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Computer-Based Test (CBT) Assisted Assessment with Rasch Model to Improve Vocational High School Teachers' Skills

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Abstract: The aim of the community service program conducted is to enhance the skills of teachers and students at Bina Kusuma Private Vocational High School in Nanga Pinoh by using computer-based tests and improving teachers' skills in analysing the quality of assessment instruments using the Rasch model theory with the assistance of WinStep. The proposed solution to address these challenges involves conducting workshops and assisting in preparing test instruments. This includes guidance on using computer-based tests for both teachers and students, as well as workshops and assistance in applying the Rasch model to determine the validity of instruments. This community service used Participatory Action Research (PAR) method to find problems experienced by partners. The partners' issues consist of instruments from authentic assessments used at Bina Kusuma Private Vocational High School in Nanga Pinoh, which were made independently by the respective subject teachers and were directly used as benchmarks for student achievement, and the assessment instruments still did not utilise the available resources (computers and smartphones). Efforts made to address the partners' issues included developing authentic assessment instruments that were appropriate and valid. Based on the evaluation results of the activity implementation using the Kick Patrick Level 1 method, the average evaluation score for the presenters was 82.125, and the average evaluation score for the method, relevance and usefulness, facilities, and consumption was 88.75. The constraints encountered in this activity were that the community service program implementers needed to consider timing and conduct more in-depth evaluations. Recommendations for implementing community service program activities included developing a more structured community service program and integrating it with routine school activities.
Keyword: assessment; computer-based test; evaluation; measurement; rasch model

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INTRODUCTION

Bina Kusuma Private Vocational High School is a private school in Nanga Pinoh, Melawi Regency, West Kalimantan Province. The school is located on Pendidikan Desa Pall Street, Nanga Pinoh. This school is owned by a foundation with School Establishment Decree Number 04/144/Kep/2001 dated February 1, 2001. According to the education office, the number of recognised teachers in Bina Kusuma Private Vocational High School is 18 people, with a total of 287 students. The school's departments consist of the technology department, computer and network department, office management department, institutional accounting and finance department, and nursing department. The school's flagship program is the improvement of non-cognitive abilities through extracurricular activities. Currently, a school entrepreneurship group has been formed with its main focus on cassava, covering everything from cultivation to producing final products.

This school supports the government's activities in implementing the independent school curriculum. The teacher development program at Bina Kusuma Private Vocational High School is called "*Merdeka Mengajar*" (Teaching Independence). The "*Merdeka Mengajar*" activities aim to help teachers implement the independent curriculum at the school. These activities focus on preparing the learning process that results in project-based learning to strengthen the profile of Pancasila learners. Unfortunately, the government has not yet provided facilities to facilitate teachers in producing valid learning assessments.

Assessment is the measurement of students' success in learning. The assessment used by Bina Kusuma Private Vocational High School in Nanga Pinoh is authentic. Authentic assessment is a reflective action in learning (Marzano et al., 2011). Authentic assessment includes cognitive, affective, and psychomotor assessments (Hasyim et al., 2020; Rusdiana et al., 2014). This activity is crucial as a benchmark for success in the learning process. Providing appropriate assessments demonstrates the accuracy of the learning process outcomes.

The instruments for authentic assessment used at Bina Kusuma Private Vocational High School are independently created by subject teachers and directly used as benchmarks for student achievement. There have been no efforts to validate these assessments because teachers perceive testing validity using Excel as complicated. However, validity can be achieved through two methods: content validity and empirical validity. Content validity is the testing of instruments to measure the components within the instrument, such as material and language suitability. Several experts test content validity, and the data presented are considered valid (Haynes et al., 1995). Meanwhile, empirical validity is obtained through the test results given to respondents equivalent to those who will be evaluated or studied (Chappuis et al., 2012).

Such conditions indicate that the assessments are less objective and not tailored to the respondents. However, assessment instruments should be adjusted to the respondents and the level of the questions. Stiggins & Chappuis (2012) explained that the quality of an assessment is good if it has clear and targeted goals, target test participants, design, and reports (Chappuis et al., 2012; Shiau-Wei Chan et al., 2020). After the assessment instruments meet the quality criteria, instrument validity testing is conducted.

