

The Effectiveness of Teaching Materials Loaded with Blended Learning with a Scientific Approach on Buffer Solution Learning

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Abstrak

Dalam kurikulum 2013 berbasis saintifik, guru harus memfasilitasi siswa untuk memperoleh pengetahuan atau keterampilan berdasarkan metode saintifik. Penelitian ini bertujuan untuk menganalisis keefektifan bahan ajar. Jenis penelitian pengembangan, bahan ajar memiliki konten dan media yang berharga. Bahan ajar dinyatakan efektif apabila terjadi peningkatan ketuntasan klasikal siswa, peningkatan pencapaian kompetensi dasar, dan siswa dapat memahami representasi tingkat makroskopis, mikroskopis, dan simbolik. Metode penelitian deskriptif kuantitatif, dimulai dari analisis kualitas bahan ajar dan instrumen tes diagnostik *Two-Tier Multiple Choice (TTMC)*, penerapan bahan ajar, penerapan soal, analisis data hasil tes, ketuntasan klasikal, ketercapaian kompetensi dasar, dan analisis pemahaman representasional. Subjek penelitian adalah siswa kelas XI dan XII MIPA. Hasil belajar diperoleh dari hasil tes TTMC siswa pada materi larutan penyangga yang telah menggunakan Bahan Ajar. Analisis data dilakukan secara klasikal. Hasil penelitian menunjukkan peningkatan ketuntasan klasikal sebesar 9%, ketercapaian indikator kompetensi dasar meningkat sebesar 8%, dan pemahaman konsep meningkat sebesar 6%. Sehingga bahan ajar yang dikembangkan efektif untuk digunakan.

Abstract

In the 2013 scientific-based curriculum, teachers must facilitate students to gain knowledge or skills based on the scientific method. The research aims to analyze the effectiveness of teaching materials. This type of research development, teaching materials have valuable content and media. Teaching materials are declared effective if there is an increase in students' classical mastery, an increase in the achievement of basic competencies, and students can understand macroscopic, microscopic, and symbolic level representations. Quantitative descriptive research method, starting from the analysis of the quality of teaching materials and diagnostic test instruments *Two-Tier Multiple Choice (TTMC)*, application of teaching materials, application of questions, data analysis of test results, classical completeness, achievement of basic competencies, and analysis of representational understanding. The research subjects were students of classes XI and XII MIPA. The study results were obtained from the student's TTMC test results on the buffer solution material that had used Teaching Materials. Data analysis was done classically. The results showed an increase in classical completeness by 9%, the achievement of basic competence indicators increased by 8%, and concept understanding increased by 6%. So that the teaching materials developed are effective to use.

INTRODUCTION

Learning in education units uses the 2013 curriculum, valid from the 2013/2014 school year. Students can observe, ask questions, reason, try, and communicate (relationships) that occur from the knowledge learned (Tawil *et al.*, 2014). There are two types of student-centered learning approaches: scientific and contextual learning. The scientific approach is highly recommended in implementing the 2013 Curriculum (Indrilla, 2018). This is in line with the scientific-based 2013 Curriculum. The scientific approach is a learning mechanism to facilitate students gaining knowledge or skills with procedures based on a scientific method. The learning process using scientific principles is included in the scientific approach (Yuselis *et al.*, 2015; Nugraha & Suherdi, 2017). Learning with a scientific approach is a learning process designed in such a way that students actively construct concepts, laws, or principles through the stages of observing (to identify or find problems), formulating problems, proposing or formulating hypotheses, collecting data with various techniques, analyze data, draw conclusions and communicate the concepts, laws or principles found (Sufairoh, 2016).

The results of observations made at SMAN 1 Donorojo Jepara showed that the teaching materials used were in the form of Student Worksheets (LKS). The learning system applied by the teacher is limited to explaining the material in the LKS and students working on the questions in the LKS. This is not following the learning model used and the learning objectives to be achieved and causes students' thinking skills to become static and untrained. These problems can be overcome with teaching materials that match the learning model and learning objectives.

