

ABC - Acid and Base Chemistry: An Android Mobile Learning Media to Improve Students' Learning Outcomes and Motivation

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Abstract

This research aimed to obtain "ABC - Acid & Base Chemistry" android mobile learning media that is valid, practical, and effective in improving students' learning outcomes and motivation. The developmental model with the stages: define, design, and development is used in the current study. The instruments used include validation sheets, students' response questionnaire, learning motivation questionnaire, and pretest-posttest question. Thirty-five students conducted a limited trial at SMAN 3 Sidoarjo. Data analysis using one group pretest-posttest design. Based on the research results, the validity test scored more than three in the valid category. The practicality test of the media with the analysis of the student response questionnaire got a percentage of 96% with a very practical category. The media effectiveness test is seen from the analysis of the students' learning outcomes obtaining a classical completeness percentage of 88.5%, and a questionnaire analysis of students' learning motivations obtaining an overall average percentage of 95% with a very effective category. It can be decided that the "ABC - Acid & Base Chemistry" android mobile learning has fulfilled the aspects of validity, practicality, and effectiveness as a learning media to improve student learning outcomes and motivation.

Keywords: Learning Media; Acids and Bases; Learning Motivation; Learning Outcomes; Android Mobile Learning

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INTRODUCTION

Information technology is developing rapidly in the Industry Revolution 4.0, and every aspect of life, including the world of education, is integrated with technology's help (Rosalina et al., 2019). In the education field, teachers can support the development of independent distance learning by utilizing technological developments, especially by prioritizing convenience, flexibility, and interactivity between users (Jannah et al., 2017). Rapid technological developments inevitably require the concepts and mechanisms of education based on Information and Communication Technology (ICT). This concept is called e-learning. The newest field of e-learning is mobile-based learning, commonly known as mobile learning. Mobile learning is being improved along with the need for the use of modern mobile devices (smartphones, tablets, notebooks), which are increasing and are not yet optimally used in the field of education (Taufiq et al., 2016). The research of Putranta et al. (2021) explained that not all teachers and students use smartphones to make learning easier.

The condition certainly needs to test the wisdom of using smartphones while learning at school. Using smartphones wisely and appropriately for students will help them understand what teachers are teaching effectively and efficiently. The use of mobile learning can provide students with information about learning. Students and teachers need to work to maximize the benefits of mobile learning and help to achieve the desired learning goals (Putranta et al., 2021).

In addition, more mobile devices are produced than laptops and PCs. Android is one of the gadgets favored by all circles, especially the smartphone operating system. Android is user-friendly and easily operated (Prasad, 2016). According to the market share of Indonesia's mobile operating system in May 2022, Android users accounted for 91.57%, 8.31% were iOS users, and 0.12% were windows users (Statcounter, 2022). Based on the direct observation results, most students already have their smartphones and are used to using them. However, these smartphones are often used to play games, open chat applications, watch videos on YouTube, and play TikTok, so they are not optimally used in learning activities (Muttaqin et al., 2021).

Furthermore, the research by Handoyono and Mahmud (2020) reveals that smartphone use cannot be optimal. Students only use smartphones for entertainment, such as games and social media. Supposedly, being so close and familiar with Android devices with daily life can be appropriately used to support learning activities (Handoyono & Mahmud, 2020).

Teachers must be able to take advantage of technology that is currently developing. With affordable smartphones' availability, applications in different areas such as travel, productivity, entertainment, communication, and learning can increase (Bano et al., 2018). Smartphones can be operated as learning media and teacher's tools or complementary to teaching and learning activities. Teachers have to choose the suitable learning media to achieve the educational goals arranged by the school. Learning media is central to the learning process because it can be used as a learning source to increase students' insight (Nurrita, 2018). The use of mobile devices in mobile learning helps students access material without being constrained by space and time and supports closer interactions between educators and students (Rahmawati & Partana, 2019). The use of mobile learning based on Android can foster interest and motivation to learn new things in the learning materials delivered by the teacher. Engaging learning media for students can be a driving force in the learning process (Nurrita, 2018). According to the research conducted by Alisia et al. (2022), media based on Android is stated to improve student learning outcomes and increase student learning motivation got a score of 83.4% with very good criteria (Alisia et al., 2022).

