



Development of An Interactive E-Module Based on Blended Learning to Enhance Student Independence and Learning Outcomes

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Abstract: This study aims to analyze the feasibility and effectiveness of interactive e-modules based on blended learning to increase independence and learning outcomes on acid-base materials. This research is development research using the Borg & Gall model which consists of ; 1) Research and Information collection, 2) Product planning, 3) Product development, 4) Product validation, 5) Product revision, 6) Product trial. The subjects of this study were chemistry lecturers and chemistry teachers as well as students of SMA Negeri 1 Krembung Sidoarjo who took chemistry specialization. The instruments used were review and validation sheets, learning independence questionnaires, response questionnaires, and learning outcomes test sheets. Data analysis using the N-gain to determine the increase in student independence and learning outcomes. The validation results are processed using the mode of each statement, the results of content validity get mode 5 with very valid criteria, and construct validity get mode 4 with valid criteria. The results of this study indicate that learning chemistry using interactive e-modules based on blended learning can increase learning independence with an n-gain value at 3 meetings of 0.49 in the medium category and learning outcomes with an average n-gain value of 0.69 in the moderate category. Therefore, the interactive e-module based on blended learning developed is feasible and effective to be used to improve students' independence and learning outcomes on acid-base materials.

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Introduction

Education plays an important role in life because it is a human need in life. The purpose of education cannot be separated from the curriculum. The independent curriculum is a curriculum change that provides new ideas to take advantage of technological developments to utilize the knowledge needed (Manalu et al., 2022). One of the technological developments in education is the development of interactive e-modules. Interactive e-modules can be used flexibly without any space and time constraints. The use of E-Modules can be used anywhere and anytime, this allows students to access without being connected to the teacher (Wulandari et al., 2021). Interactive E-Modules are a means of developing technology to improve the quality of learning to be more effective and can increase knowledge and skills for educators and students in the learning process both when in the classroom (indoor) and outside the classroom (outdoor) (Firmandani, 2020). In addition to the use of interactive e-modules, the use of learning methods is also very important to realize smart and skilled student outcomes. One of them is the utilization of blended learning, which is learning that combines e-learning and face-to-face learning (Zakaria, 2022). Blended Learning has advantages over conventional models because it can facilitate students' different learning styles and help students to understand concepts (Elvianasti et al., 2022). This is also in line with research



conducted by (Rahman et al., 2020) that blended learning can significantly improve student motivation and learning outcomes.

However, in reality, the implementation of innovative technology-based learning has not been implemented. This is in line with research conducted by (Fajrin et al., 2020) which states that student difficulties in acid-base material with a difficulty level of 47% with the greatest difficulty in calculating the pH of acid-base solutions with a difficulty level of 88%. Acid-base material is chemistry material taught in class XI SMA. Acid-base material contains factual, conceptual, and procedural knowledge (Setiadi & Zainul, 2019). Difficulties in acid-base material can affect other materials because acid-base material is a prerequisite material to continue to the next material such as buffer and salt hydrolysis (Fajrin et al., 2020). This needs student independence to improve learning outcomes, especially on acid-base materials.

In accordance with the philosophical basis of the independent curriculum, the implementation of learning can be carried out in a learning atmosphere that is interactive, inspiring, fun, challenging, motivating students to be active so as to provide space for students to build independence according to their talents and interests (Kemendikbud, 2024). Learning independence is important for students to form principles and concepts that are being learned (Yuliati & Saputra, 2020). Learning independence can create student confidence and student ability to understand learning materials which can increase so that better student character can be formed (Perwitasari, n.d.). Learning independence can be seen from students' expertise in carrying out learning independently. Learning independence is the ability that students have to be independent in finding learning information in addition to learning resources from teachers (Nuritha & Tsurayya, 2021). Learning independence can improve student learning outcomes in accordance with research conducted by (Khasanah & Lestari, 2021) that students who have high learning outcomes can achieve high learning outcomes and vice versa. In line with research by (Novia & F, 2019) good learning independence will have a high level of learning outcomes. If the problem of student learning independence is left unchecked, it will have a negative impact on students, they tend to have no targets because they do not have a sense of responsibility, decreased motivation, and loss of interest in learning (Rahmawati et al., 2022).

