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Analysis Concepts Redox Using Multiple Representation Based Test Instrument with Computer Based Test (CBT) Model

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Abstract

The research was designed as the method of R&D with the 4D model, define, design, develop and disseminate. The purpose of this research is to develop a diagnostic test instrument two-tier with CBT to diagnose students' understanding profile. The test instrument can be used for the analysis and understanding of the concept Redox with the interpretation of the combination of the students' answers with the class understand the concepts, misconceptions, guessing, do not understand, and do not understand. The results of the feasibility test instrument indicate that the content validity of the category feasible with reliability 0.79. Profile of understanding the concept of students showed which scientific knowledge of which 9 out of 35 students (26.86%), positive misconception that 2 out of 35 students (4.14%), negative misconceptions is one of 35 students (2.43%), the misconception is one of 35 students (1.86%), lucky guess that is one of 35 students (3.71%), lack of knowledge that 12 of 35 students (34.86%), and did not know that 9 out of 35 students (26.14%) the concept of Redox.

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INTRODUCTION

Chemistry is the study of natural science that most of the discussion about the chemical reactions that includes interactions between atoms that tend to be abstract (Kean & Middlecamp, 2010). In addition to the abstract, chemistry concepts also contains a mathematical calculation so that the necessary math skills to solve chemical problems (Hafsah et al., 2014). Ainsworth (2006) in his research suggests the various problems faced in learning chemistry. Those problems among which the chemical material being studied very much that contains a variety of representation and presentation of the concept of chemistry at school does not correspond to the facts.

Multiple chemical representation of a representation that includes aspects of macroscopic, submicroscopic, symbolic and mathematical (Johnstone, 2000; Hafsah et al., 2014). Redox materials and the nomenclature is a chemical material that is very close to the daily life and plays an important role in a variety of chemical processes. Redox materials and nomenclature involve concepts that are abstract and have links between concepts so that students tend to have difficulty in understanding the overall concept. Langitasari (2016) states that the understanding of the concept of redox reactions and nomenclature as a whole requires the ability to find connections between phenomena by the naked eye (macroscopic) into the structures and processes at the level of particulate matter (submicroscopic) and present in the form of representation of symbols (symbolic).

The learning process, especially chemical redox materials and nomenclature in school tend to use teaching methods that only explains the concept of chemistry at the macroscopic level and symbolic, and yet the link between the three levels of representation. Langitasari (2016) states that there are many teachers in high school who do not integrate the macroscopic level, submicroscopic level, and the symbolic level in teaching chemistry concepts but move among the three levels of such representations without connecting. Results of studies have provided evidence that teachers often fail to connect the levels of representation during the learning process and more often neglect the level of particulate matter (submicroscopic) so that it becomes the basis of the emergence of a misconception in students.

Identification of students' learning difficulties in understanding the concept of the right chemistry with the required tests. Formative or summative tests can be used as an initial identification, ie determining what material is felt hard by the student(Rusilowati et al., 2015), The means used to determine students' understanding of concepts such as with the use of concept maps, interviews, and diagnostic tests.

The diagnostic test is used to determine the strengths and weaknesses of the students when learning something so that the results can be used as the basis for providing follow-up. A diagnostic test with a two-tier model of a suitable test model is used to analyze student understanding because it is easy to apply to students. The first level in a two-tier diagnostic test consists of questions with five possible answers, while the second level consists of five options reason refer to the answer on the first level. The reason consists of one correct answer and distractors. Interviews should be done to reinforce the reasons students(Tuysuz, 2009).

METHODS

This study uses the Research and Development research design 4D model. The model of 4D is define, design, develop and disseminate appropriate steps (Thiagarajan et al., 1974). The steps in this research are divided into two stages. The first step is the development of a diagnostic test instruments two-tier and second stage of the application instrument two-tier diagnostic test for the identification of students' understanding of the concept.