Acid-base is a chemical material that requires understanding, application, analysis, and evaluation. The material is related to concepts and is always linked to support the following materials: hydrolysis, buffer, and Ksp. So, it is necessary to cultivate a complete and correct concept. This material is vital as an initial concept to understand chemical concepts in the next lesson (Amalia & Susilaningih, 2014). The current study developed android mobile learning on Acid and Base material which is expected to be an alternative learning media. The media developed has a "mini laboratory" menu, where the menu can help students learn more about acid-base concepts in daily life and improve skills in conducting experiments. Students can also use this learning media to study independently because the media is in the form of applications that can be accessed offline and online, so they can learn anytime and

anywhere with a learning speed that can be adjusted to individual abilities. Moreover, it can help teachers deliver abstract material, especially when learning chemistry on Acids and Bases.

Cahyana et al. (2019) have created a mobile media learning on acid and base. The media consists of several activities: material from various sources and adapted to the latest curriculum, indicators of essential competencies, exercises and discussion of questions, and questions in games (Cahyana et al., 2019). Furthermore, Nora and Lutfi (2022) have created a “Hy-Quiz” learning media based on Android. The media includes basic competence, indicators, learning media objectives, media usage procedures, learning materials, videos, evaluation, and author profiles (Nora & Lutfi, 2022). Based on these studies, android-based learning media in chemistry learning are not equipped with virtual laboratories that can train students' abilities in chemistry experiments. “ABC – Acid & Base Chemistry” media has a minilab menu containing acid-base experiments that can be accessed anywhere and anytime. Hence, the media has different characteristics from other existing media. The current research aimed to obtain mobile learning media called “ABC - Acid and Base Chemistry”. The feasibility of this media is obtained from its validity, practicality, and effectiveness.

METHOD

The type of the current study is Research and Development (R&D). One of Thiagarajan's research and development models is the 4-D model (Define, Design, Development, and Dissemination). In this research, only use the define, design, and development with the use of limited trials. Figure 1 shows the flow of the research.

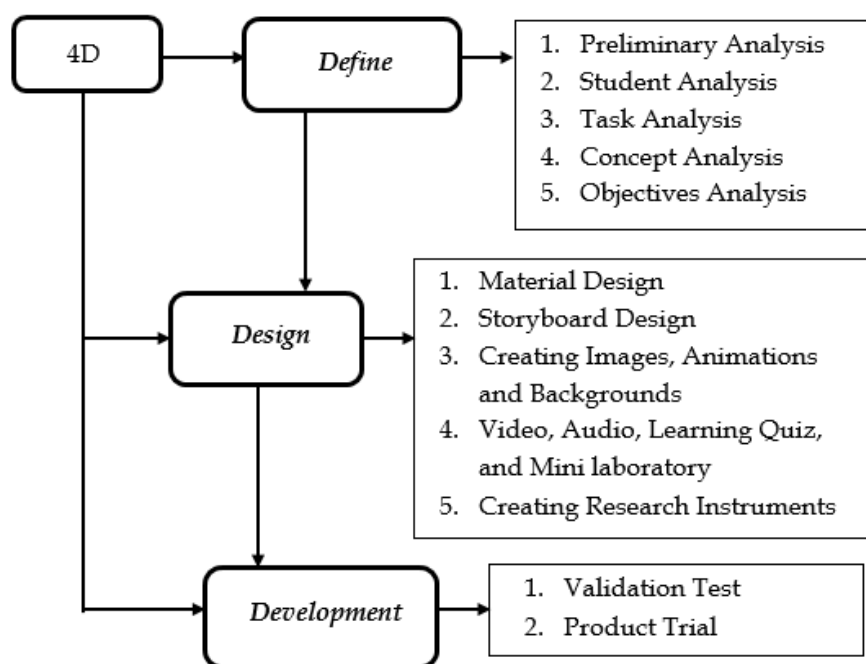


Figure 1. The flow of the research

Define

The define stage is used to define and regulate the learning process's needs and collect various information related to the developed media. At this stage, there are several steps: preliminary analysis, student analysis, task analysis, concept analysis, and objectives analysis.

