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Making of Diagnostic Assessment in the Wizer.Me-Based Problem-Based Learning (PBL) Model to Measure Students' Critical Thinking Skills

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ABSTRACT

This study evaluates the validity and practicality of a diagnostic assessment based on wizer.me. The ADDIE (Analysis, Design, Development, Implementation, Evaluation) model was used in this study. Data sources were obtained from the validation results of physics lecturers at the Faculty of Mathematics and Natural Sciences, UNP. Practicality data sources were obtained from teachers and students of class XII F1 at SMA Negeri 2 Batusangkar. The data analysis method for product validation used Aiken's V, and practicality used the percentage technique. The validation test results, which were assessed based on content feasibility, language use, presentation feasibility, and assessment graphics, were categorized as high at 0.87. With product practicality criteria including ease of use, attractiveness, and efficiency, teachers and students obtained 91.3% and 73.08%, respectively, which were categorized as very practical and practical. Thus, it can be concluded that the PBL diagnostic assessment product for temperature and heat material for grade XI high school can be used to evaluate the physics learning process.

Keywords: Diagnostic Assessment, PBL Model, Temperature and Heat.

I. INTRODUCTION

21st century education requires students to improve their competencies, including knowledge, attitudes, and skills. Students who have broad knowledge, can think critically, communicate well, create and innovate, and are literate can meet the learning objectives of the 21st century[1][2] . There are four essential competencies that must be possessed, namely critical thinking, creative and innovative thinking, communication, and collaboration[3] . Improving the quality of education by emphasizing the development of students' critical thinking skills is one of the efforts that can be made[4] . The ability to think critically will have a positive impact on training students to solve problems during the learning process.

Assessment is a systematic and continuous process or activity to gather information about students' learning processes and outcomes in order to make decisions based on specific criteria and considerations[5] . Diagnostic assessment can be said to be the first step taken by teachers before teaching begins[6] . Diagnostic assessment is actually used to identify students' strengths and weaknesses in learning activities[7] . Diagnostic assessment is the first step taken by teachers before teaching begins to identify students' strengths and weaknesses[8][9] . Through this assessment, teachers can understand the initial conditions of their students so that teaching can be designed and adapted to the needs of each student to make the learning process more effective.

Students' critical thinking skills were the first issue. The researchers assessed students' critical thinking skills using essay questions. The graph below shows the results of critical thinking skills assessment conducted at SMA Negeri 2 Batusangkar. The researchers used critical thinking ability indicators from Ennis[10][11] [12] . Of the five indicators used, there was one indicator that students still lacked mastery of , namely the indicator of drawing conclusions. The average score obtained was 40, which is categorized as very low.

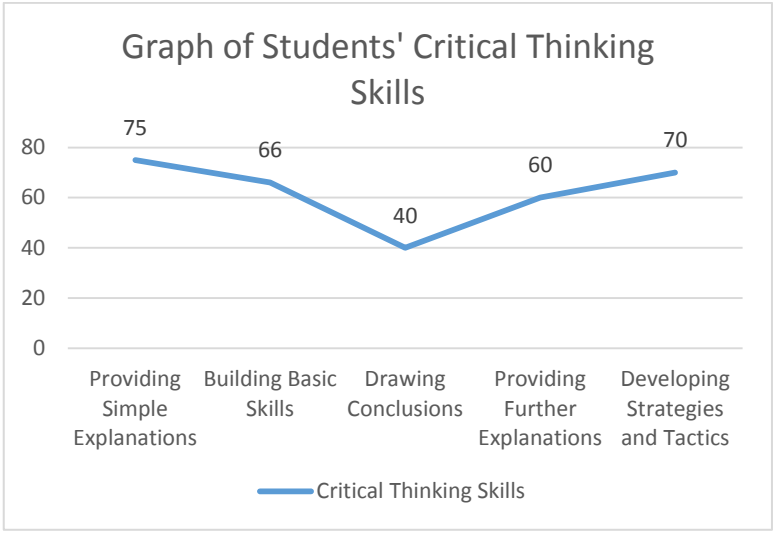

Fig. 1 . Graph of Students' Critical Thinking Skills

Based on Figure 1, it was found that students' critical thinking skills in the indicators of providing simple explanations and setting strategies and tactics were in the good category, followed by the indicators of building basic skills and providing further explanations in the moderate category, and finally the indicator of drawing conclusions in the very low category.