Source data used are primary data and secondary data. Primary data is data collected directly. In this study, the primary data used were (1) Data from the experts to determine the

validity (appropriateness) instruments developed; (2) Data on student results small-scale trials; (3) Data on students' test results a large scale; (4) Data from the two-tier diagnostic test students with redox materials; (5) Data from interviews with some of the students with the greatest misconceptions value of data in the form of a narrative. Secondary data collected from various sources, ie from journals, theses, books literature and others. The research subjects in this study can be seen in Table 1.

The instruments used in data collection and data collection techniques performed in this study are presented in Table 2.

Table 1. Research subject

No.	Type Test	Research subject	The number of students
1	Small-scale trials	Students of class X MIA 3 MAN 2 Semarang	9
2	Large-scale trials	Class X MIA 3 MAN 2 Semarang	35
3	Data retrieval	Class X MIA 1, MIA 2 MIA 3 MAN 2 Semarang	100

Table 2. Techniques and Data Collection Instrument

Stage Research	Data	Data collection technique	Data Collection Instrument
Preliminary studies	Study of literature	set of Literature	Literature Summary Sheet
	Field Study description	Student interviews	Interview sheet
	Students	test Description	Problem Description Sheet
development Instrument	Validity Test Instruments	Giving Questionnaire	Validation sheet
	The validity of the non-Test Instruments	Giving Questionnaire	Validation sheet
Small-Scale Trial	Answer Students	Test	sheet Problem
Large-Scale Trial	Answer Students	Test	sheet Problem
Data retrieval	Answer Students	Test	sheet Problem
	Student response	Interview	Interview sheet

Test the validity of the data include: (1) Validation expert test instruments (2) Validation of media experts (3) small-scale trials to test the readability level of the instrument; (4) large-scale trial to test the feasibility of the test instrument.

Test the feasibility of diagnostic test instruments developed a two-tier reliability test, test, and test questions difficulty level of different power. Furthermore, the reliability test results compared with the reliability criteria based on Arikunto (2012) Shown in Table 3.

Profile of student understanding is measured using a combination of the answers contained in the matter. Profile of student understanding is divided into 7 types of complete scientific knowledge (Sk), positive misconceptions (Pm), negative misconceptions (Nm), misconceptions (Ms), Lucky guess (Lg), Lack of knowledge (Lk), and do not understand (Nu).

Table 3. Criteria for Reliability

Interval	Criteria
r11 <0.2	Very low
0.2 <r11 <0.4	Low
0.4 <r11 <0.6	Fair
0.6 <r11 <0.8	High
0.8 <r11 <1.0	Very high

RESULTS AND DISCUSSION

Instrument Development Phase

The results of the feasibility test instrument two-tier diagnostic test developed to

described in detail as follows:

a. Validation Expert

Validation is done by two kinds of experts are specialists instruments and media experts. Problem diagnostic tests that meet these criteria are eligible for each item assessment with a minimum score of 1 and a maximum score of 4. Summary of the results gathered by the researchers that the test instrument that has been validated by a validator comprising 3 on 1 and 2 lecturers chemist chemistry teacher. Validation results with a mean score of 38.5 out of a maximum score of 44 which indicates a good response and a matter suitable for use in a test in MAN 2 Semarang.

Media diagnostic tests that meet these criteria are eligible for each item assessment with a minimum score of 1 and a maximum score of 4. recapitulation collected by researchers that media diagnostic tests that have been validated by 2 validator which is one media expert lecturers and one computer expert. Validation results with a mean of 24.5 with a maximum score of 32 which indicates a good response and CBT media suitable for use in Implements in MAN 2 Semarang

b. Results Test Problem

The trial results matter of 30 items found 20 valid questions consisting of 12 items Redox Concepts and 8 items Nomenclature Compounds. Valid items are numbered 1, 2, 3, 4, 5, 6, 7, 9, 11, 13, 19, 20, 22, 25, 26, 27, 28, 29 and 30. Category distinguishing used including the type of matter enough, good, and excellent. Category of difficulties that are used includes the type of matter easy, moderate and difficult. Items used are 20 items that meet the criteria overall. The instrument is said to be valid if $t \geq t$ table is 0,339. The results of the statistical calculation formulas use traditional calculated reliability problems KR 21 and obtained by 0.79 Problem reliability that meets all the criteria consist of 20 items, all already includes indicators to be achieved and achieve the expected number of questions.