Design

The design stage aimed to produce a mobile learning media that can be used in chemistry learning. The product design needs to be validated by lecturers/teachers from the same field of expertise before the product design proceeds to the next stage. Activities included in the design stage are material design, storyboard, images, video, animation, music, sound, learning quizzes, mini-laboratory, and display design. Researchers also prepared research instruments, including media validation sheets, student response questionnaires, learning motivation questionnaires, and pretest and posttest question sheets.

Development

At this stage, validation tests and media trials are carried out. Media experts and material experts assessed the learning media created to determine whether the media is declared valid as learning media. The validators of this research were two chemistry lecturers and one chemistry teacher. The validity results are used as material for upgrading the perfection media.

After expert validation, a limited field trial was conducted to observe the implementation of the media in classroom learning, namely in the data collection stage. The results obtained from this stage are Pocket Mobile Learning "ABC - Acid & Base Chemistry" valid. A limited trial was conducted by 35 students of Senior High School 3 in Sidoarjo, especially in grade 11 MIPA 2, by filling out a questionnaire after using the media and measuring student learning outcomes before and after learning. The limited trial uses one group pretest-posttest design, as shown in Figure 2.

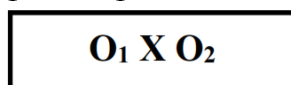


Figure 2. The Schematic

Notes:

O₁ = Pretest

X = Treatment, learning process using "ABC - Acid & Base Chemistry" Media

O₂ = Posttest

Data Analysis

Analysis of the data used in this research is validation analysis, practicality analysis, and effectiveness analysis. The data from the validation results by the three validators were then analyzed using a descriptive method based on the calculation of the Likert scale (Table 1) (Riduwan, 2015). The validation results were analyzed and calculated using the mode score. Based on Table 1, mobile learning "ABC - Acid & Base Chemistry" can be declared valid as a learning media if the score reaches ≥ 3 .

Table 1. Likert Scale

Scale	Category
1	Very Invalid
2	Less Valid
3	Fairly Valid
4	Valid
5	Very Valid

The practicality of the "ABC - Acid & Base Chemistry" media was obtained through a student response questionnaire to find out students' opinions about the

"ABC - Acid & Base Chemistry" media. In the student response questionnaire, there are positive and negative statements. The assessment of the student response questionnaire results was analyzed based on the Guttman scale (Dwiningsih et al., 2018) in the following table.

Table 2. Guttman Scale

Statement	Answer Score "Yes"	Answer Score "No"
Positive	1	0
Negative	0	1

Furthermore, the data assessment results were analyzed using the percentage of the Guttman Scale data obtained by the formula.

$$P(\%) = \frac{\text{Student's Score}}{\text{Total number of students}} \times 100\%$$

The percentage of student response questionnaire results is then interpreted into a criteria score. Table 3 shows the criteria for interpreting scores of the Guttman scale (Dwiningsih et al., 2018). Furthermore, from the results of the interpretation score, if the percentage result is $\geq 61\%$, then the "ABC - Acid & Base Chemistry" media can be practically used as learning media.

Table 3. Interpretation Score of Guttman Scale

Percentage (%)	Category
0-20	Very Less Practical
21-40	Less Practical
41-60	Fairly Practical
61-80	Practical
81-100	Very Practical

The effectiveness of the "ABC - Acid & Base Chemistry" media was obtained through a learning motivation questionnaire and pretest-posttest scores to determine students' learning outcomes before and after using learning media. The students' initial ability can be known by doing the pretest, while the final ability of the students can be known by doing the posttest. Analysis data of the learning test was obtained from the learning outcomes of students who obtained the result completeness of learning. Students' learning success indicators are stated to be achieved if students have achieved a score of 75% or a score of 75. Furthermore, a class is stated as complete learning if 85% of the class members have achieved an absorption capacity of 85% (Afrita, 2021). To determine the value of classical completeness learning outcomes, use the following formula.

$$\text{Classical Completeness} = \frac{\text{Number of Students Who Complete}}{\text{Total Number of Students}} \times 100\%$$

The learning outcomes scores that have been obtained were then analyzed by normality test and then Paired Sample T-Test using the IBM SPSS Statistics 26 application. The normality test was used to determine whether the pretest and posttest scores are normally distributed. At the same time, the Paired Sample T-Test test was used to state whether there was a differentiation between the average pretest and posttest scores (before and after the media was given).