Based on interviews with the School Principal at Bina Kusuma Private

Vocational High School, data were obtained indicating that the exam questions given to students were paper-based due to limitations in learning facilities and infrastructure. The limitation in facilities could be addressed by using CBT, which could be used on computers and smartphones. Another limitation was that the instruments used tended not to be analysed for their quality, and revisions were made due to difficulties in conducting the analysis. The Rasch model was employed to facilitate data analysis, making validity and reliability data processing easier. This was because the Rasch model could describe the level of ability of students participating in the trial. Rasch model analysis was used in this research because it could analyse student score patterns deeply, not just as group data (Debelak et al., 2022). The Rasch model is suitable for use with dichotomous data. For polytomous data, the partial credit model, which is a development of the Rasch model, can be used (Handoko et al., 2019).

Another issue at Bina Kusuma Private Vocational High School is that the assessment process still lacks available resources (computers and smartphones). The assessment implementation at Bina Kusuma Private Vocational High School is still paper-based. Paper-based assessments have drawbacks, namely, the assessment results take a long time compared to computer-based assessments. Teachers need time to check students' answers before announcing the assessment results. In contrast, computer-based assessments can announce test results shortly after students finish them. Therefore, efforts are made to maximise the available resources by replacing paper-based tests with computer-based ones.

Computer-based Test (CBT) is a term used to describe the implementation of tests using computers. The advantages of using this method include the distribution of questions and answers, time-saving in checking answers, and reducing paper usage (Handoko et al., 2019). CBT is quite effective for evaluating student learning outcomes (Carpenter & Alloway, 2018; Marzuki et al., 2020; Tananda et al., 2023). However, several considerations must be made when implementing CBT, such as increasing cognitive workload, understanding students' readiness for technological transition, and knowing students' characteristics and their biological development (Tananda et al., 2023).

Based on the analysis of the situation, the partner's problems to be addressed are 1) the lack of teachers at Bina Kusuma Private Vocational High School who conduct authentic assessments with appropriate and valid instruments and 2) the lack of resources related to test implementation at the school. Based on these problem statements, the proposed solutions are efforts to improve the quality of partner services through training and mentoring and increase partner resources by providing facilities such as CBT and WinStep.

METHOD

The method of community service implementation used was Participatory Action Research (PAR) (Agustiningsih & Sholehah, 2023; Rizal & Mustapita, 2023; Saa'dah & Fitriah, 2023). Implementing this method began with the conduct of Focus Group Discussions (FGDs) to identify the partners' issues and find solutions to these issues. The Melawi Teacher Training and Education College conducted community service activities with the target partner being Bina Kusuma Private Vocational High School in Nanga Pinoh. This activity was attended by 21 teachers from Bina Kusuma Private Vocational High School. The FGD activities aimed to

understand the partner's condition and prepare the training and practical guidance processes to be more effective. These activities included FGDs with the School Principal, Operators, and students. Based on the needs analysis, Bina Kusuma Vocational High School still faced challenges in developing and analysing test instruments. Additionally, while the school's resources were considered sufficient, there was a need to enhance these resources to maximise the implementation of learning outcome measurements using technology to support education.

Based on those issues, several activities were carried out, including workshops and mentoring for the development of authentic assessment instruments, using CBT applications for teachers, operators, and students, and testing the quality of instruments using the Rasch model. The activities were conducted offline from October 6th to 9th, 2021, with teachers assigned tasks to collect grids and multiple-choice test instruments, one of which was piloted with students. The trial was conducted using the CBT provided prior to the activity. The trial results served as the basis for practice in analysis using WinStep. The expected outcomes included Bina Kusuma Private Vocational High School teachers being able to develop valid multiple-choice test instruments based on the Rasch model theory and the service provided by Bina Kusuma Vocational High School to students becoming more optimal.

The final stage of this activity was monitoring and evaluating using questionnaires and a section for suggestions and feedback from training participants. This activity aimed to monitor the implementation of the community service program and efforts to improve the quality of service delivery. Monitoring and evaluation activities were conducted using questionnaires based on the Kick Patrick Level 1 Theory.

