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# NEEDS ANALYSIS OF ELECTRONIC PORTFOLIO ASSESSMENT TO ASSESS CONCEPT MASTERY AND CREATIVE THINKING OF HIGH SCHOOL STUDENTS ON ACID-BASED MATERIALS

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**ABSTRACT**

*The purpose of this study was to analyze the needs of electronic portfolio assessment documents to assess concept mastery and creative thinking of high school students on acid-based materials. The data collection process was carried out using the method of interviewing chemistry teachers in high school and giving acid-base material tests to their students. This research was conducted at SMAN 6 Cimahi, West Java. The results of interviews with chemistry teachers showed that the form of assessment carried out by teachers did not understand and had not applied the electronic portfolio assessment model, and students' mastery of materials on acid-based material was in the lower category. The results of the analysis of the tests given to high school students showed that as many as 52% C1, 65% C2, 51% C3, 70% C4, and 40% C5. The average value of mastery of acid-base material is 59.68.*



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## 1. INTRODUCTION

Learning assessment is an important part of several stages of learning activities because it can improve the quality of learning (Redecker & Johannessen, 2013). Good assessment activities can improve the quality of learning, because if the assessment carried out by the teacher is appropriate, it will increase the motivation of students to learn better. On the other hand, if the assessment is not appropriate, it can cause students not to be motivated to do good learning. Currently, learning is still predominantly teacher-centered with paper and pencil test-based assessments that usually only measure cognitive abilities without providing adequate feedback. This condition makes it difficult for students to make improvements in their learning process, which in turn can reduce their understanding of the concepts taught (Taufiq, 2016). Therefore, efforts are needed to improve the quality of student assessment.

The aspects of learning outcomes assessment should be able to measure cognitive, affective, and psychomotor aspects to comprehensively measure student competence. However, Wijayanti's (2014) research found that teachers' learning outcomes assessment activities often only focus on cognitive assessment, with affective and psychomotor assessment aspects often ignored. In another study, Muslich (2014) found that in providing affective assessments, the scores given often tend to be equated with cognitive scores, without following the appropriate assessment stages. These phenomena are found in learning activities, so various efforts are needed to improve the learning outcomes assessment system. Improving the methods and stages of learning outcomes assessment is expected to improve the quality of teaching and learning activities in schools.

One of the assessment models used in Curriculum 2013 is authentic assessment (Sudibawa & Rina 2020). The purpose of this assessment is to monitor the learning process, produce relevant information for decision-making, and be able to improve the effectiveness of learning activities (Nahadi & Liliasari, 2007). According to Doran et al. (2002), alternative assessment approaches are more student-centered and emphasize authentic assessment. Portfolio is one of the alternative assessment methods used to collect various information about students' development, both in terms of the process and the results of their learning, through documents or records of experience (Nahadi et al., 2022). This is in line with research conducted by Aripin in Selamet et al. (2019), which shows that the use of portfolio assessment

can be used to measure student progress and achievement based on the results of tasks done from time to time.

According to Chang (2003), chemistry is a field of science that focuses on the exploration of matter and its transformation. Research by Isdayanti et al. (2022) highlighted the important role of chemistry in the high school curriculum because chemistry learning underlies natural phenomena and experimental investigations. Sukarna's (2000) research characterizes chemistry as a scientific discipline based on the scientific method, which deals with abstract concepts that are interconnected in sequence. Chemistry includes a vast and complex collection of knowledge. Many chemical concepts are abstract in nature, posing a great challenge to student understanding, especially in the acid and base domains (Suprapto et al., 2018; Darwis et al., 2020). This is in accordance with the findings of Isdayanti et al. (2022), student achievement in chemistry is less than optimal, mainly due to difficulties in understanding acid-base concepts.

One of the materials learning chemistry in the 2013 curriculum is acid-base materials. The Basic Competency (KD) of chemistry subject in class XI is to analyze the nature of the solution based on the acid base and/or pH of the solution. The results of observations made in learning acid-base material show that the teacher still conducts teacher-centered teaching and learning activities, so that the interaction that occurs is only one-way, and students also only gain knowledge from the explanation given by the teacher (Safitri, et al., 2015). Concept mastery, as explained by Dahar (2011), refers to the ability of students to understand scientific meaning, both in theory and in everyday applications.