Therefore, a learning media is needed that can increase students' learning independence. One of them is learning media that can support students to increase independence and learning outcomes that allow students to learn flexibly anywhere and anytime. The purpose of this study is to determine the validity of interactive e-modules based on blended learning on acid-base materials and to determine the effectiveness of using interactive e-modules based on blended learning in increasing student independence and learning outcomes.

Research Method

The study used a research and development method (R&D) to produce a product and test the effectiveness of the product (Sugiyono, 2016). The research method used refers to the development model (Borg & Gall, 2003) which consists of 10 stages of research and development. However, in this study it was modified according to the needs, namely 1) Research and Information collection, 2) Product planning, 3) Product development, 4) Product validation, 5) Product revision, 6) Product trial.

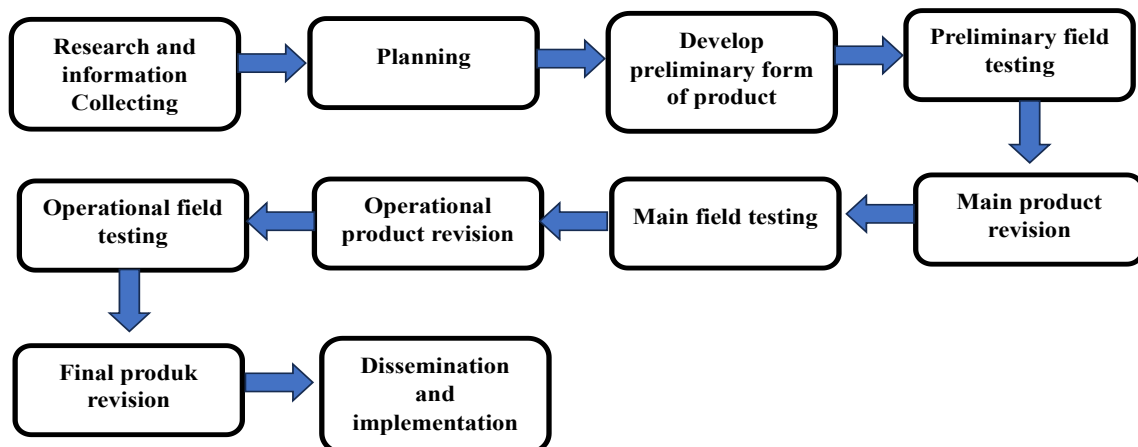


Figure 1 Flowchart Research and Development Borg and Gall

The test subjects in this study were students of SMA Negeri 1 Krembung Sidoarjo who took chemistry specialization. The subjects of this study were instrument validators, namely 2 chemistry lecturers and chemistry teachers as well as students of SMA Negeri 1 Krembung Sidoarjo who took chemistry specialization.

The instruments used were review and validation sheets, learning independence questionnaires, response questionnaires, and learning outcomes test sheets. The analysis technique at the validation stage was carried out by 2 chemistry lecturers and 1 chemistry teacher. The validation of the e-module is assessed in the form of construct and content validation which includes the appearance, presentation, language, and content of the e-module. This assessment uses a Likert scale of 1 to 5 which includes value 5 as very valid, value 4 as valid, value 3 as quite valid, value 2 as less valid, and value 1 as invalid (Riduwan, 2015). Data from the results of this study were analyzed for each indicator using the mode value. After getting the validation value from the validator, the interactive e-module based on blended learning is declared valid with a mode value of 5.

The next stage is the trial stage which is carried out using a questionnaire of learning independence and pretest and posttest questions to determine the improvement of learning outcomes. The learning independence questionnaire contains statements related to five indicators of learning independence consisting of positive statements and negative statements. The independence questionnaire is filled in before and after learning at each meeting. This assessment uses a Likert scale from 1 to 4. For positive statements, score 4 means Always (SL), score 3 means Often (SR), score 2 means Rarely (J), and score 1 means Never (TP). Conversely for negative statements. This learning independence was analyzed using the formula.

$$\text{Independence value} = \frac{\text{score obtained}}{\text{maximum score}} \times 100\%$$

Then the increase in student learning independence can be calculated using the Ngain analysis method with the following formula.

$$\langle g \rangle = \frac{\text{Posttest} - \text{Pretest}}{\text{Smax} - \text{Pretest}}$$

Description:

- $\langle g \rangle$ = gain value
- Posttest = final test score
- Pretest = initial test score
- Smax = maximum score



Students' learning outcomes can also be analyzed using the n-gain method with the same formula to determine the improvement of learning outcomes.