The normality test uses the results of the Shapiro-Wilk data because the total number of respondents is <50. The Shapiro Wilk normality test is conducted to determine the distribution of random data for a small sample. The two-term papers by Shapiro, Wilk in 1958 and Shapiro, Wilk, & Chen in 1968 used less than 50 samples, so if the data samples are less than 50 samples ($N < 50$), the Shapiro-Wilk test will be used. In a data test, if the significance value is > 0.05 (Sig. > 0.05), the data can be noted to be normally distributed (Suardi, 2019). While the Paired Sample T-Test data is declared to have a differentiation in the average score between the pretest and posttest if the significance value (2-tailed) is less than 0.05, H_0 is rejected, and H_a is accepted (Wibawa, 2019).

Data from the questionnaire results on students' learning motivation were also used to analyze the effectiveness of the media. In the student learning motivation questionnaire, there are positive and negative statements. The assessment of students' learning motivation data results was analyzed based on the Guttman scale (Dwiningsih et al., 2018) in Table 4.

Table 4. Guttman Scale

Statement	Answer Score "Yes"	Answer Score "No"
Positive	1	0
Negative	0	1

Furthermore, the data assessment results were analyzed using the percentage of the Guttman Scale data obtained by the formula.

$$P(\%) = \frac{\text{Student's Score}}{\text{Total number of students}} \times 100\%$$

The percentage of students' learning motivation results are then interpreted into a criteria score. Table 5 shows the criteria for interpreting scores of the Guttman scale (Dwiningsih et al., 2018). If the percentage result is $\geq 61\%$, then the mobile learning "ABC - Acid & Base Chemistry" can be assumed to be effectively used as a learning media.

Table 5. Interpretation Score of Guttman Scale

Percentage (%)	Category
0-20	Very Less Effective
21-40	Less Effective
41-60	Fairly Effective
61-80	Effective
81-100	Very Effective

RESULTS AND DISCUSSION

Define

At this stage, the researcher begins to get the needs and information during the learning process related to the media developed using the following steps: First, preliminary analysis to detect the fundamental problems in the learning process by observation. One of the problems found is that the learning media used is monotonous and less fun. Therefore, the researchers developed mobile learning based on Android as a learning media.

Second, student analysis by observing the characteristics of students. Based on direct observation, it was found that (1) The lecture method and the use of textbooks made students less enthusiastic during the learning process, so they quickly got bored; (2) Students need learning media, so the learning process becomes more exciting and fun; (3) As many as 80% of students have smartphones based on Android.

Third, task analysis consists of an analysis of the Core Competencies (KI) and Basic Competencies (KD) related to the material on the media, namely Acids and Bases. Acid and Base materials refer to KD 3.10 Explain the concepts of acids and bases, their strengths, and ionizing equilibrium in solution, and 4.10, Analyze the pH change trajectories of several indicators extracted from natural materials through experiments.

Fourth is concept analysis, which decides the material's content in the developed media. There are four sub-materials in Acid-Base material: acid-base theory, acid-base strength, acidity degree (pH), and acid-base indicators. Moreover, learning objectives analysis is carried out by determining learning achievement indicators based on material analysis and curriculum analysis.

Design

At the design stage, the researcher begins to design and compile the contents of the learning media. Activities included in the design stage are material design, storyboard, image, video, animation, music, sound, learning quizzes, mini-laboratory, and display design. Researchers also prepared research instruments, including media validation sheets, student response questionnaires, learning motivation questionnaires, and pretest and posttest question sheets. In the media "ABC - Acid & Base Chemistry," there are five main menus, including 1) Competencies containing core competencies, essential competencies, and learning objectives, 2) Learning materials which are also equipped with learning videos, 3) Quiz, 4) Mini laboratory, and 5) Author profile.

Creating "ABC - Acid & Base Chemistry" media using the Adobe Flash CS6 (Action Script 3.0) then converted into Android form using the Adobe Animate CC 2019. The background design of the learning media was created using <https://canva.com/> and the Corel Draw 2020. Learning materials are obtained through chemistry books, journals, and modules. To increase the attractiveness for students, researchers added moving animations and videos related to acid-base material in the media to make it easier to understand the material.