A strong understanding of acid-base concepts is essential, as this serves as a foundation for later topics, such as buffer solutions. Without a deep understanding of acid-base chemistry, students will most likely have difficulty mastering later concepts. Therefore, a deep understanding of acid-base properties is essential to mastering chemistry as a whole. One strategy that can be used is to obtain an assessment not only on the cognitive aspect. Therefore, assessment of learning is the most important part. Assessment serves as a tool to measure the achievement of student learning objectives and evaluate the effectiveness of the teaching process (Wijayanti, 2014). Assessment, then, does not only focus on the end result, but teachers should engage in continuous assessment to comprehensively evaluate students' learning journey.

Curriculum 2013 mandates the use of authentic assessment to evaluate student learning outcomes. This assessment method is considered capable of providing a comprehensive picture of students' abilities (Permendikbud Number 22 of 2016). In evaluating learning outcomes, teachers must align assessment with student competencies that include cognitive, psychomotor, and affective domains (Muslich, 2014). This authentic assessment process involves collecting diverse data to build a comprehensive profile of student learning progress (Wijayanti, 2014).

Based on the explanation above, before developing an authentic assessment that not only assesses student learning outcomes but also assesses the student learning process in fulfilling the abilities to be achieved. So it takes the mastery of students' concepts on acid-based materials. There has been no research on the preliminary study of the needs analysis of electronic portfolio assessment to assess concept mastery and creative thinking of high school students on acid-based materials.

## 2. METHOD

This research was conducted at SMAN 6 Cimahi, West Java. The population in this study was the students of class XII IPA high school at SMAN 6 Cimahi, while the research sample was the students of class XII IPA 3 at SMAN 6 Cimahi, which amounted to 35 students. The research stages consisted of two stages, namely: an interview with a chemistry teacher and measuring the understanding of the acid-base concept by giving multiple-choice acid-base questions in accordance with the knowledge dimension (Anderson & Krathwol, 2001).

The question instrument used has been developed by Isdayanti's research; (2022) there are 25 multiple-choice questions on acid-base material. The percentage results of expert validation obtained was 86.5% (very feasible). Then the questions were tested for validation by students; out of 25 questions, only 20 questions were valid. However, in this study it was adjusted to the Basic Competencies (KD) and Competency Mastery Indicators (IPK), so that 18 questions were obtained in accordance with KD and IPK, which would be used in this study to determine students' mastery of the concept of acid-base material. After the validity test is carried out, then the reliability test is carried out and the rcount> rtable value is obtained (0.947> 0.444); this shows that the question is reliable and suitable for use to collect data.

## 3. FINDINGS AND DISCUSSION

*Results of Interview with Chemistry Teacher*

After conducting a preliminary study, interviews with chemistry teachers and giving questions to students of class XII IPA to find out the mastery of the concept of acid-base material. Then analyse the subject matter of acid-base which is adjusted to the Basic Competencies (KD) and Competency Achievement Indicators (IPK), and analyse the tasks given to students. The results of the implementation of field studies by conducting interviews with chemistry teachers, the following is a list of questions and answers from chemistry teachers.

Table 1. Chemistry Teacher Interview Results

| Question | Answers |
|---|---|
| 1. What are the forms of assessment that youhave carried out in learning chemistry in class XI? | Forms of assessment that have been carried out in the form of tests, and performance (doing questions in front), as well as the results of questions and answers. |
| 2. How do you assess students' assignmentsin 1 semester as a whole? | For the assessment at the end, the average ofthe test scores, midterm exams, end-of-semester exams, and the assessment of questioning activity. |
| 3. Have you ever conducted an electronicportfolio assessment for learning? | I have never done an electronic portfolio assessment. But I have carried out a portfolio assessment. But now it only takes from the test scores; the average score is obtained. |
| 4. What is the average score on acid-basedequipment? | The average score on acid-based equipmentis 60. |
| 5. After the assessment/test, are students given feedback in the form of explanations of material that has not been or is not understood by students? | Yes, feedback is given, explained again, and then given another question to correct it. |
| 6. What do you know about electronic portfolio assessment? | Because I have never done an electronic portfolio, so I don't understand. |
| 7. What do you think if the acid-base material is applied to the electronic portfolio-based assessment strategy as an assessment for learning? | For this acid-base material, it seems like it would be good if the electronic portfolio assessment is applied. |

