Analysis of computer-based assessment instruments on buffer solution material

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Abstract. This study aims to determine the need for computer-based assessment instruments in buffer solution material. Research conducted is quantitative research. The research subjects were 192 students from 3 high schools in Boyolali and 6 chemistry teachers from these 3 schools. The research was conducted using Random Sampling Technique. Data collection using non-test method supported by questionnaires for students and teachers. From the results of the questionnaire it was concluded that 65.63% of students and 83.3% of teachers stated that the use of this computer-based assessment instrument was needed. From the results of preliminary research, it was concluded that computer-based assessment instruments are needed by teachers and students.

1. Introduction

The use of technology in learning has long been used to help improve the quality of learning. The use of technology in the learning process, especially computer technology, makes it easy for educators to explain learning material that is abstract and far from the reasoning of students to be easily accessible and understood. According to Abdullah the use of the internet in the learning process makes the learning process different from the learning carried out by educators before the Information and Communication Technology (ICT), so that it will attract the attention of students in the learning process [1]. The use of ICT in learning has changed the learning process "from anywhere in the classroom, from cycle time to real time, from paper to online, and from physical facilities to networks". The use of ICT in learning is believed to be able to improve the quality of learning and students are easier to accept learning material. To measure the achievement of students in the learning process an assessment is carried out, where the assessment serves to find out how far the understanding has been gained by students. In Article 1 of Permendikbud number 23 of 2016 concerning assessment standards states that assessment is the process of collecting and processing information to measure the achievement of learning outcomes of students in education. In the assessment process, a measuring instrument is needed. The measuring instrument used by a teacher usually uses a measuring instrument in the form of a test. Good and standardized instruments for assessment activities are important in the implementation of education, because the assessment results provide information as a reference for decision making. Berry & Andamson states that assessment has two functions, namely: (1) to make judgments about individual performance or system effectiveness; and (2) to improve learning [2], while according to Bennet and Gitomer assessment in the learning process is distinguished as a tool to detect learning difficulties (assessment as learning), assessment of learning processes (assessment for
learning), and assessment to measure the achievement of learning outcomes (assessment of learning) [3].

A good and accurate assessment requires learning outcome test instruments that meet the standards. The preparation of standardized test instruments can be done through several stages. According to Mardapi there are nine stages in the development of achievement test instruments, namely: (1) preparing test specifications; (2) writing test items; (3) reviewing test items; (4) testing the test instrument; (5) analyzing test items; (6) improve test items; (7) assemble test items; (8) carry out testing; and (9) interpreting the test results [4]. Test instruments that have met the standards, will certainly be the first step for schools in developing a computer-aided assessment system if the school has computer laboratory facilities and is supported by a local network system (Local Area Network). The availability of information technology and communication facilities is one of the requirements to be able to carry out computer-assisted assessments. Based on the results of observations made in the initial activity, the study found that most high schools in Boyolali area already have computer laboratories, because the national exams have used computer facilities (Computer Based Test). The existence of ICT infrastructure provides a vast opportunity for high school schools to implement a computer-aided assessment system.

The instrument that will be developed in this study is the Buffer Solution material. This is based on the results of field studies by interviewing chemistry teachers and students, there are some material that students find difficult. This can also be seen from the average value of the daily test that is still low in the buffer solution material. In addition, based on the report data from the results of the national exam (UN) in 2015/2016 and 2016/2017 published by PUSPENDIK, shows that the absorption capacity of students in buffer material is found to be still below 70%. In the 2015/2016 National Examination questions, there were 2 indicators about the buffer solution material, as well as the 2016/2017 National Exam, but with different indicators. Indicators on buffer solution material are presented in table 1.

| No | Ability tested | Mastery percentage Buffer Solution material |
|----|----------------|---------------------------------------------|
|    |                | Kab Boyolali | Propinsi Jawa Tengah | Nasional |
| UN SMA/MA Tahun 2015/2016 (%) | Learners can explain the buffer solution curve if given 5 images of the acid-base titration curve and the equation of the reaction in the titration. Given some compounds / ion solutions | 50,92 | 54,81 | 47,20 |
| 1  | students can determine the pair of buffer solutions that play an important role in the human body | 48,97 | 56,21 | 54,65 |
| UN SMA/MA Tahun 2016/2017 (%) | Given several steps to test the nature of the buffer solution and its solutions, students can design experiments to prove the validity of the nature of the buffer solution. | 49,13 | 55,13 | 49,80 |
| 1  | Students can calculate the comparison of the volume of the buffer solution contained in the human body (NaH2PO4 and Na2HPO4 / H2CO3 and HCO) with a certain concentration, if the blood pH and pH are known | 41,15 | 46,29 | 44,24 |