Apart from the results of the instrument test conducted, there are several other studies that show that students' critical thinking skills are still low. Based on research conducted by Agustin[13] , it shows that the critical thinking skills of grade XI IPA students at SMA Negeri 9 Samarinda on the subject of heat are in the very low category, namely 36.11%. Furthermore, research conducted by Wahid[14] shows that the critical thinking skills of grade XI IPA students at SMA Negeri 22 Makassar on the subject of heat are still very low, with an average percentage of 39.06%.

The next problem relates to the subject of temperature and heat. The low success rate in answering questions about temperature and heat indicates that many students still have difficulty understanding this subject, according to the results of the test instruments that have been used. In addition, a number of studies show that students' understanding of the concept of heat is still lacking[15] . High school students' understanding of heat material is still relatively inadequate, according to Merya's research[16] . The average conceptual understanding score of the 14 students who participated in this study was 22.28%; the lowest score was 13, and the highest was 33.

The next problem relates to the use of assessment in the learning process. Based on interviews with several physics teachers at SMA Negeri 2 Batusangkar, it was found that in physics learning, the application of assessment has not focused on students' critical thinking skills. The results of the interviews with teachers showed that teachers are aware of the competencies that students must have in the 21st century and teachers also said that students need to have critical thinking skills. However, teachers never assess, test, or conduct assessments to measure students' critical thinking skills.

There are difficulties in this research due to the problems described above. Therefore, the use of technology-based assessment in education can help solve 21st-century problems and offer innovative solutions. One solution to overcome this problem is to use a platform that has great potential in the development of digital assessment. That platform is *Wizer.me*. *Wizer.me* is a *website* that allows educators to create assessments that are engaging, interactive, and easy to use[17] . Based on the issues mentioned above, there are problems in this research. Therefore, the use of technology-based assessments in learning can address the challenges of the 21st century to find innovative solutions[18] .

II. METHOD

The ADDIE development model was used in this research. The ADDIE model is divided into five stages: *(Analysis, Design, Development, Implementation, Evaluation*). The five steps in the ADDIE model development process are illustrated in the following figure.

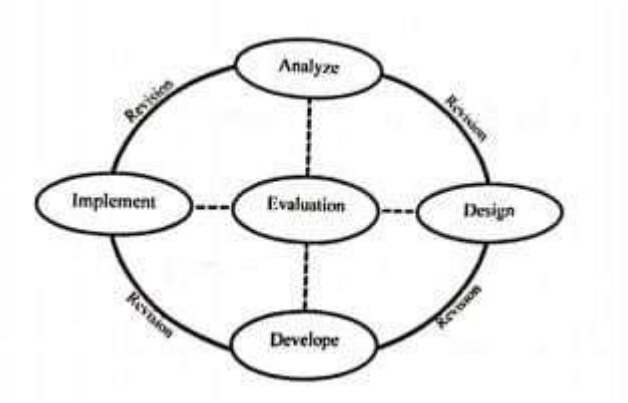

Fig. 1. ADDIE Scheme [19]

The initial stage of product creation is the *analysis* stage. The three components of the *analysis* stage are student needs analysis, curriculum analysis, and student characteristics analysis. Diagnostic assessment evaluation is designed during the *design* stage, which includes task selection, determining criteria, creating rubrics, and initial product design. Product creation is part of the *development* stage. *The design* stage plan serves as the stage for product creation. The *development* stage includes 1) creating diagnostic assessments, 2) conducting validation tests, and 3) revising the product based on validator suggestions. Finally, the product's readiness for practical testing is evaluated throughout the *implementation* stage. The *evaluation* stage is the final stage, which aims to ensure that the product meets the desired objectives.