From the results of interviews with chemistry teachers, it was found that the assessment carried out only focuses on the cognitive aspect (knowledge) marked in the first interview question. The teacher conducted an assessment by giving test questions, student performance doing questions in front of the class, as well as assessment during the learning process conducting discussions and question and answer results. In the second interview

question, the teacher conducted an assessment for one semester with the results of the average score from the test, midterm exam, final exam, and assessment of activeness in asking questions. In this case, it proves that the assessment obtained for student learning outcomes is seen from the acquisition of average scores on cognitive aspects.

In the third interview question, the teacher has never carried out task collection or assessment with electronic portfolios. But portfolio assessment is done by giving assignments. However, what is done now only takes from the test scores, which are averaged. On the fourth question, the average obtained on acid-base material is 60, where the KKM in chemistry learning is 75. So that students are said to still not meet the standard value for completion. The fifth question is regarding providing feedback on learning if students have not reached the KKM score. Teachers provide feedback to students whose scores are still less than the KKM by explaining again the material that many students do not understand, but if time is limited to explain again, the teacher gives questions related to learning objectives that have not been completed.

In the sixth interview question, teachers still do not understand electronic portfolio assessment, so they do not conduct electronic portfolio assessments. It can be seen from the answer to the sixth question that the teacher has not taken advantage of the technology that has been developed, so the teacher still conducts manual or conventional assessments. In the seventh interview question, the teacher's opinion regarding acid-base material implemented using electronic portfolio assessment is quite interesting so that students do not just listen to explanations from the teacher. But students are given assignments so that before learning is done, students have read the material in accordance with the learning directions carried out.

*Student mastery of Acid-Base Materials*

After the interview with the chemistry teacher, the researchers confirmed that students still had not mastered the concept of acid-base well by giving questions on acid-base material that had been adjusted to the knowledge dimension of C1-C5. The questions given to students were 18 multiple choice questions. The results of giving this multiple-choice question show the average value of the results of mastery of the acid-base concept of students is 59.68. From the average value obtained, it has not met the KKM, so from the results of the average value of students, it can be said that students do not understand the concept of acid-base. Data on the results of mastery of acid-base material are presented in Figure 1.