Results and Discussion

1) Preliminary Description of Interactive E-Module Based on Bended Learning

Based on the results of needs analysis through observations and interviews with 3 chemistry teachers and 31 students at SMA Negeri 1 Krembung about learning media that are often used by teachers in teaching and learning activities. The media still use printed books and LKPD whose contents are less interesting for students. This statement is proven based on the results of the interview questionnaire as 83.9% of students stated that the media that is often used is LKPD while the rest answered notes from the teacher. So 58.1% of students feel less interested in learning independently using LKPD/printed books. This is in line with research by those who stated that textbooks have weaknesses, namely not being able to visualize a phenomenon, and less interactive (Ricu Sidiq & Najuah, 2020). Interactive e-books can be one of the best alternatives to improve reading comprehension and reading interest (Winatha, 2018).

In addition, teachers feel that they need learning media that are effectively used offline or online because learning hours at school are limited for teachers, while the material that must be given does not match the availability of learning hours at school. From the results of these interviews, teachers and students feel the need for learning media that is interesting, effective, and can increase student independence and learning outcomes.

2) Development of Interactive E-Modules Based on Blended learning

Based on the problems that have been described, it is very necessary to develop learning media that is easily accessible online and offline that can increase student independence and learning outcomes which are expected to overcome these problems. This is in accordance with research conducted by (Herawati & Muhtadi, 2018) which states that interactive e-modules can increase students' interest in learning so that it can improve learning outcomes. Therefore, interactive e-modules are effectively used for online learning activities (Rahmatsyah & Dwiningsih, 2021).

The blended learning model is chosen as the model for developing interactive e-modules to facilitate the learning process. Using the Blended learning model is an efficient solution for online and offline learning (Irsalina, 2018). One of these innovations is blended learning with the flip classroom model. The blended learning model used is a flip classroom. Students are given material to study at home which can be studied flexibly in their respective homes (Rahmayani, 2020). The advantages of this flipped classroom are that it takes time to interact with students more effectively, can help with learning difficulties, and helps to understand the concept of material (Mirlanda et al., 2020). The overall development of interactive e-modules based on blended learning is shown in the following figure

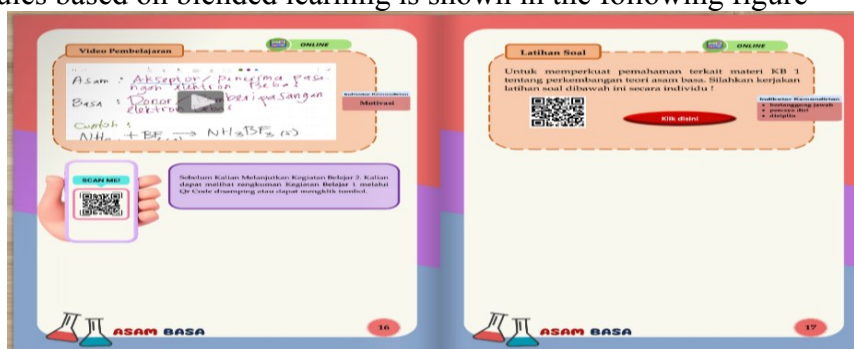


Figure 2. Illustration of Interactive E-Module based on blended learning when online