Implementation Phase

This phase is conducted to obtain data on understanding concepts and nomenclature redox students. These phase activities conducted diagnostic tests in class X MIA 3 with the number of students as many as 35 students. Test instruments used in diagnostic test activity is a test instrument test consisting of 20 items that meet the criteria of validity. 20 Furthermore, the item was transferred to the CBT system.

The amount of time the implementation of diagnostic tests through CBT gave to the subject of the study is 60 minutes. The execution of test runs smoothly because it is supported by adequate facilities like good internet connection and computer in good condition, but there is a shortage of computer units 3 units. Excellence tests through CBT are easily accessible anywhere, so it can be opened on the smartphone. The unit shortage can be solved easily by using a smartphone. Technology greatly facilitates education. The diagnostic test is obtained analytical understanding of the concept of redox who have a scientific knowledge of which 9 out of 35 students (26.86%), positive misconception that 2 out of 35 students (4.14%), negative misconceptions is one of 35 students (2.43%), the misconception is one of 35 students (1.86%), lucky guess that is one of 35 students (3.71%), lack of knowledge that 12 of 35 students (34.86%), and did not know that 9 out of 35 students (26.14%). Recapitulation analysis of the number of students in each group of students' level of understanding is presented in Table 4.

Table 4. Results Summary of Analysis Profile Concept Training

Amount	Classification Profile Concept Training						
	Sk	Pm	Nm	Ms	Lg	Lk	Nu
Whole	188	29	17	13	26	244	183
Average	9	2	1	1	1	12	9
Percentage (%)	26.86%	4.14%	2.43%	1.86%	3.71%	34.86%	26.14%

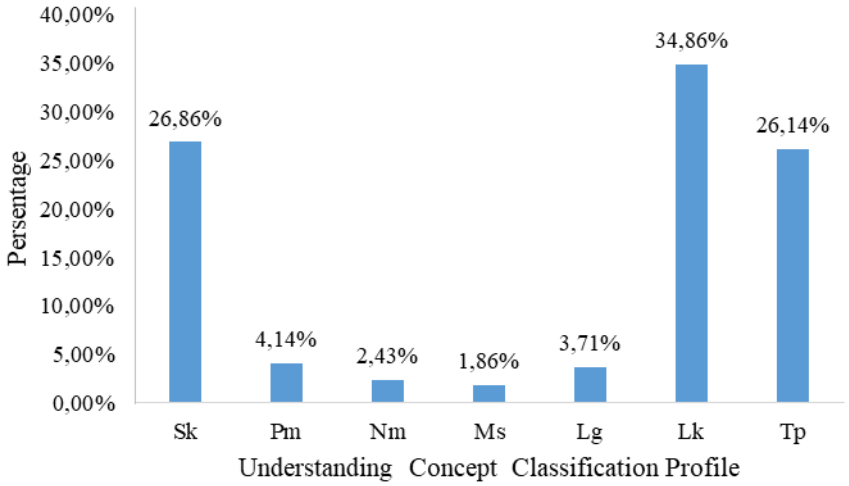

Figure 1. Persentage Understanding Concept Classification Profile

CONCLUSION

Instrument two-tier diagnostic test with CBT can be used for analysis redox concept understanding of students by way of interpretation of a combination of the students' answers to understand the concept category, misconceptions, guessing, do not understand, and do not understand. Instrument tests that have been compiled meet the criteria of valid and reliable. Its validity with a score of 38.5 out of a total score of 44 and a reliability problem by 0.79, then the diagnostic test instruments can be said to be valid and reliable. Profile of understanding the concept of students showed which scientific knowledge of which 9 out of 35 students (26.86%), positive misconception that 2 out of 35 students (4.14%), negative misconceptions is one of 35 students (2.43%), the misconception is one of 35 students (1.86%), lucky guess that is one of 35 students (3.71%), lack of knowledge that 12 of 35 students (34.86%), and did not know that 9 out of 35 students (26.14%) the concept of Redox.

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