Teaching materials are all forms of materials that contain learning materials used in the learning process where the learning materials should be learned and mastered by students (Setiawan, 2017). Books or teaching materials used in the 2013 curriculum learning must follow the five stages of learning: observing, asking, trying, reasoning, and presenting (Abadi *et al.*, 2017). One of the learning models that can be applied is blended learning. Blended learning combines online and face-to-face learning in the classroom (Yulia, 2017). It can also be said that blended learning integrates traditional classroom teaching methods and technology-based online learning for the same subjects in the curriculum (The Hung, 2021). In addition, teachers are still the main actors in the teaching and learning process. Blended learning is a learning model in which teachers use technology, usually filling out web-based instructions, daily tasks or allowing it as the instructor's main guide (Aeni *et al.*, 2017). The online system also allows teachers to measure or assess student activity in the distance learning process (Rahma & Dwiningsih, 2017).

The concept of Blended learning can be optimized by using teaching materials to facilitate students in the learning process. Teaching materials are effective when viewed from the improvement of 3 aspects: students' classical mastery, basic competencies, and understanding concepts.

Teaching materials' effectiveness is done by giving students three-tier multiple-choice diagnostic test questions. Aspects measured in the diagnostic test include identifying students' learning difficulties (Hidayati *et al.*, 2013). The design and quality of questions are the main components of diagnostic tests. The pattern of answers to questions can be categorized as not understanding the concept, not understanding the concept, misconceptions, and not understanding the concept (Hatari, N., Widiyatmoko, A., 2016). The three-tier multiple-choice instrument has the advantage of distinguishing between misconceptions and lack of understanding of the concept or not knowing the concept through the level of confidence in students' answers so that it is accurate in detecting misconceptions (Kamilah & Suwarna, 2016).

This study aimed to determine the effectiveness of teaching materials buffer solutions based on blended learning with a scientific approach.

METHODS

This research is a type of Research and Development (R&D) research. A design that has been modified into a 4-D model development research (Four D Model which includes four stages, namely the definition stage, namely determining and defining the needs in the research process in the form of problems in the learning process, design for designing buffer solution teaching materials based on blended learning with a scientific approach that can be used in learning chemistry on buffer solution material, development to produce blended learning based buffer solution teaching materials with a scientific approach that has been tested, namely through the stages of expert validation, trial and error implementation, dissemination teaching materials. Dissemination is carried out in the form of the publication of journal articles. In addition, the dissemination of teaching materials that have been developed in research schools as a source of additional learning materials.

Teaching materials' effectiveness is done by giving students three-tier multiple-choice diagnostic test questions. The research was conducted in the even semester of the 2018/2019 academic year at SMA Negeri 1 Donorojo. The subjects of this study were class XII students who received buffer solution material and class XI students who received buffer solution material. The results of the TTMC diagnostic test were then

analyzed classically, the achievement of basic competencies and understanding of concepts in the buffer solution material.

RESULTS AND DISCUSSION

The design of the learning implementation in this study uses a blended learning model. Students learn by using developed teaching materials uploaded on google classroom. The appearance of Google Classroom is not much different from other social media such as Facebook, making it easier for students to adapt to their use. After the learning process on the buffer solution material is complete to assess the effectiveness of teaching materials, a test is held to measure students' conceptual understanding using a three-tier multiple-choice diagnostic test. Diagnostic tests are used to determine the presence or absence of a condition that needs to be corrected (Campbell *et al.*, 2015). The answers from these test results are then analyzed according to the interpretation of the diagnostic test results. The interpretation of the answers to the diagnostic test results is presented in Table 1.

The student's answers were then analyzed to determine the percentage of students' classical completeness, the achievement of basic competencies, and the achievement of understanding concepts that became the measure in assessing the effectiveness of teaching materials.

Aspects of Classical Completeness

Teaching materials are effective if classical completeness is 75% of the total number of students. This is following what was said by Savitri *et al.* (2019) that students' success in learning is said to be complete in learning (classical completeness) if it is shown by a minimum mastery percentage of 75%. The KKM that students must achieve is 70. Students who score less than 70 have not achieved the KKM. Students' classical mastery at the implementation stage can be seen in Figure 1.

The analysis results showed that the buffer solution material's three-tier multiple-choice diagnostic test results were 64 out of 100 students or as many as 64% who reached the KKM. This indicates that the buffer solution teaching materials based on blended learning have not been effective.