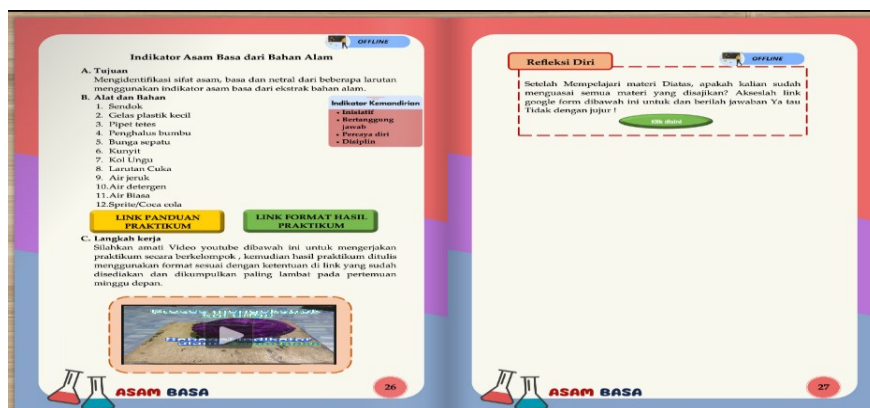


Figure 3. Illustration of Interactive E-Module based on blended learning when offline
Blended learning can encourage students to be involved in the learning process so that students can build their knowledge, this will affect students' independence and learning outcomes (Baidowi et al., 2021). Blended learning can eliminate student boredom in learning so that learning feels more interactive, this can have a positive impact because it can increase student understanding. Thus, the blended learning method can encourage students to improve their learning outcomes (Firmansyah, 2019).

To make it easier for teachers to know student independence, independence indicators are included in each lesson. There are 5 indicators of independence used (Mudjiman, 2006) that students can be said to have learning independence if they have self-confidence, are active, are disciplined, responsible in learning. Meanwhile, according to (Astuti, 2016) Learning independence has indicators of believing in yourself, having a sense of responsibility, have your own initiative. Learning independence is a conscious action that is driven by oneself so that one can find students' abilities to achieve goals. Assessment of indicators of student learning independence can be measured using indicators of learning independence, namely 1) Self-confidence, 2) Discipline in learning, 3) Initiative in learning, 4) Responsibility in learning, and 5) Motivation to learn (Febriani, 2021).

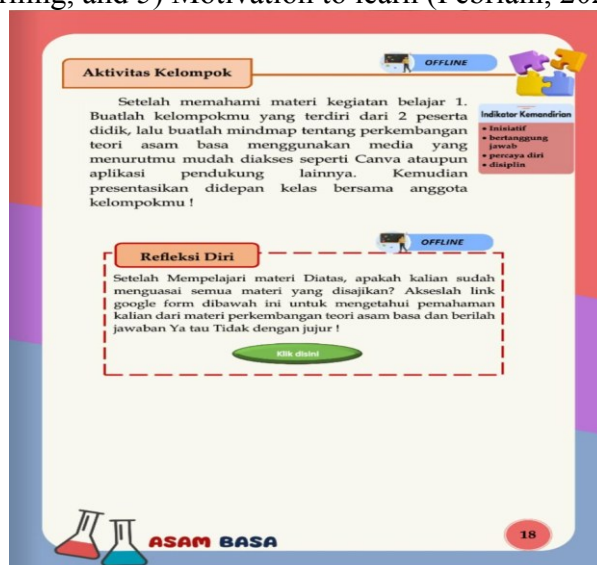


Figure 4. Illustration of student learning independence indicators

In this interactive e-module based on blended learning, 5 indicators of independence are used, namely self-confidence, initiative, motivation, responsibility, and discipline. Independence indicators will appear in each activity on the e-module according to the activities that will be carried out by students.



3) Feasibility of Interactive E-Modules Based on Blended Learning

Learning media that is suitable for use must go through a validation test stage in the form of content and construct validity. The validity test is carried out to determine the level of validity of the media developed in the study and can be said to be valid if it can measure and reveal data from the variables studied appropriately (Sanaky, 2021). The following are the validation results of the interactive e-module based on Blended learning.

a) Content Validation Results

Content validity is seen from the feasibility of a learning media (Dzikro & Dwiningsih, 2021). There are 10 aspects of content validation assessed by validators based on the content in the interactive e-module based on blended learning. Of the 10 aspects, 6 of them got a mode value of 5 with the assessment criteria being very valid while 4 of them got a mode value of 4 with the assessment criteria being valid. Based on this assessment, shows that the interactive e-module based on blended learning is valid for use and fulfills the criteria of content validity according to the Likert scale.

b) Construct Validation Results

Construct validation is the validity used to determine the extent to which the impact of measurement results is in accordance with the theoretical construction in the development of an instrument (Pada et al., 2018). Construct validation There are 4 statements related to the appearance of interactive e-modules based on blended learning with 3 of them getting a mode value of 5 with very valid criteria and 1 statement getting a mode value of 4 with valid criteria. Language construct validation There are 3 statements with 2 of them getting a mode value of 5 with very valid criteria and 1 statement getting a mode value of 4 with valid criteria. Finally, the validation of the presentation construct has 3 statements, all of which get a mode value of 4 with valid criteria. Based on these criteria, the interactive e-module based on blended learning in visual design, language, and presentation can be said to be valid. Easy-to-understand language can make it easier for students to learn and master the concepts (Wardhana & Hidayah, 2022).

