8 | .86 | -1.8 | .48 | .48 | 52.4 | 46.3 | 11 | |
| 2 | 1324 | 400 | .03 | .07 | .88 | -1.7 | .78 | -2.6 | .50 | .45 | 57.4 | 49.7 | 2 | |
| 7 | 1340 | 400 | -.04 | .07 | .78 | -3.1 | .73 | -3.2 | .51 | .44 | 59.7 | 51.5 | 7 | |
| MEAN | 1315.0 | 400.0 | .00 | .07 | 1.06 | .6 | 1.00 | .0 | | | 56.8 | 53.5 | | |
| S. D. | 107.2 | .0 | .55 | .01 | .22 | 2.8 | .25 | 2.8 | | | 13.2 | 10.5 | | |

Fig. 3. Item Fit Order

To determine fit and misfit items, add the MEAN and S.D. values, then compare them with the MNSQ INFIT values. A logit value greater than the sum of MEAN and S.D. indicates a misfit item. Based on the picture above, it is known that the ideal logit value obtained is $1.06 + 0.22 = 1.28$. Thus, four items fall into the misfit category, namely item number 4 with a value of +1.61, number 22 with a value of +1.59, number 12 with a value of +1.43, and number 16 with a value of +1.37.

Unidimensionality is used to determine whether the instrument used can measure what should be measured, in this case, namely, the perception of teacher competence. The following presents the results of unidimensionality in Figure 4.

| Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units) | | | | |
|---|---|-----------------|--------|---------|
| | | -- Empirical -- | | Modeled |
| Total raw variance in observations | = | 33.6 | 100.0% | 100.0% |
| Raw variance explained by measures | = | 9.6 | 28.6% | 32.0% |
| Raw variance explained by persons | = | 4.0 | 11.8% | 13.2% |
| Raw Variance explained by items | = | 5.6 | 16.8% | 18.8% |
| Raw unexplained variance (total) | = | 24.0 | 71.4% | 68.0% |
| unexplnd variance in 1st contrast | = | 4.3 | 12.8% | 17.9% |
| unexplnd variance in 2nd contrast | = | 2.0 | 5.8% | 8.1% |
| Unexplnd variance in 3rd contrast | = | 1.6 | 4.8% | 6.8% |
| Unexplnd variance in 4th contrast | = | 1.4 | 4.2% | 5.9% |
| unexplnd variance in 5th contrast | = | 1.3 | 3.8% | 5.4% |

Fig. 4. Unidimensionality

Based on Figure 4, it can be seen that the value of the raw variance explained by measure obtained by the instrument in this study is 28.6%; this indicates that the unidimensionality requirement is met, namely a minimum of 20%; if the value is more than 40%, it means it is better; if more than 60% means special. In addition, the unexplained variance section moves from 3.8% to 12.8%, which means that it fulfills the predetermined requirements that the variance value that the instrument cannot explain is not more than 15%. It can be concluded that the instruments used in this study can measure what should be measured.

The next analysis in Figure 5 presents the results of the Variable Map, which focuses on the distribution of respondents' abilities and item difficulty levels.

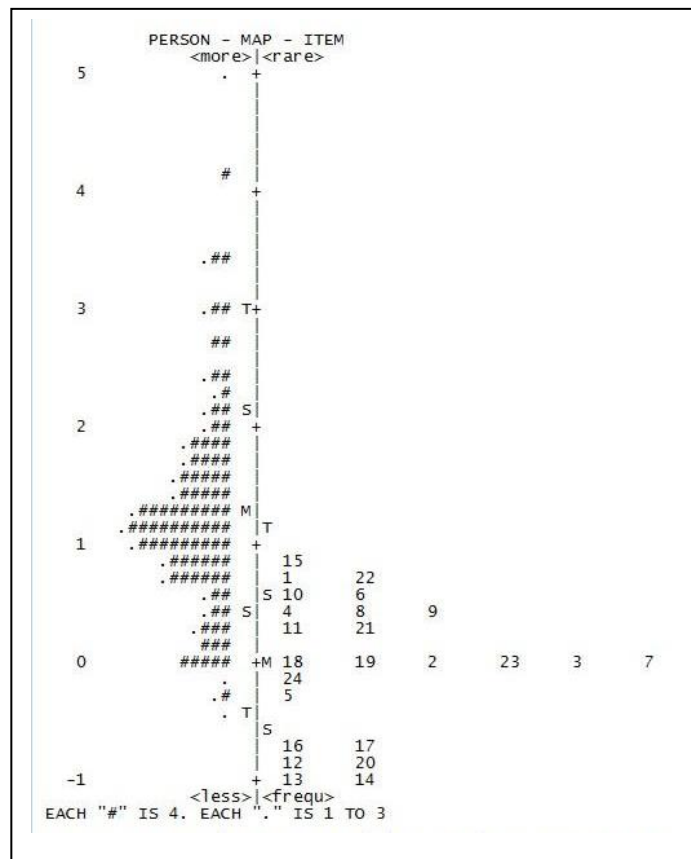


Fig. 5. Variable Maps

The left side is the distribution of respondents' abilities, while the right is the distribution of item difficulty levels. Based on the map in Figure 5, it can be seen that most of the respondents' logit

values are above the average (logit 0) so that overall they can answer instrument items. The most difficult item is item 15 (+0.79) at the top. Theoretically, these items are the most difficult for respondents to agree with. Meanwhile, item number 13 (-1.00) and 14 (-0.95) are in the lowest position, which is the easiest for respondents to agree.

