Student Worksheet Oriented on Assessment for Learning to Improve Learning Outcome on Acid Base Titration

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Abstract
This study aims to obtain student worksheet that can improve learning outcomes on acid-base titration material. The research method used in this research is the Research and Development (R&D) model of Borg and Gall with three steps, namely preliminary studies, development studies, and limited trials. The limited trials employed a one group pretest-posttest design. Data are derived from a validity score based on the mode, a practicality score derived from the student responses questionnaire results, and an effectiveness score derived from the results of the pretest, posttest 1, and posttest 2, which were analyzed by a parametric statistical test using the sample paired t-test. According to the study's findings, the validity mode was obtained score ≥ 3 on each aspect, a practicality score of 98,14% and a significance of the t test obtained 0.000 in the first t-test and 0.000 in the second t-test, so that Student worksheet oriented on assessment for learning can be deemed feasible for raising student learning outcomes for the subject for acid-base titration. The presence of assessment for learning and feedback provided in student worksheet makes students active and can improve student learning outcome on acid base titration material.

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INTRODUCTION

In a learning environment, there is interaction between students, teachers, and learning resources. The assistance that teachers provide students with in order for them to acquire knowledge, master skills, and form attitudes and beliefs is known as learning. (Djamaluddin & Wardana, 2019). Learning result will finally be attained through teaching and learning activities. Learning outcomes are more constructive course corrections that students make as a result of the learning process over time and in the form of knowledge gained from tests on the subject matter being studied. The low learning outcomes are one sign of Indonesia's inadequate educational system. The fact that students have low learning results in some courses, including chemistry, shows that the subject has flaws and challenges (Hemayanti et al., 2020). Due to the fact that answering chemistry issues requires the usage of fundamental principles, chemistry is one of the courses that secondary students find challenging to comprehend. Chemistry is regarded as being challenging for students since in addition to memorizing concepts, students also need to thoroughly grasp a material (Fajrin et al., 2020).

According on the findings of early observations at SMA Negeri 20 Surabaya, it was discovered that up to 54.83% of students thought the content for acid base titration was challenging and that 45.16% thought it was very challenging to learn. These findings suggest

that the information related to acid-base titration is thought to be challenging, which results in poor student learning outcomes. According to the findings of the preliminary study carried out at SMAN 20 Surabaya, the low learning outcomes in the acid-base titration material were not only attributable to the material's difficulty, but also to the fact that teachers failed to give their students feedback on the learning process. One of the assessment techniques that provides feedback is assessment for learning.

According to research by MacMath et al., (2010) most instructors continue to place a greater emphasis on assessment of learning (aol) than assessment for learning during learning activities. In essence, the use of evaluation for learning will have a big impact on the learning process, allowing students to identify their own learning methodologies as well as their own strengths and shortcomings. Summative assessments, or tests used to determine student accomplishment results without any further progress, are frequently used by educators in Indonesia. Value is the most crucial factor in a summative assessment because the advantages of the assessment process itself are not continued (Sobarningsih et al., 2018).

Since learning and evaluation systems are intertwined, a successful learning system will ultimately produce high-quality learning. According to Fitrianna & Anita, (2017) a successful assessment system will motivate teachers to create successful teaching strategies and motivate students to learn more. One of the factors that might assist a reliable assessment system and high-quality learning is the instructional materials that instructors use. Student's learning activities will be enhanced by teaching resources created by educators, one of which may take the shape of Student worksheets (Prastowo, 2012).

Student worksheets are essentially printed instructional tools in the form of sheets of paper that provide information, summaries, and directions for tasks that students must do in relation to the skills they must attain. To support the implementation of teaching and learning activities and to assist students in independently exploring the material and comprehending every theory presented by the teacher in order to achieve their learning objectives, the educators can create student worksheets in accordance with the lessons to be taught. (Prastowo, 2012).

The student woksheet and assessment for learning can work together. The evaluation system used in class will be influenced by Student worksheet, which is focused on assessment for learning. It is intended that this will lead to student engagement (student center), with the instructor serving only as a facilitator. According to research conducted by Dini & Muchlis, (2022) student learning outcomes in chemical equilibrium material can be improved by assessment for learning by 87.88% in the high N-gain category and by 12,12% in the medium N-gain category. Safithri & Muchlis (2022), claimed that student learning outcomes in reaction rate material can be enhanced by assessment for learning by 97.22% in the high N-gain category and by 2.78% in the medium N-gain category.