4) Effectiveness of Interactive E-Modules based on Blended learning to improve Independence and Learning Outcomes

a) Learning Independence Results

After the interactive e-module is said to be valid, the next step is to conduct a trial. The next step is to conduct a trial to find out the effectiveness of media. Learning can be said to be effective if students are complete in learning (Kurniawan & Hidayah, 2020). In this trial, two instruments were used, namely the independence questionnaire sheet and the pretest-posttest sheet for learning outcomes. This trial was conducted for 3 meetings with the results of learning independence as follows.

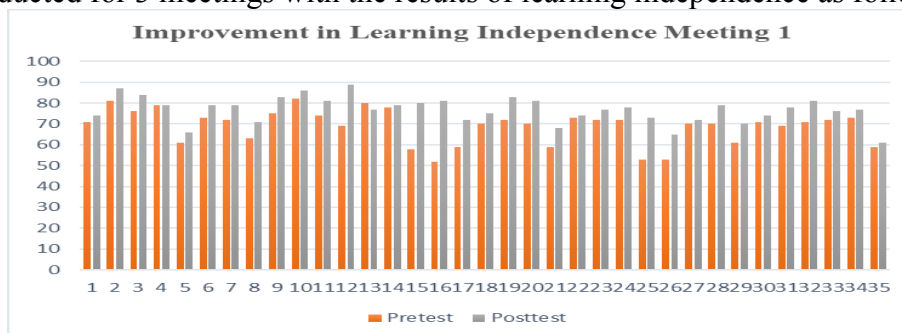


Figure 5. Improvement in Learning Independence Meeting 1

In Figure 5 above, it can be seen that 10 students experienced an increase in independence with an n-gain value of $0.7 > g \geq 0.3$ which is included in the moderate category. while 25 of them experienced an increase in independence in the low category.

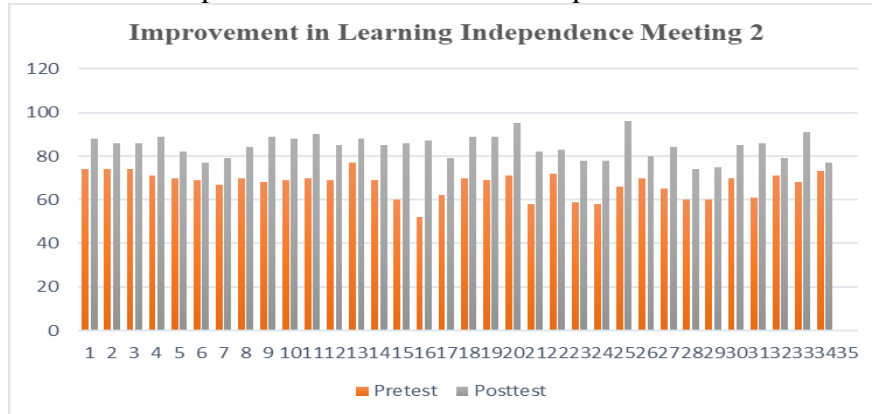


Figure 6. Improvement in Learning Independence Meeting 2

In Figure 6 above, it can be seen that almost all students experienced an increase in learning independence at meeting 2. A total of 29 students experienced an increase in the moderate category with a range of n-gain values of $0.7 > g \geq 0.3$, then as many as 4 students experienced an increase in the high category with a range of n-gain values of $g \geq 0.7$ and 2 students experienced an increase in independence in the low category with a range of n-gain values $g < 0.3$.