The teacher's competency perception scale is one of the teacher's benchmarks for self-reflection. Students as parties who interact intensively have perceptions of the implementation of teacher learning (Le et al., 2018; Liu & Chiang, 2019). Students can see teacher competence based on four aspects: pedagogic, professional, personality, and social (Rusilowati & Wahyudi, 2020). Student perceptions of teacher competency also contribute to student engagement in learning. Teachers with good competence encourage students to respect and be motivated to achieve maximum academic achievement (Miller et al., 2017). The teacher is a key figure in students' success in learning at school (Curran & Standage, 2017).

The first teacher competency that students can see is pedagogic. The teacher's pedagogic competence refers to the teacher's abilities and skills in managing student learning. The study's results reported that teacher pedagogic competence contributes to teacher performance (Murkatik et al., 2020). Students can feel good teacher performance in the learning process at school correlates with high student academic achievement (Gess-Newsome et al., 2019). Good teacher performance as an implementation of pedagogic competence creates good student study habits (Efendi, 2021). The item statement of aspects of students' perceptions of teacher pedagogic competence refers to students' assessment of teacher performance in designing and managing teaching and learning activities in class.

Teacher professionalism is also the second aspect determining student perceptions of teacher competence. Professional competence includes the teacher's active commitment to learning to master learning material more broadly and deeply (Kunter, Kleickmann, et al., 2013). Good student perceptions of teacher professional competence correlate to good teacher teaching quality and student development in both academic and non-academic fields (Kunter, Klusmann, et al., 2013). Teachers with good professional competence trigger the development of teacher productivity (Asmarani et al., 2021; Nisa & Saleh, 2020). Students can see teacher productivity as a positive thing they can take advantage of, especially in the learning process at school. The item statement on the aspect of student perception of the teacher's professional competence refers to the student's assessment of the depth of the material conveyed by the teacher during teaching and learning in class.

The third aspect determining student perceptions of teacher competence is the teacher's personality. Personality is an important aspect for teachers to be able to interact with students (Sukawati et al., 2020). He personality of the teacher is also reported to have contributed to the creation of positive attitudes and behavioral performance in students (Ulug et al., 2011). Students who have a good perception of the teacher's professional competence contribute to high student interest in achievement and student self-efficacy (Kim et al., 2018). The item statement on the aspect of students' perceptions of the teacher's personality competence refers to the student's assessment of the attitude and behavior of the teacher in interacting with students during teaching and learning in class.

Finally, students can also see the teacher's ability to socialize or social competence. Based on the study results, students reported that teaching social competence is a fundamental aspect that needs to be possessed by teachers because it can trigger the emergence of two-way communication between teachers and students (Tynjälä et al., 2016). Two-way communication between teachers and students encourages the emergence of a good perception of teacher competence because it can trigger positive academic performance. The item statement on students' perceptions of teacher social competence refers to students' assessment of the teacher's ability to establish communication with school members.

Analysis of the instrument's validity using the Rasch model is one of the advantages of this study. Rasch analysis provides more comprehensive data on the analysis of the validity and reliability of the instrument so that the measuring instrument becomes more valid and reliable (Bond & Fox, 2013; Boone, 2016). The measuring instrument as a product of this study has advantages over Rasch analysis because previous studies of instruments for measuring teacher competencies used conventional analysis such as ETCS (Evaluation of Teaching Competencies Scale) (Catano &

Harvey, 2011) dan STERLinG (Teachers' Competencies to Encourage Reflective Learning in small Groups) (Schaub-de Jong et al., 2011). The advantages of measuring teacher competence perceptions are expected to produce accurate data about student perceptions of teacher competence.

The teacher competency perception scale has an important role in education. This measuring instrument can be an instrument that can identify teacher competence based on the student's point of view. Efforts to measure teacher competence from a student's point of view can be a choice behind the problems of teacher competency tests carried out in Indonesia, which only measure from the teacher's point of view (Himawan, 2016). Teacher competency assessment involving the teacher and students' perceptions of teacher competency provides comprehensive and accountable data on teacher competence, both pedagogic, professional, personality, and social.

Research that produces a measuring instrument for the perception of teacher competency has several limitations. First, the subject of this instrument trial is limited by involving teachers in one area. Trials involving a large scale increase the chances of increasing the level of validity and reliability of the instrument. In addition, another weakness of this study is the need for expert judgment that can analyze the content validity of the instrument item on the teacher competency perception scale. Expert judgment can reduce the chance of invalid items.

4. Conclusion

The need for measuring instruments to identify student perceptions of teacher competence is answered in this study. The teacher competency perception scale consists of 20 statement items in four aspects (pedagogic, professional, personality, and social). These are categorized as good for measuring the student perception scale of teacher competence. This research has contributed to the science of teacher professionalism, especially in presenting data that complements teacher competency data based on teacher competency tests. The results of this study should be a reference for experts and practitioners to measure teacher competency. In addition, we recommend that future research broaden the subject of trials that do not only focus on teachers in one region but also involve teachers from various regions in Indonesia.

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Declarations

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