According on the research conducted by Fitriana et al., (2017) assessment for learning can improve students' mathematical thinking skills. Basically assessment for learning can improve students' learning outcomes, but no one has implemented afl into teaching materials, one of which is student worksheet.

Based on the background that has been described, researchers want to produce new student worksheet that are integrated with assessment for learning, so can make teaching materials including student worksheet more varied. The goal of this study was to acquire student worksheets that were oriented on assessment for learning in acid-base titration material. Students' learning outcomes on the material for acid-base titration are anticipated to be improved by the produced media.

METHOD

According to (Sugiyono, 2016), the development of Student worksheet is focused on Borg and Gall development model. Due to time constraints, this development research was only completed until a limited trial, and the primary goal of the project was to create worksheets that could enhance student learning outcome on acid-base titration content.
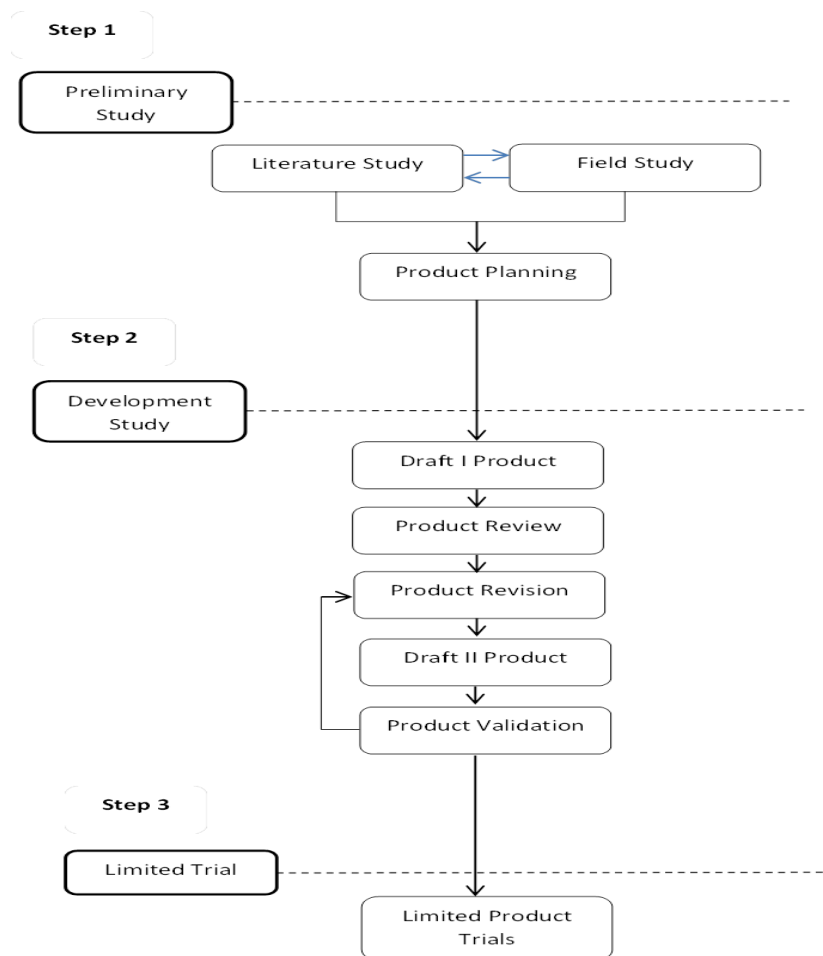

Figure 1. Borg and Gall Development Steps (Sugiyono, 2016)

The limited trial step in this research used the one group pretest posttest design model (Sugiyono, 2016).
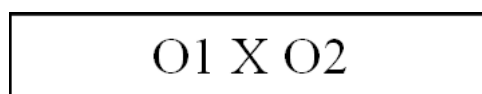
$$O1 \ X \ O2$$

Figure 2. One group pretest posttest design (Sugiyono, 2016)

Description:
O1 : Pretest score
X   : Student worksheet application
O2 : Posttest score

The research's instruments included validation sheets to find out the validity of Student worksheets, student's responses questionnaires to find out the practicality of Student worksheet and pretest posttest question sheets to determine the effectiveness of the worksheets being developed.