RESULTS AND DISCUSSION

The community service activity was conducted offline on October 6th, 7th, and 9th, 2023, with 21 teachers from Bina Kusuma Private Vocational High School in Nanga Pinoh participating. The implementation of the activity involved training and mentoring related to developing multiple-choice test items, mentoring on CBT usage, training and mentoring on using WinStep, and data interpretation. This aimed to integrate technology into the testing process, and the assessment of the suitability of test instruments in the learning process needed to be done intensively. This was in line with previous community service conducted by Karim et al. (2021), which stated the importance of continuous community service implementation so that teachers were able to conduct test trials intensively and analyse their validity and reliability. One basis for this community service implementation was to enhance implementation in different partners and use modern theory applications to analyse test feasibility. The steps taken during this activity included:

Preparation

The preparation stage aimed to ensure the smooth implementation of the activities. Several activities carried out at this stage included coordinating with the Principal of Bina Kusuma Private Vocational High School, coordinating with School Operators, conducting FGDs related to the material to be presented, drafting an evaluation questionnaire for the activities, preparing presentation slides, and conducting FGDs related to the roles and responsibilities of lecturers and students.

During the preparation stage, the implementation team also ensured that the CBT and WinStep applications to be used were installed on the school's computers and laptops. The installation activities for both applications took place over three days, from October 2nd to 4th, 2023. The implementation team coordinated with the School Operator and the Computer Laboratory Manager at Bina Kusuma Private Vocational High School.

Implementation

The implementation of this activity consisted of training and mentoring aimed at enabling teachers to design five multiple-choice test items, apply the test instruments in a Word template in CBT, understand how to operate WinStep and interpret the resulting data. The implementation of training and test development assistance is shown in Figure 1.

Figure 1 Training and mentoring in test development

The training assisted by CBT aimed to improve efficiency in the learning evaluation process.

The implementation of activities in session 1, which focused on designing multiple-choice test instruments, began with a review of teachers' knowledge regarding tests, test construction methods, types of tests, and the criteria for well-constructed tests for each type, as well as understanding examples of well-categorised tests. During this session, participants appeared enthusiastic about the activities, providing feedback and asking questions about the material being taught. After the presentation of the material, participants were given time to develop multiple-choice tests using the grid template and question template for the CBT application provided. A challenge encountered during the implementation of this activity was that teachers were unable to complete the tasks during the training and mentoring sessions. Nevertheless, teachers remained committed to completing the tasks and agreed to submit them by Monday, October 9th, 2023. Teachers conducted independent practice at their respective homes. Assisting students with computers, handphone, and operators are shown in Figure 2.

(a) (b) (c)

Figure 2 (a) Assisting students with computers, (b) Assisting students with handphone, and (c) Assisting the operator

Session 2 focused on using CBT to aid in the learning assessment process. CBT in education provided more valid learning outcomes (Witmer & Bouck, 2023) and enhanced learning motivation (Suparman et al., 2023). Therefore,

CBT played a role in improving the quality of learning evaluation.

This activity was carried out in three groups: teachers, students, and school operators. Teachers were provided with an understanding of how to fill in the question templates used in the CBT application. Teachers found it easy to understand because the template used was very simple, consisting of columns for questions, answer choices, and scores. Students were trained in using CBT on computers and smartphones. The students understood the CBT provided adequately. A challenge faced during session 2 was that students still needed to understand the CBT interface fully. This resulted in students needing to ask about how to complete the tests. The solution was to provide a module on how to use it before the exam and monitor its implementation. The implementation of training and mentoring in WinStep usage is shown in Figure 3.

Figure 3 Training and mentoring in WinStep usage

The final session of this activity was training and mentoring in using the WinStep application. This activity began with providing material related to validity, the differences between classical and modern theories in measurement, types of measurement with modern theories, explanations of how to use WinStep, and interpreting the results obtained from WinStep. Empirical validity measurements of tests using the WinStep application are more accurate than SPSS 20. WinStep is an application integrated with Rasch modelling (Tarigan et al., 2022; Linacre, 1999).