Table 1. Interpretation of answers to diagnostic test results

Answer combination			Classification of student's answers
Tier 1	Tier 2	Tier 3	
Right	Right	Certain	Understand concept
Right	Wrong	Certain	Misconception
Wrong	Right	Certain	Misconception
Wrong	Wrong	Certain	Misconception
Right	Right	Not sure	Not really understand
Right	Wrong	Not sure	Not really understand
Wrong	Right	Not sure	Not really understand
Wrong	Wrong	Not sure	Do not understand

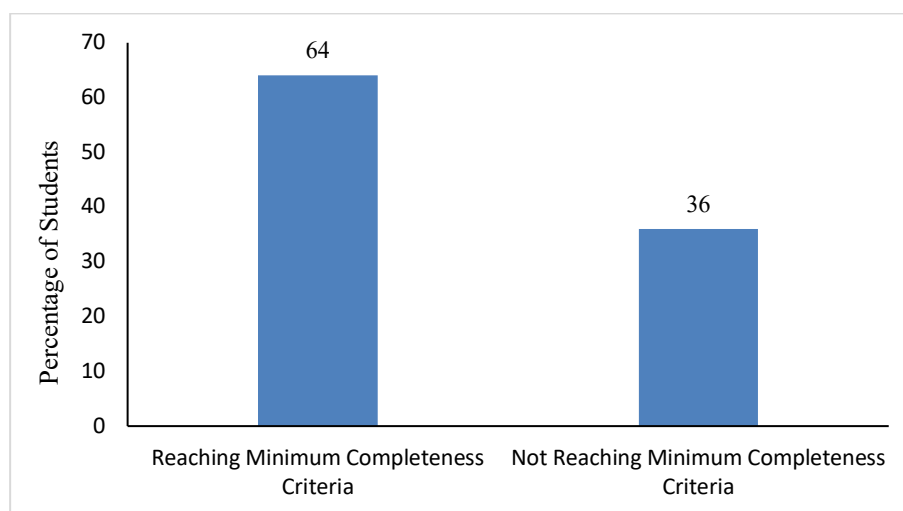


Figure 1. Students' classical mastery at the implementation stage

Aspects of Achievement of Basic Competencies

Teaching materials are effective if the achievement of students' basic competencies is 75% of the total number of students (Zukhrufurrohmah *et al.*, 2017). The achievement of students' Basic Competencies at the implementation stage can be seen in Figure 2.

Description of indicators of achievement of basic competencies:

1. Explain the meaning of buffer solution.
2. Identify the components of the buffer solution.
3. Explain the nature of the buffer solution.
4. Analyze the working principle of the buffer solution.
5. Explain how to make a buffer solution.
6. Calculating the pH of an acid buffer solution.
7. Calculating the pH of an alkaline buffer solution.
8. Explain the buffer capacity.
9. Classifying the components of support in the body.
10. Mention the role of buffer solutions in daily life.

Buffer solution teaching materials based on blended learning with a scientific approach are effective if the achievement of basic competencies is 75% of the total students (Zukhrufurrohmah *et al.*, 2017). The results of the analysis of the achievement of the basic competencies of the buffer solution material are 73% or as many as 73 of 100 students. This indicates that the buffer solution teaching materials based on blended learning with a scientific approach have not been effective because basic competencies have not reached 75%.

Aspects of Student Concept Understanding

Teaching materials are said to be effective if the achievement of students' conceptual understanding is 75% of the total number of students (Zukhrufurrohmah *et al.*, 2017). The achievement of students' understanding of the concept of the Buffer Solution material can be seen in Figure 3.