Analysis of validity uses data from validation results obtained from three validators when the validator performs validation sheet using a Likert scale according to Table 1.

Table 1. Likert Scale Category

Scoring Scale	Category
1	Invalid
2	Less Valid
3	Quite Valid
4	Valid
5	Very Valid

(Riduwan, 2015)

Results of data validation were examined using the mode. An aspect or indicator is said to be valid if it gets a mode of ≥ 3 (Lutfi, 2021).

Analysis of practicality data used data from questionnaires on student's responses to the Student worksheets developed during the trial run. The results of the response questionnaire were analyzed by the practical percentage formula.

$$P (\%) = \frac{Total\ score\ for\ each\ statement}{Total\ respondent} \times 100\%$$

Following that, the proportion of student response questinnare findings are interpreted in light of the practicality standards in Table 2.

Table 2. Practically Category

Percentage (%)	Category
81 - 100	Very Practice
61 - 80	Practice
41 - 60	Quite Practice
21 - 40	Less Practice
0 - 20	Inpractice

(Riduwan, 2015)

Practicality is supported by data observations of the students activities during the learning process. Student activities are analyzed with the following formula.

$$\%\ students\ acivity = \frac{\%\ frequency\ of\ the\ activity\ that\ occurs}{\%\ frequency\ of\ overall\ activity} \times 100\%$$

Student activities are said to be carried out well if the percentage of relevant activities is greater than irrelevant activities (Riduwan, 2015).

Effectiveness data analysis was carried out by analyzing the pretest-posttest and posttest 1-posttest 2 scores obtained through the t-test with cognitive test results. It was necessary to perform a normalcy test as a prerequisite test before the t-test was used to evaluate the data.

To ascertain if the data being investigated are regularly distributed or not, the normality test is utilized. The Shapiro-Wilk statistical test, supported by SPSS version 25, is used for this normality test. If the value of Sig > 0.05, the data is considered to be normally distributed in the normality test (Yuliana, 2019).

A paired sample t-test must be performed following the normality test to see whether the data is normally distributed and whether there is a significant difference between the two periods before and after the application of the student worksheet. If the Sig of paired sample t-test (2-tailed) value is greater than 0.05, H_0 is accepted and H_a is rejected; if it is less than 0.05, H_0 is rejected, and H_a is accepted (Wibawa, 2019).

RESULTS AND DISCUSSION

Preliminary Study

There are two main activities being carried out in terms of research and information gathering, namely literature studies and field studies (Sugiyono, 2016). Literature study is an activity used to assess proficiency and curriculum and to examine information on acid and base titrations is literature study. Field studies were carried out when researchers carried out initial observation activities at SMA Negeri 20 Surabaya. Based on the findings of the observations made, the researcher identified a number of issues, such as the fact that the Student worksheet used was the Student worksheet that was widely available and that was dominated by material summaries and questions that lacked practicum as a support for learning chemistry, and that the assessment used was still formative, so it still gave priority to the results attained from the process that students undertook to achieve these results.

The Student worksheet design is carried out to find out the Student worksheet design that will be developed. The generated Student worksheet are created by following processes in guided inquiry that are focused on assessment for learning. The framework of the Student worksheet consists of the following components: Title, Instruction, Basic Competencies, Competemcy Achievement Indicators, Learning Objectives, Student Activities, Exercises, Reflection, Evaluation and References (Amali et al., 2019).