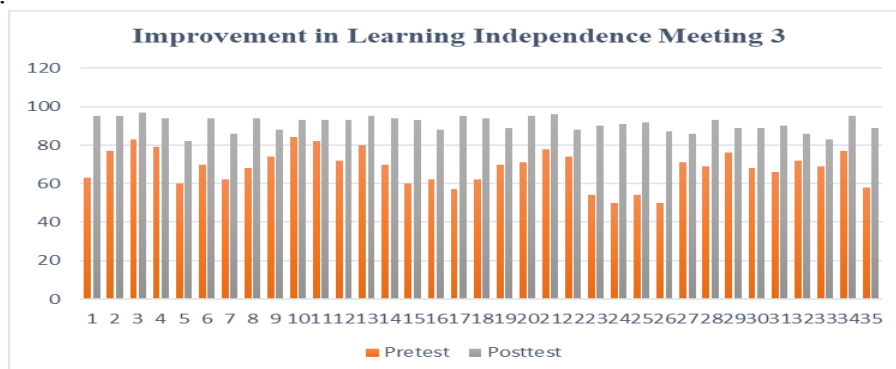


Figure 7. improvement in Learning Independence Meeting 3

In Figure 7 above, it can be seen that all students experienced an increase in learning independence at meeting 3. A total of 13 students experienced an increase in the moderate category by obtaining an n-gain value with a value range of $0.7 > g \geq 0.3$. Then as many as 22 students experienced an increase in the high category with the acquisition of the n-gain value range $g < 0.3$.

b)Cognitive Outcomes

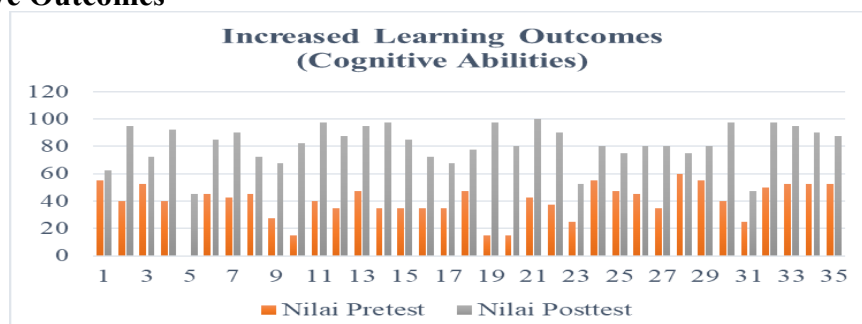


Figure 8. Increased Learning Outcomes



Based on Figure 8, it can be seen that there is an increase in learning outcomes in all students. This can be analysed using n-gain analysis of pretest and posttest results. Based on the n-gain value that has been obtained, 16 students experienced an increase in learning outcomes in the high category with the acquisition of an n-gain value range of $G \geq 0.7$. Then, 13 students experienced an increase in learning outcomes in the low category with the acquisition of an n-gain value range of $0.3 \leq G < 0.7$ and as many as 5 students experienced an increase in learning outcomes in the low category with the acquisition of an n-gain value range of $G < 0.3$. The results of data analysis and discussion on research conducted on students of class XI-01 SMA Negeri 1 Krembung showed that the implementation of learning carried out using interactive e-modules based on blended learning on acid-base material can effectively improve student independence and learning outcomes. This is evidenced by an increase in the n-gain value at 3 meetings of 0.49 with a moderate category and student learning outcomes get an average gain of 0.69 with a moderate category.

Conclusion

Based on the results of the research that has been done it can be concluded that:

- 1) Validation of interactive e-modules based on blended learning in acid-base material obtained a content validity value of 5 with a very valid category and construct validation obtained a value of 4 with a valid category. So it is said that the interactive e-module based on blended learning is feasible to use.
- 2) The increase in student learning independence obtained an n-gain value range at meeting one of 0.25 with a low category, at meeting two obtained an n-gain value range of 0.51 with a medium category, and at meeting three obtained an n-gain value of 0.71 with a high category. So the average at 3 meetings obtained an n-gain of 0.49 with a moderate category. So it is said that interactive e-modules based on blended learning can increase student learning independence.
- 3) The learning outcomes obtained from the pretest and posttest on acid-base material obtained an average n-gain value of 0.69 with a moderate category. So it can be said that interactive e-modules based on blended learning can improve student learning outcomes.

Recommendation

Some research recommendations that can be used for the future are 1) learning tools that are in accordance with the independent curriculum through various media, both printed and non-printed 2) learning tools that are easily accessible for students to learn.

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