Researchers added quizzes, mini laboratories for evaluation, and complimentary chemistry learning media. Chemistry learning is synonymous with a practicum in the laboratory, so researchers created an online mini laboratory to make it easy for teachers and students to use. With a mini laboratory in this media, it can be used as a place to practice understanding concepts and improve skills in conducting scientific experiments (Emda, 2017b).

The quiz contains ten multiple choice questions regarding the acid-base. This quiz aims to measure students' understanding of the acid-base material. Based on research conducted by Fahmi, Wijaya, and Danial (2021), one of the methods used by teachers in teaching so that student learning outcomes are satisfactory according to the desired goals is by giving quizzes (Fahmi et al., 2021). The mini-laboratory has a guidebook to find out how to use the minilab. The results contain observation tables and conclusions that students can fill by typing in the provided column. The activity aims so that students not only do practicum but also analyze the practicum carried

out in the minilab to increase understanding of acid-base material. In addition, there are also several experimental videos of the application of acid-base in daily life.

Development

Validity Test

At this stage, it aims to produce an “ABC – Acid & Base Chemistry” media based on Android that is valid, practical and effectively used as a learning media so that validity tests and media trials are carried out. The media created is then validated by three validators using a validation sheet. Two lecturers did validation, and one chemistry teacher with two aspects assessed: content validity and construct validity. The validity results are used as material for upgrading the perfection media. Table 3 shows the revision from the validators, while the results of the three validators' assessments are shown in Figure 3.