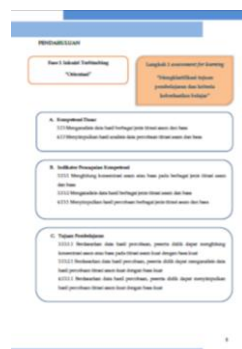

Figure 3. Cover

Figure 4. Instruction

Figure 5. Basic competencies

Figure 6. Student activities

Figure 7. Student refection

Figure 8. References

Developement Study

There are many steps on the developement stage, namely product review, product revision and validation. Draft I of the produced Student worksheet design then examined by the supervisor in order to get feedback, comments, and helpful suggestions. Suggestions and criticisms that have been obtained from the results of the study by the supervising lecturer will be used as a reference for improving the Student worksheets that it is used as revision

material in draft I and will produce draft II Student worksheet. Draft II that have been obained will be validated (Sugiyono, 2016).

Validity

Validity data analysis used the results of content, construct and presentation validation obtained from three validators. The purpose of content validity is to evaluate the applicability and connections between the created student worksheet and instructional materials. Content validity includes two aspects, namely 1) conformity of learning objectives with basic competencies, 2) truth of facts, concepts, principles, laws and theories contained in student worksheets (Kustianingsih & Muchlis, 2021). The construct criteria indicate the extent to which the instrument can reveal the trait or theoretical construct to be measured. Construct validity includes two aspects, namely 1) the suitability of the Student worksheet with the afl step, 2) the appropriateness of the guided inquiry stage in the student worksheet. The last aspect is the presentation which includes the sequence of presentation contained in the student worksheet. The validation result are presented in Table 3.

Table 3. Data validation result

Validity Aspect	Mode	
	Student worksheet 1	Student worksheet 2
Content validity	4	4
Construct validity	4	4
Presentation	5	5

According to Table 3 above, student worksheets 1 and 2 receive a mode of 4 for the content validity assessment findings. On student worksheets 1 and 2, construct validity receives a value of 4. Regarding the presentation, it receives a mode of 5 on student worksheet 1 and 2. The Student worksheet is recognized as valid based on the data from the validation results because it achieved the required mode score of 3 (Aprilia & Lutfi, 2023).

Limited Trial

Limited trials were conducted with the aim of knowing whether there were differences before and after applying the Student worksheet. The limited trial used a one group pretest-posttest design. Limited trials were conducted on 18 students of class XI-3 SMA Negeri 20 Surabaya.

Practiaclity

The practicality of student worksheet oriented on assessment for learning was obtained from the results of student's responses questionnaires after using student worksheet and through the questionnaires given to 18 students. The response questionnaire contains statements that must be answered by students after using the developed student worksheet. The results of the students response questionnaire are presented in Figure 9.

According on Figure 9, it is known that in the content aspect the students gave a positive responses of 100%. In the construct aspect, the positive responses was 94.43% and the negative responses was 5.57%. In the presentation aspect, a positive responses was obtained by 100%. The construct aspect did not get a perfect response because some student could not understand the assessment for learning steps contained in the student worksheet (Yan, 2021). Considering the responses on the questionnaire, the student's responses mean reach 98,14% so it can be said that student worksheets oriented on assessment for learning was practical because they get a percentage of $> 61\%$ (Arthamena & Anwar, 2023).

The practicality of the developed Student worksheet is supported by the results of students's observation activities during the learning activities. Relevant activities are assessed based on the assessment for learning steps and guided inquiry syntax contained in the Student

worksheet. While irrelevant activities are activities carried out without any connection with learning. Rahman, (2022) states that learning activities will not take place without student activity.
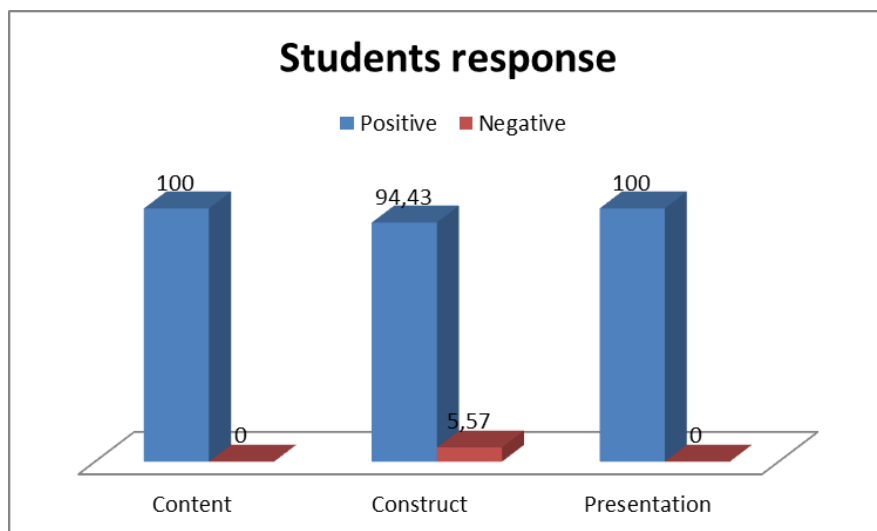