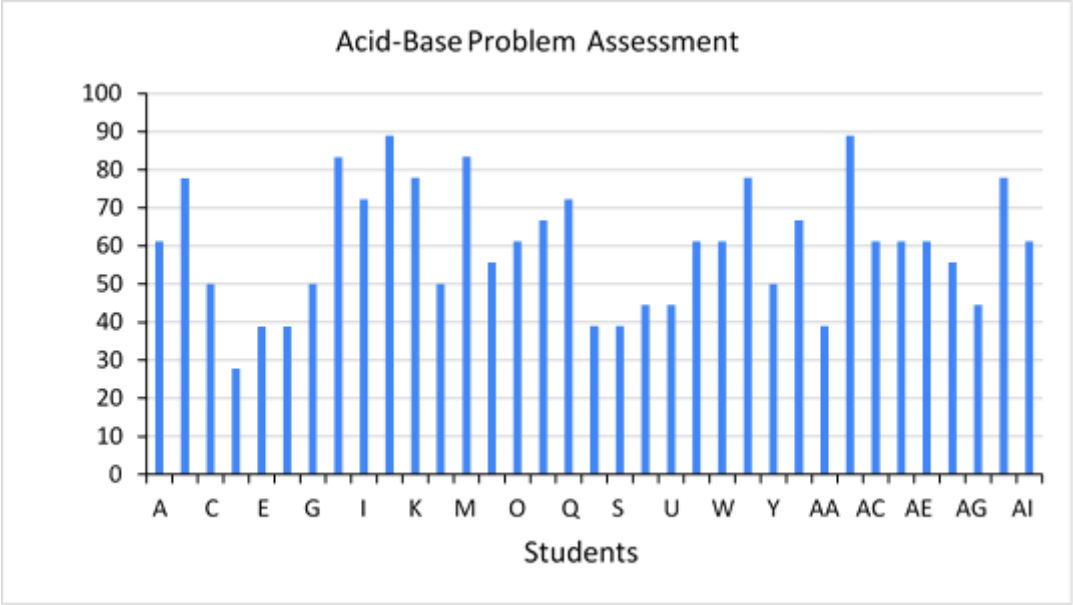


Figure 1. Mastery of Acid-Base Material

In Figure 1, the acquisition of student scores working on acid-base problems is produced. The highest score for working on the acid-base problem was 89, while the lowest score was 28 with a KKM value of 75. Of the 35 students, only 8 students scored above 75, while 27 students scored below 75. This proves that students still cannot master the concept of acid-base. Data on the knowledge dimension of Anderson & Krathwol (2001) are presented in Figure 2.

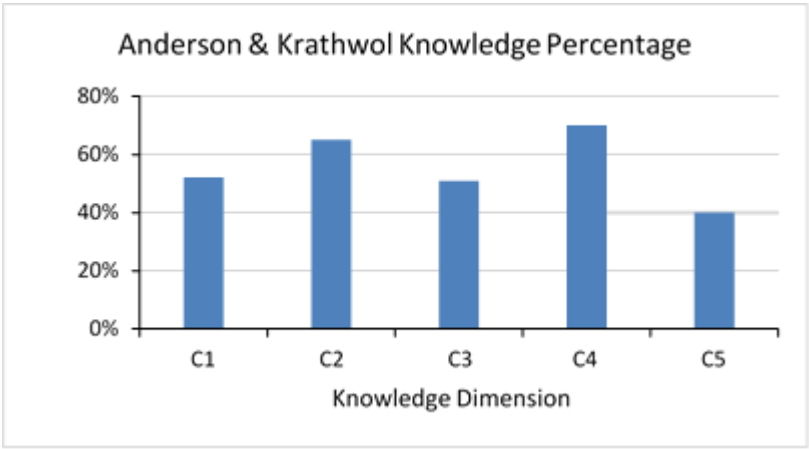


Figure 2. Anderson & Krathwol Knowledge Percentage

The results of the analysis of the mastery of the acid-base concept in this study, based on the Anderson & Krathwol taxonomy (2001), obtained the percentage value of C1-C5. There are four dimensions of knowledge that are still below 70%. The percentage obtained is still

low, namely at C1 of 52%, C2 of 62%, C3 of 51%, and C5 of 40%. From the percentage results obtained, it can be said that students' mastery of concepts in acid-base material is low.

## 4. DISCUSSION

*Results of interviews with chemistry teachers*

The results of interviews conducted with chemistry teachers, namely teachers, still conduct learning conventionally or with the lecture method. So, learning tends to be only one-way, which makes learning tend to be monotonous. So that the results of the scores obtained on acid-base material are still below the completion limit. In addition, the teacher also obtained an assessment only by giving questions; it can be said that the teacher only obtained the final results of students on the cognitive aspect. And the teacher also provides feedback on learning; if the value is not complete, the teacher explains again if it still has enough time. However, if the time is insufficient, students are given questions and work on them again so that they can add value in order to meet learning completeness. This is one of the things that proves that students cannot master concepts in learning, especially in acid-based materials, marked by the average value of learning completeness, namely a value of 60.

Interviews with chemistry teachers indicated that they more often use practice questions, test scores, and end-of-semester exams as assessment tools that only evaluate cognitive aspects. The lack of attention to students' psychomotor aspects and skills is the reason why teachers do not use electronic portfolio assessment. This finding is in line with Lukitasari et al.'s (2017) research that shows the dominance of written tests in the assessment system, which tends to test students' recall of information but does not fulfill the needs of assessment in the three domains of knowledge: cognitive, affective, and psychomotor.