From the indicators in the existing national exam questions indicate that the problem is patterned from experimental data that requires students to be skilled at interpreting data as generic science skills. In this case many students are less skilled and less accustomed to dealing with experimental data-based questions, so on this occasion research will be conducted that can measure students' skills in solving problems, be able to think critically and creatively in processing experimental data from group work or team so that it can produce correct information.
The instrument used by the teacher in learning more often uses essay questions for daily tests, this is because the teacher wants students to be able to apply the concept. But with a model like that not all students are able to express the existing concepts, so that the existing forms of skills cannot be measured properly. As for the midterm test, the semester test and grade increase are more often used multiple choice questions, because the form of multiple choice questions will be easier and faster in the correction in accordance with the background that has been stated, then in this study a computer-based assessment tool will be developed on the material of the buffer solution.

2. Method
This type of research is research and development (R&D) or research and development aim to produce a Computerized test let instrument that is equipped with software analysis of items and individual profiles. The model used to develop products refers to the development steps proposed by Borg and Gall [5]. The research carried out is the preliminary research phase, namely the initial information collection / Research and Information Collecting. At this stage, it is carried out by means of literature review, class observation, interviews, and questionnaire distribution.

The method used was descriptive qualitative. The object of the study were students and teachers of chemistry subjects in 3 schools where research was conducted in Boyolali district. The number of students from the three schools in the sample is 192 students, the chemistry teacher used in the sample is 6. The 3 schools used for this study represent the school with the achievement assessed in the 2017 National Examination at high, medium and low levels. In the 3 schools where there were facilities and infrastructure for testing using a computer, it was very possible because in the present condition all secondary schools had already done the National Examination using computers.

From the results of the questionnaire given in the form of questions include: the use of test kits in the form of multiple choice questions, essays, multiple choices and essays for the analysis of the use of test instruments that will be developed and questions include: using a computer test or using paper tests to analyze the use of test media. From the results obtained analyzed using the formula:

\[ P = \frac{n}{N} \times 100\% \]

Information:
P = Percentage of a score
n = number of scores obtained / students who answered x points
N = number of maximum scores/number of all students

3. Results and discussion
Activities in this study are to analyze the results of questionnaires given to respondents. There were 6 teachers and 192 students in this study who acted as respondents. From the results of the questionnaire, it was found that:

Tests conducted in schools where research in Boyolali district still uses conventional methods, namely PBT (Paper Based Test). PBT actually has many shortcomings, including requiring a lot of time and costs, prone to fraud in its implementation, the inspection process (correction) requires a lot of time, the value processing and giving feedback to respondents is also quite complicated.

Computer-based assessment becomes a new paradigm in response to the challenge of assessing large numbers of students [6]. The advantages of computer-based testing are security testing, reducing costs and time, quick results to be obtained, automatic recording for test distribution analysts [7], data collection without paper use, efficiency, quick feedback; tend to have a positive effect on students' motivation, concentration and performance, and are able to provide detailed reports for teachers and students regarding strengths and weaknesses that can support formative assessment [8].

From 192 students as respondents found that as many as 126 students (65.63%) chose a test using a computer, 61 students (31.77%) chose a test using paper and 5 students (2.60%) did not give an answer. As if from the teacher as the executor of the assessment process of the 6 teachers there were as many as
teachers (88.33%) chose the computer assessment process compared to using paper-based assessments.

Much research has been done on the use of instruments with computers, as has been done by Anna Muna et al. It is stated that the process of developing testlet diagnostic test instruments on the subject of buffer solutions starts from the analysis stage by conducting a need analysis of product development.

Analysis of diagnostic test instruments was conducted to determine the teacher's needs for the product being developed. Analysis of diagnostic test instruments was obtained from the results of interviews with chemistry teachers at SMAN 1 Pulau Laut, chemistry teachers at Mondial Batam High School and chemistry teachers at SMAN 12 Pekanbaru. Based on the results of interviews with three chemistry teachers, information was obtained that there had never been a specific instrument to determine the learning difficulties of students, usually teachers only looked generally from the results of daily exams or semester exams, so it was still not effective in diagnosing participants student. In this study the researchers made a testlet diagnostic test instrument to find out precisely where students were learning difficulties. Furthermore, an analysis of the material that is to be developed is then carried out. Material analysis is done by determining the material and concepts that refer to the revised 2013 curriculum syllabus 2016, so as to produce indicators that will be poured into diagnostic test instruments.

4. Conclusion
From the results of the initial needs analysis, the researcher obtained a description that the tests applied by schools in Boyolali sub-district majority still use paper-based tests, 65.63% students and 88.33% teachers choose tests using computers. The implication of this initial research is the existence of further research, namely determining the material, type of test instrument and determining the software product to be used. Instruments made as an alternative to measure students' skills and abilities in learning.

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