Figure 9. Result of Student's responses

The results of observing student activities are presented in table 4.

Table 4. Result of percentage student activity

Observed Activity	Meet 1 (%)	Meet 2 (%)
Relevant activity	84,44	88,89
Irrelevant activity	15,56	11,11

Table 4 above shows that each meeting's relevant activities receive a higher percentage than its irrelevant ones. These findings show that students engage in educational activities quite effectively and complete all of the worksheet's tasks. According to the information from the questionnaire responses and the provided student activities, the student worksheet oriented on assessment for learning is said to be practice for improving student learning outcomes in acid-base titration material.

Effectiveness

The findings of the pretest, posttest 1, and posttest 2 for the learning outcomes test are used to determine the success of student worksheets focused on assessment for learning. The purpose of the pretest, posttest 1, and posttest 2 was to determine the initial and final scores of the students' learning outcomes prior to and following the application of student worksheets focused on assessment for learning. Figure 10 displays the outcomes of the pretest, posttest and posttest 2.

According to Figure 10, no students received a pretest score for the learning outcomes test above the individual completeness score of 75, so that the students' classical completeness in the pretest was 0%. The incompleteness of these students is due to the way of teaching which is still teacher-centered and the assessment system used is still formative assessment and there are no teaching materials that support the learning process (Paolini, 2015). In posttest 1, 9 students were declared complete individually because they got scores above 75 and the rest did not complete so that classical completeness only reached 50%. Student oriented on assessment for learning is able to significantly improve student learning outcomes even though they do not achieve completeness (Knight et al., 2013). This is due to the fact that some students are still unsure of what the Student worksheet's definition of assessment for

learning means. Some students do not understand the feedback given by the teacher and students are still wrong in writing lesson plans (Brown, 2019).
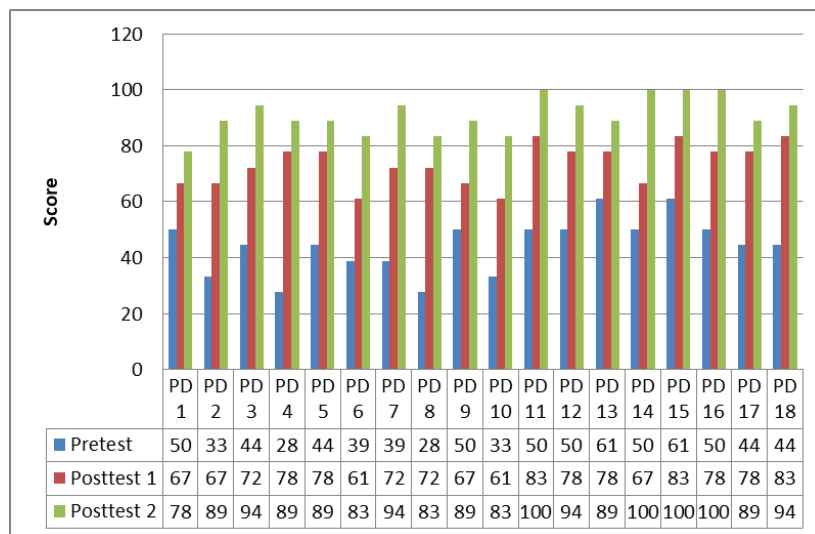

Figure 10. Result score of pretest, posttest 1 and posttest 2

All students achieved scores over 75 on the last posttest, which mean posttest 2, bringing the overall percentage of classical completion to 100%. This because they can grasp the teacher's feedback and the assessment for learning that is included in the Student worksheet. In line with the research conducted by Budiyono, (2011) the emphasis on the meaning of assessment for learning lies in the process of obtaining information and using information.