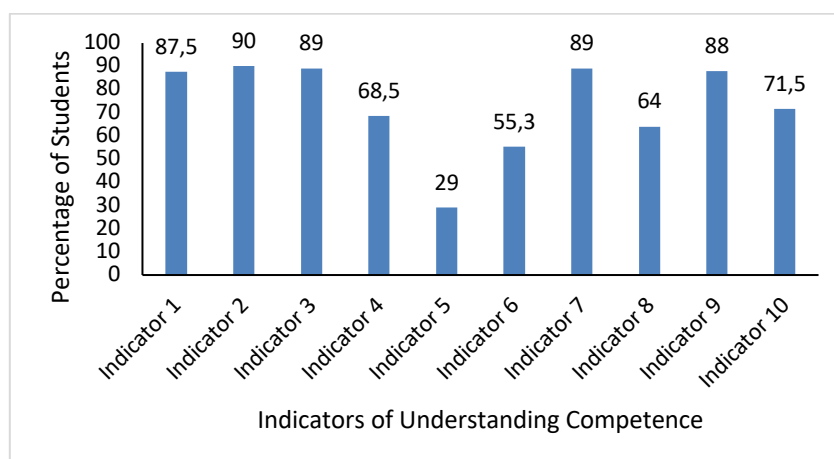


Figure 2. Achievement of indicators of understanding basic competence

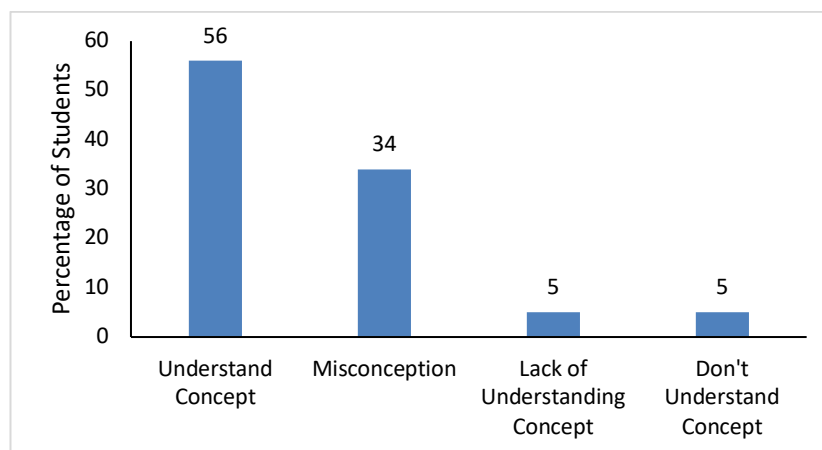


Figure 3. Achievement of concept understanding indicators

Buffer solution teaching materials based on blended learning with a scientific approach are effective if students' conceptual understanding is 75% of the total students (Zukhrufurrohmah *et al.*, 2017). The analysis results showed that 56 out of 100 students or as many as 56% who understood the concept were the Three-Tier Multiple Choice diagnostic test results on the buffer solution material. This indicates that the buffer solution teaching materials based on blended learning have not been effective. Overall, from these three aspects, teaching materials have not been effective. This is due to several factors, namely teaching materials and students.

Teaching materials include students unfamiliar with the applied blended learning concept, so assessing learning in online classes takes up students' free time. In addition, the scientific approach to teaching materials is not yet straightforward, so that students are less able to understand teaching materials. Another factor in the discussion section students has to work on questions in groups. Students who do not participate in understanding / working on the questions will have difficulty working on the questions and understanding the meaning of the material. In addition, researchers also experienced delays in uploading teaching materials so that only a few students opened and read teaching materials before face-to-face meetings.

Another student factor is that because students do not master the pre-requisites material, one of the pre-requisite materials is acid-base material, students still have difficulty in distinguishing acidic compounds and basic compounds. Students still have difficulty distinguishing strong acids and weak acids and strong bases and weak language. In addition, students also do not understand the reactions between acids and bases. Another factor occurs because they are required to do many assignments when giving teaching materials, so they feel burdened in doing them.

The teaching materials developed have not been effective when viewed from the classical aspect, the achievement of basic competencies, and understanding of concepts in the Buffer Solution material. However, compared to the previous material, there is an increase in classical, the achievement of basic competencies, and the understanding of concepts. In the previous material, namely acid and base, the classical completeness was 55%, while the classical completeness was 64% in the Buffer Solution material. In achieving basic competence, basic competence is 65% in the acid-base material, while in the Buffer Solution material, the indicator achievement is 73%. Moreover, in understanding the concept, the concept in the acid-base material is 50%. In comparison, understanding the concept in the Buffer Solution material is 56%. Based on this, the teaching materials can be effective because there is an increase in the classical aspects, the achievement of basic competencies, and the understanding of concepts.

CONCLUSION

Blended learning teaching materials with a scientific approach are effectively used as a source of student learning. Based on the analysis results, there is an increase in the classical aspects, the achievement of basic competencies, and the understanding of concepts from the previous material. In the previous material, namely acid and base, the classical completeness was 55%, while the classical completeness was 64% in the Buffer Solution material. In achieving basic competence, basic competence is 65% in the acid-base material, while in the Buffer Solution material, the indicator achievement is 73%. Furthermore, in understanding the concept, the concept in the acid-base material is 50%. In comparison, understanding the concept in the Buffer Solution material is 56%.

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