The validity of the product results is seen from the questionnaires filled out by lecturers from the Physics Department of Padang State University. The validity test assessment questionnaire was compiled based on a Likert scale[20] . The data obtained from the validators was analyzed using the validity index proposed by Aiken. Based on the evaluation results of three lecturers who are knowledgeable about the topics of temperature and heat, the content validity coefficient was calculated using the V Aiken formula. The following is the V Aiken formula used:

$$V = \frac{\sum s}{n(c-1)} \qquad (1)$$
$$s = r - l_0$$

The criteria used in determining the validity of the diagnostic assessment can be seen in the following table.

Table 2. Decision categories follow Aiken's V scale

Interval	Valid category
< 0.4	Less
0.4 ≤ V ≤ 0.8	Moderate
> 0.8	High

(Source: Ref[21])

Analysis of the practicality of the developed product based on the practicality test sheet filled out by physics teachers and students

$$Nilai = \frac{Bobot\ Total}{Bobot\ Maksimum} x\ 100\% \qquad (2)$$

The scores given by students were calculated based on these instructions, and the final results were matched with the Likert scale table.

Table 3. Product Practicality Criteria

Final Score (%)	Category
81 – 100	Very Practical
61	Practical
41–60	Less Practical
21	Not Practical
0	Very impractical

(Source: Ref[22])

III. RESULTS AND DISCUSSION

This study evaluates the validity and practicality of wizer.me-based diagnostic assessments. This study was validated by three physics lecturers and tested for practicality by two physics teachers and 31 students. According to Rohmat[23] , "to determine the quality of the results of model and learning tool development, three criteria are required: validity, practicality, and effectiveness." This study was limited to the practicality stage. This is in line with the research objective, which is to create a valid and practical diagnostic assessment product for use in physics learning.

This research began with an *analysis* stage which showed that students' critical thinking skills were in the low category in terms of providing further explanations and building basic skills, especially in terms of drawing conclusions, which were still categorized as very low. *The Problem-Based Learning model* has not been fully implemented in the learning process, and assessment is still focused on print media and does not yet utilize technology.

In *the design stage,* tasks were obtained through curriculum analysis and the determination of final achievements in the diagnostic assessment design stage. The diagnostic assessment was created using the PBL model. The results of the diagnostic assessment placement multiplied cases in everyday life. The characteristics were made flexible for use in each KD in the diagnostic assessment so that they were general but still in line with the material and the final achievement requirements for student abilities. The characteristics that have been determined are translated into a diagnostic assessment rubric for each PBL model syntax. Next, the rubric is created based on the criteria from the diagnostic assessment analysis. The structure, components, writing, and content of the diagnostic assessment activity sheet are in accordance with the Ministry of Education and Culture's[24] .

This *development* stage produces a diagnostic assessment that can measure students' critical thinking skills. The following is the cover design for the diagnostic assessment, which consists of instructions for using CP, TP, IKTP, critical thinking indicators, Meeting 1, Meeting 2, and Meeting 3 for students, containing instructions for completing the questions.