Table 6. Revision of Media Review Result

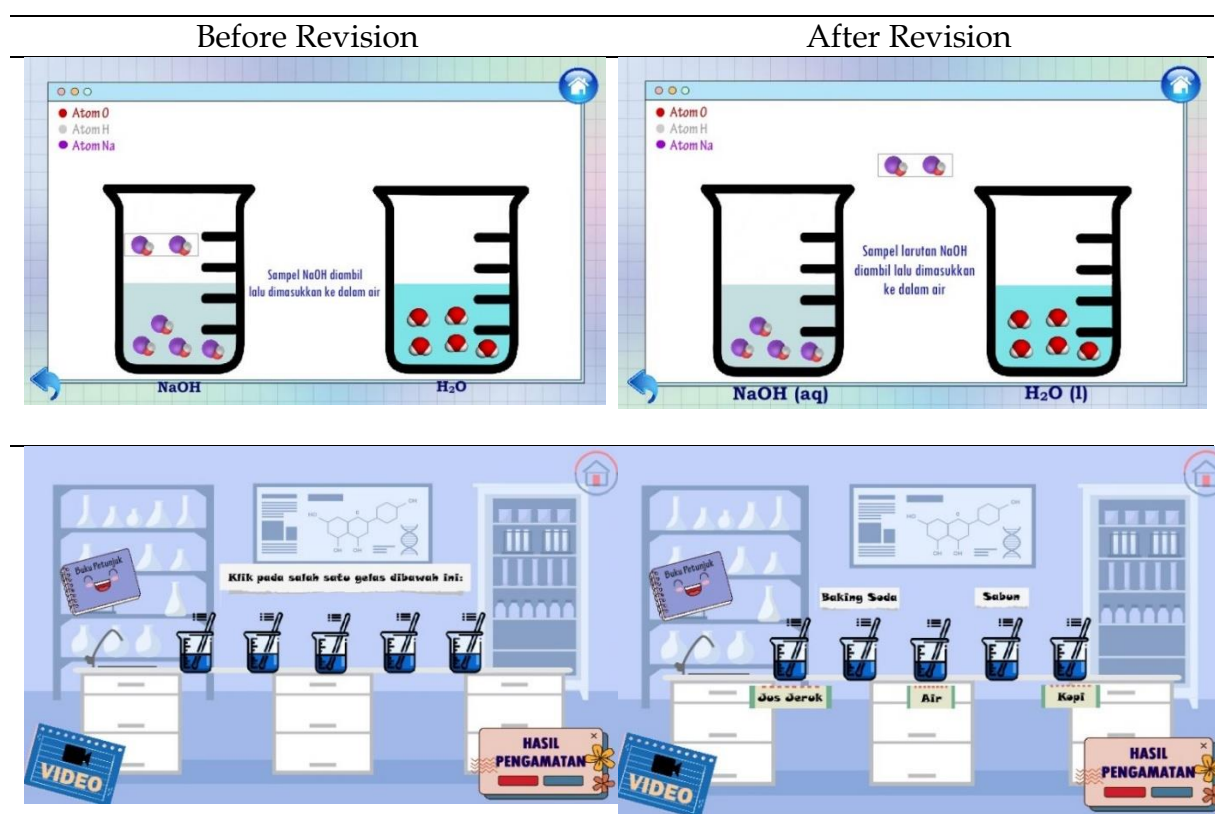


Figure 3. The result of the Validity Test

Content validity aims to determine the suitability between learning media and learning materials. In contrast, construct validity is validation which is understood as the extent to which the impact of a measurement result can reflect the theoretical structure that underlies the development of the instrument (Asri & Dwiningsih, 2022). Based on Figure 3, the assessment results on content validity scored 4 (67%) and 5 (33%) from three validators. Furthermore, according to construct validity, the media scored 4 (89%) and 5 (11%). The result reveals that the mobile learning "ABC-Acid and Base Chemistry" media can be verified as a learning media regarding content and construct validity.

In content validity, there are two criteria components: the truth of the concept of knowledge (content) and the suitability of the content to the learning objectives (knowledge structure). Construct validity also has six criteria components, namely: 1) Chemical characteristics, 2) Validity of presentation on learning media, 3) Appropriateness of language use in learning media, 4) Quality of display on learning media, 5) Communication audiovisual, and 6) There is a standard of success. Based on research conducted by Wulandari et al. (2019), mobile learning received a validity rating of 87%, indicating that the media is valid to be tested in learning (Wulandari et al., 2019).

Furthermore, the "ABC - Acid & Base Chemistry" media conducted a limited field trial to find out the results of the media implementation in classroom learning to the students of SMAN 3 Sidoarjo, which consisted of 35 students of grade 11 MIPA 2. The results of the limited trial can be seen as follows.

Practicality Test

The practicality of "ABC - Acid & Base Chemistry" media was obtained from a student response questionnaire which aims to determine students' interest in the media and find out the ease of content and how to use the media. The student response questionnaire consisted of 23 statements, including negative and positive statements, which included four assessed indicators, namely: 1) Students' interest in the media, 2) Ease of understanding the content of the media, 3) The level of ease of use of media, and 4) Media display of "ABC - Acid & Base Chemistry." The results of data recapitulation of the average student responses are shown in Table 7.

Table 7. The result of Students' Response Questionnaires

No.	Aspects	Percentage (%)	Category
1	Students' interest in the <i>Pocket Mobile Learning</i> "ABC - Acid & Base Chemistry" Media	96	Very Practical
2	Ease of understanding the content of the <i>Pocket Mobile Learning</i> "ABC - Acid & Base Chemistry" Media	95	Very Practical
3	The level of ease of use of media <i>Pocket Mobile Learning</i> "ABC - Acid & Base Chemistry" Media	97	Very Practical
4	Display of <i>Pocket Mobile Learning</i> "ABC - Acid & Base Chemistry" Media	97	Very Practical

Based on the results of the response questionnaire recapitulation above, it shows that the indicators of "The level of ease of use of media" and "Display of ABC - Acid & Base Chemistry media" have the highest percentage among other indicators, which is 97% with very practical criteria. According to Levie & Lentz (in Dwiningsih et al., 2018), this statement follows the function of learning media, especially visual media, which have an attention function. In other words, it can direct the learner's attention to the learning material being studied so that the ability to absorb and remember the material's content will get bigger (Dwiningsih et al., 2018). Furthermore, in accordance with Rohinah's statement (2016), the ease of accessing applications causes students to be more interested in learning the material provided (Rohinah, 2016).

The indicators "Students' interest in the media" and "Ease of understanding the media content" got 96% and 95% with very practical criteria. It means that students are led to try the "ABC - Acid & Base Chemistry" media when learning, and this media is easy to understand. Amirullah and Hardinata (2017) explained that learning media that can be accessed via smartphones is an innovation that can be used in the learning process as it can attract students with the complete load and attractive appearance of the application (Amirullah & Hardinata, 2017).