Furthermore, the core competencies (KI) and basic competencies (KD) were analyzed to determine the appropriate subject for this research. Based on this analysis, the chemistry subject of class XI was chosen with a focus on acid-base material. The selection of this material was strengthened by the observations of Sudibawa & Rina (2020), which showed that learning and assessment on this acid-base material resulted in 57% learning completeness. This occurred because the assessment only focused on the cognitive aspect.

*Student mastery of acid-base materials*

The stages in assessing the competence of mastery of the concept of students of class XII SMAN 6 Cimahi in learning chemistry are given by giving a test sheet of multiple-choice

question instruments that have been adapted to the indicators of mastery of the concept of Anderson and Krathwol taxonomy (2001) and also adapted to the Basic Competencies (KD) of learning to be achieved, namely on KD knowledge 3.10 and KD skills 4.10.

Anderson and Krathwol's taxonomy (2001) categorizes cognitive abilities into: C1 (ability to remember material), C2 (ability to understand the meaning of material), C3 (ability to apply and use learning in problems), C4 (ability to analyze in determining the relationship of each concept), C5 (ability to evaluate in making decisions based on criteria), and C6 (ability to create by combining several concepts in concept mastery).

The results of the acid-base concept mastery test were obtained from the answers of students in class XI IPA 7 on acid-base questions. The highest score was 89, while the lowest score was 28 with a KKM value of 75. The average result of students' mastery of the acid-base concept was 59.68. From the average value obtained, it has not met the KKM, so from the results of the average value of students, it can be said that students do not understand the concept of acid-base. This is evidenced in the results of Nakhleh's research (1992) that students have difficulty learning the concept of acid-base because they do not have a correct understanding of the initial concepts of chemistry. This is supported by the results of Irawati's research (2019) on the importance of mastering acid-base concepts because it can affect other chemical concepts such as student hydrolysis.

The results of the analysis of the mastery of the acid-base concept in this study based on the Anderson & Krathwol taxonomy, (2001) obtained the percentage value of C1-C5 there are four dimensions of knowledge that are still below 70%. The percentage obtained is still low, namely at C1 of 52%, C2 of 62%, C3 of 51%, and C5 of 40%. From the percentage results obtained, it can be said that students' mastery of concepts in acid-base material is low. This is supported by the research of Musrin (2010), that the subject matter of acid-base and the results of acid-base reactions are chemicals that most of the concepts are abstract. The results of mastery of this concept are low because acid-base materials are very complex materials when viewed from their characteristics. The characteristics of acid-base materials consist of three aspects, namely macroscopic, namely the material studied in macro form that can be seen with the naked eye, while symbolic in the form of symbols, names of acid-base compounds in chemistry or calculations such as acid-base pH.

The results of the analysis of the C1-C5 knowledge dimension obtained low percentage results, analyzing previous research, namely by Musrin & Salila, who explained

that acid-base material is abstract; this is due to the characteristics of acid-base materials, which are very complex. Research by Setiawan and Sriwijaya (2011) found that chemistry learning in schools tends to only present concepts, laws, and theories in books without providing concepts accompanied by examples to improve students' mastery of concepts. Most chemistry materials can be related to conditions or problems that exist in everyday life, such as on the topic of acid-base; for example, the use of basic compounds in the treatment of stomach ulcers, the use of lime to neutralize agricultural soil acid, and so on. However, the results of research by Setiawan and Sriwijaya (2011) prove that what has happened so far is that the topic of acid-base in learning chemistry in high school is more conditioned to be memorized by students; as a result, students have difficulty mastering the concept because learning is not related to everyday life and do not feel the benefits of learning acid-base, so that students' mastery of the concept is low.

## 5. CONCLUSION

The results of interviews with chemistry teachers show that teachers do not understand well and have not applied the electronic portfolio assessment model, and students' mastery of materials on acid-based materials is in the lower category. Based on the results of the analysis of high school students' mastery of concepts based on the Anderson & Krathwol taxonomy by giving multiple choice tests, the value of C1 is 52%, C2 is 65%, C3 is 51%, C4 is 70%, and C5 is 40%. The average value of mastery of acid-base materials is 59.68, with the highest score obtained by students of 89 and the lowest score of 28. These data indicate that students' mastery of concepts in acid-base material is low.

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