The enthusiasm from the training participants regarding using the WinStep application was quite good. Most teachers had never used the WinStep application in teaching before. It was evident that only 1 out of 21 teachers was familiar with logits in data validity measurement. The class tended to be enthusiastic because the teachers at Bina Kusuma Private Vocational High School felt that the application was new and tended to facilitate categorising test items and students' abilities. However, implementing this activity faced challenges, such as insufficient time, because participants tried to use it directly. Another challenge was the need for more understanding of this application by the assigned students who were supposed to assist.

Activity Evaluation

The evaluation of this activity used the Kick Patrick Level 1 method. Level 1 evaluation assesses participants' reactions to the training implementation (Pramanik et al., 2022; Irfan et al., 2022; Iskandar, 2019). Participants provided ratings on the quality of the training implementation. The aspects measured in the Patrick Level 1 method in this training consisted of the presenter, methods and media, relevance and usefulness, facilities, and refreshments. Evaluation of Presenters is shown in Figure 4.

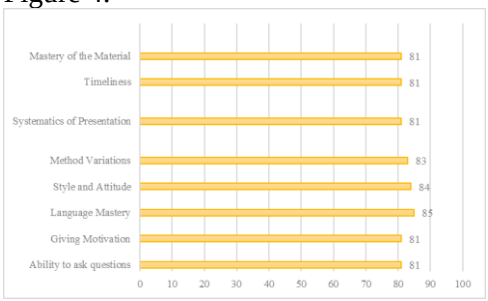

Figure 4 Presenter evaluation

The evaluation results for the presenter using eight aspects of mastery of the subject matter, punctuality, presentation systematic, method variation, style and attitude, language proficiency, motivation provision, and question-answer ability, scored 82.125, as shown in Figure 4. Language proficiency was the highest aspect possessed by the presenter, while motivation provision was the lowest.

The evaluation results for the method, relevance and usefulness, facilities, and refreshments scored 88.75 as shown in Figure 5. Based on the evaluation results, the method and media still needed to be improved, especially regarding the suitability of observations, the quality of teaching materials, and delivery time. Furthermore, their relevance and usefulness also need to be clarified further to maximise their effectiveness.

Evaluation of Program is shown in Figure 4.

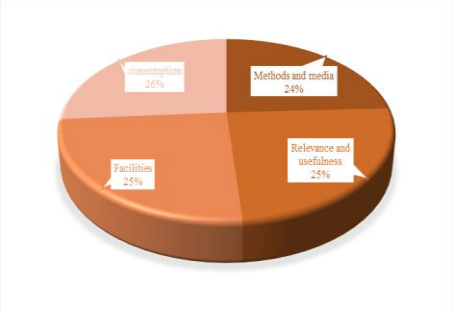

Figure 5 Program evaluation

Some comments from participants who filled out the comments and suggestions column were as shown in Table 1. The issue of using technology in education was one of the challenges faced by teachers. Therefore, training in using technology in education was highly anticipated by teachers (Pramita et al., 2021). Implementing community service became one of the alternatives for teachers to obtain direct assistance in using technology in education, especially in using CBT to evaluate learning outcomes and using WinStep to improve teachers' skills in analysing the empirical validity of test instruments.

Based on the results of the activity, input and suggestions were obtained as shown in Table 1.

Table 1 Comments and suggestions

Comments and Suggestions
It greatly assists the learning process in school by creating questions to assess students' competency levels.
This activity greatly aids teachers in question creation and understanding the strengths and weaknesses in question development.
The implementation and activities are quite good for teachers to use new applications in the teaching process at school and can be applied to students.
The delivery of materials and the implementation of activities are quite satisfactory and provide new knowledge. The material is presented clearly and systematically, using simple and clear language.
It is very beneficial, and we hope we can apply it. The explanation is systematic.
The delivery of materials is very satisfying and understandable; it adds to my knowledge.
Hopefully, in the future, explanations can be slower.
It is very satisfying and has taught me a lot.

CONCLUSION

The community service activities were carried out through the preparation, implementation, and evaluation stages and were maximally executed. Participants, consisting of teachers, could design multiple-choice tests and use the WinStep application. The involved students could use CBT without obstacles, and operators understood their roles in using the CBT application. Similar activity implementations were suggested to consider timing and conduct more in-depth evaluations. This ensured that the activities

were more meaningful and could be easily applied to the partners.

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