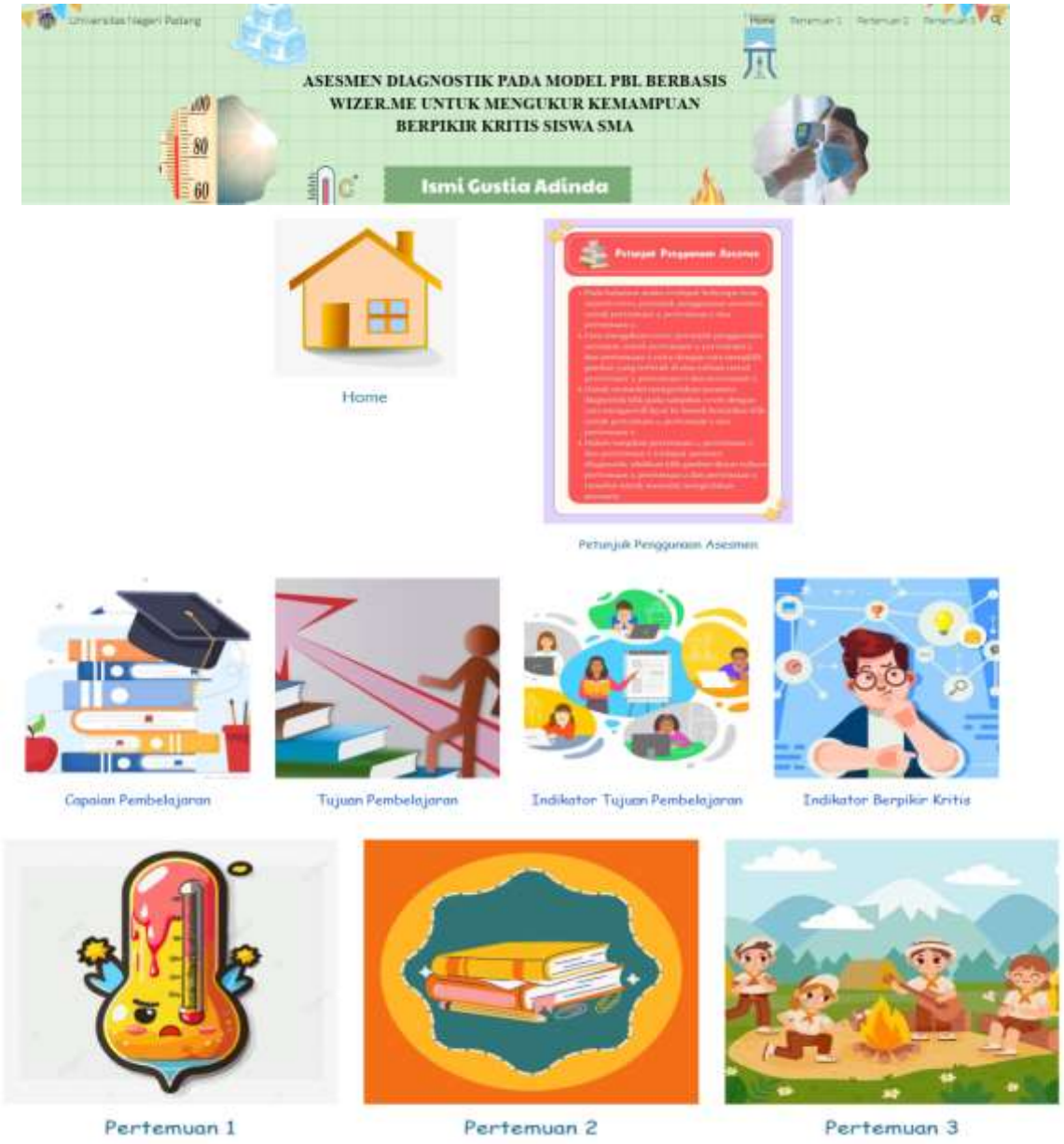

Fig. 2. Diagnostic Assessment Cover

The diagnostic assessment that has been created will be validated by three expert lecturers. Based on the validity assessment instrument, there are four assessment components analyzed by experts regarding the diagnostic assessment. The validity instrument used for experts can be seen in the following figure.

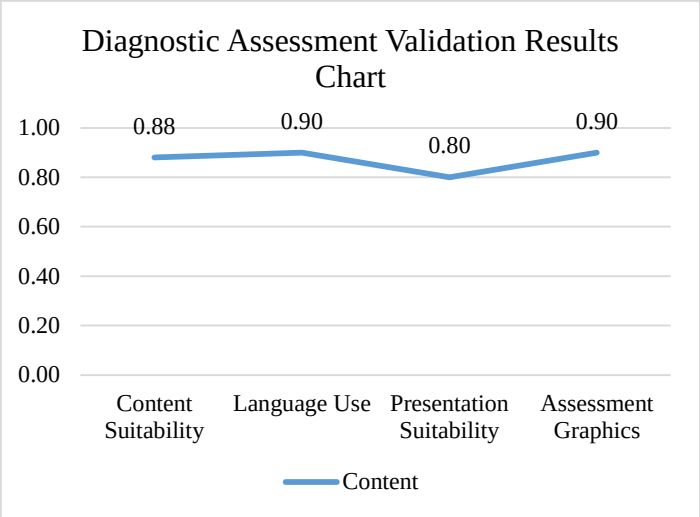

Fig. 3. Diagnostic Assessment Validation Results

Based on Figure 3, the diagnostic assessment validation results from the content feasibility component were 0.88, the language usage component was 0.90, the presentation feasibility component was 0.80, and the assessment graphics component was 0.90. The average value of the diagnostic assessment validation was 0.87.