Collaboration between teachers and students yields knowledge or information, and this information is used by teachers and students to enhance and raise the caliber of following learning (Ekua & Sekyi, 2016). Students have taken the teacher's criticism into account so that they may develop lesson plans correctly and improve student learning results (Yusron & Sudiyatno, 2021). The consistency of learning carried out by students can improve student learning outcomes in the material they learn (Box, 2018).

Effectiveness data were analyzed using the t test with the help of SPSS 25. The normality test using the Shapiro-Wilk statistical test required to be conducted before the data could be evaluated with the t test. The results of the normalcy test are shown in the Table 5.

Table 5. Normality test of pretest, posttest 1 and Posttest 2

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.173	18	.165	.928	18	.183
Posttest1	.224	18	.017	.905	18	.071
Posttest2	.183	18	.114	.916	18	.109

a. Lilliefors Significance Correction

The pretest, posttest 1, and posttest 2 each had significant values of 0.183, 0.071, and 0.109, as shown in the normality test results table above. The three data have a significance level greater than 0.05, and are consequently regarded as being normally distributed (Yuliana, 2019).

After the normality test, the data from the pretest, posttest 1, and posttest 2 were analyzed using the Paired Sample t-test within the SPSS 25 program. Table 6 displays the results of the Paired Sample t-test.

Table 6. Result of Paired sample t-test of pretest-posttest 1 and posttest 1-posttest 2

Paired Samples Test

| | | | | | 95% Confidence Interval of the Difference | | | | |
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	pretset - posttest1	-29,01389	9,63209	2,27031	-33,80382	-24,22396	-12,780	17	,000
Pair 2	posttest1 - posttest2	-17,59111	6,39069	1,50630	-20,76913	-14,41309	-11,678	17	,000

According to the paired sample t-test calculation results table, H_0 is rejected/H_a is accepted if the Sig. (2-tailed) in pair 1 is $0.000 < 0.05$. It is well known that in the paired pair 2 test, a Sig. (2-tailed) value of $0.000 < 0.05$ results in the rejection of H_0 and the acceptance of H_a (Ischak et al., 2020). It is clear from the average pretest, posttest 1 and posttest 2 scores that there is a substantial difference, indicating that employing student-oriented worksheets on assessment for learning has an impact on improving student learning outcomes in acid-base titration material (Subehi & Sriyanto, 2021).

Assessment for learning emphasizes providing feedback in learning activities that are used by students to see their potential in mastering learning. In its application, it takes a lot of special preparation to see assessment for learning-oriented learning (Jeyaraj, 2019). Teachers must have the ability to manage learning such as planning, setting learning objectives, and making the right decisions based on assessment results so that students are motivated to improve their learning outcomes (Wiliam, 2013). The implementation of assessment for learning is very effective in improving students' learning outcomes. Assessment for learning is very effectively used for teaching and learning activities (Oyinloye & Imenda, 2019).

CONCLUSION

Student worksheet oriented on assessment for learning to improve student learning outcomes were declared valid by the validator based on content, construct and presentation with criteria score mode of 4, 4, and 5 respectively. Student worksheet oriented on assessment for learning to improve student learning outcomes were stated to be very practical based on the student response questionnaire results, which were 98.14% and supported by activities students who were relevant to the proportions at meetings 1 and 2, which were jointly agreed at 84.44% and 88.89%.

Student worksheet oriented on assessment for learning to improve student learning outcomes are claimed to be very effective for improving student learning outcomes on acid-base titration material with paired sample test scores t-test 1 and paired sample test t-test 2 respectively obtaining Sig. (2-tailed) of $0.000 < 0,05$. Based on these results of student worksheet oriented learning assessment is said to be feasible to improve student learning outcomes on acid-base titration material. In this study, the student worksheet developed only reached a limited trial in accordance with the research background. It is hoped that in the future the developed student worksheet can be used commercially on a large scale and can be disseminated.

RECOMMENDATIONS

The development of a student worksheet oriented on assessment for learning on acid-base titration material is only carried out until the limited trial stage, so it needs to be continued until large group trials and dissemination.

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