The analysis results show that the average value of *Aiken's V* index is 0.87 for all assessment components. This means that the diagnostic assessment activity sheet produced is in the high category. This diagnostic assessment can be used for trials in schools. In line with Ibrahim[25] , a valid instrument will provide valid data for educational decision making.

During the *implementation* stage, the practicality of the diagnostic assessment was tested. The feasibility of the diagnostic assessment was determined based on the results of practical tests conducted by teachers and students as users of the diagnostic assessment in learning.

The following are the results of the practicality of teachers in the following figure.

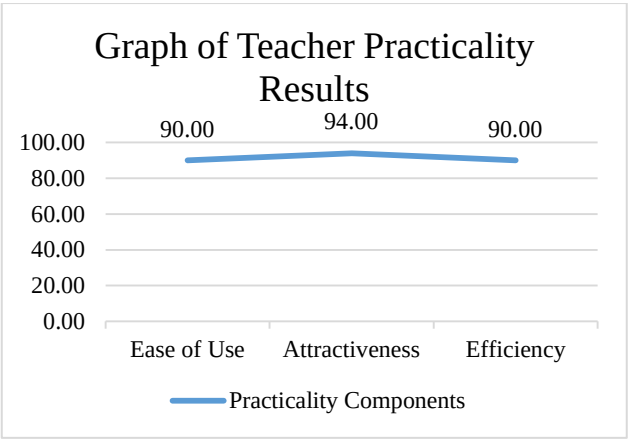

Fig. 4. Results of Practicality by Teachers

Based on Figure 31, the results of the practicality by teachers from the ease of use component were 90.00, the attractiveness component was 94.00, and the efficiency component was 90.00. The average score for the practicality results by teachers is 91.33. The results of the analysis of the practicality of teachers show an average percentage of 91.3% for all assessment components in the very practical category.

The following are the results of student practicality in the following figure.

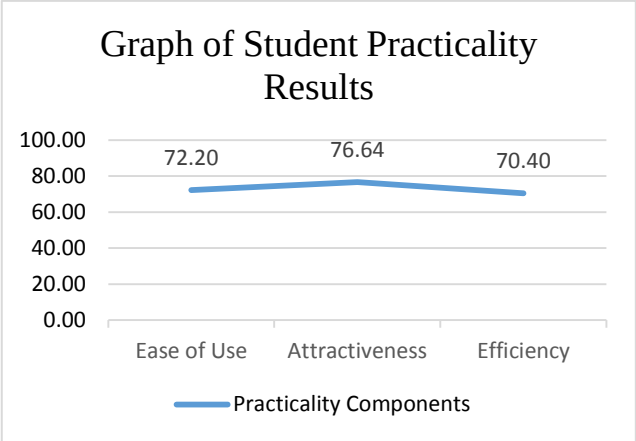

Fig. 5. Students' Practicality Results

Based on Figure 35, the results of the students' practicality are as follows: ease of use component of 72.20, attractiveness component of 76.64, and efficiency component of 70.40. The average score for student practicality was 73.08. The results of the student practicality analysis showed an average percentage of 73.08% for all assessment components in the practical category. This means that the diagnostic assessment product in the *problem-based learning* model for temperature and heat material for 11th grade high school students is very good and practical to use in learning. According to Purwanto[26] , if a product is practical, the likelihood of it being used is high. A practical product emphasizes ease of use and the benefits of using the product.

IV. CONCLUSION

Based on the results and discussion, it can be concluded that the product validity test result of 0.87 is classified as high with product characteristics seen from the content feasibility, language use, presentation feasibility, and assessment graphics. The results of the practicality test for teachers and students obtained average scores of 91.3% and 73.08%, respectively, which are classified as very practical and practical, with the criteria for product practicality being ease of use, attractiveness, and efficiency. Therefore, it can be concluded that the wizer.me-based diagnostic assessment product can serve as a practical tool for teachers to identify students' misunderstandings in the assessment of the physics learning process.

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