From the results of the data in Table 7, it can be concluded that the overall average rating got 96%. This figure reveals that the mobile learning "ABC - Acid & Base Chemistry" media 'is classified as very practical to use as a learning media on acid-base materials.

Effectiveness Test

Students' Learning Outcomes

The effectiveness of the "ABC - Acid & Base Chemistry" media was obtained through the pretest and posttest results. A pretest was conducted to determine students' initial ability before learning media. Posttest was conducted to calculate the final ability of students after using learning media. The results of the two tests are shown in Figure 4.

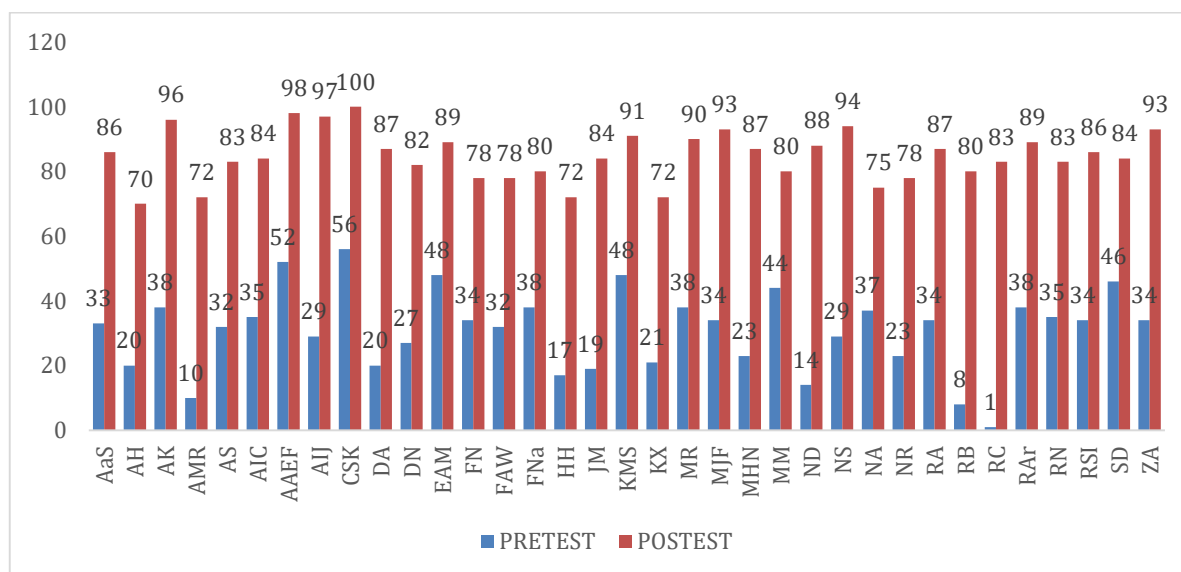


Figure 4. The result of students' pretest and posttest

Based on Figure 4, it can be revealed that there were no students who got a pretest score above 75, meaning that the percentage of classical completeness obtained

is 0%. The result shows that the pretest score did not reach classical completeness because the percentage was less than 85%. While in the posttest score, four students got a score of <75 with a classical completeness percentage of 11.5%, and 31 students with a classical completeness percentage of 88.5% got a score >75. It can be declared that the posttest scores have reached classical completeness because the percentage of students who have scored above 75 is more than 85%. Handoyono and Rabiman's research (2020) uses the pretest and posttest scores to test the effectiveness of learning application. 10% of students fulfilled the completeness criteria of learning outcomes in the pretest and 100% in the posttest. It means that students can achieve 90% learning outcomes, and Android-based learning applications have fulfilled the minimum 75% of the classic completeness percentage, making them an effective learning media (Handoyono & Rabiman, 2020).

Furthermore, the learning outcomes data were analyzed using the IBM SPSS Statistics 26 application for a normality test. The normality test uses data from Shapiro-Wilk because the number of respondents used is <50 (Suardi, 2019). The results of the Shapiro-Wilk normality test are shown in Table 7 below.

Table 8. The result of the Normality Test

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	0.135	35	0.104	0.977	35	0.647
Posttest	0.091	35	.200*	0.966	35	0.350

Based on Table 8, the calculation of the Shapiro-Wilk normality test shows a significance (Sig.) of 0.647 for pretest and a significance (Sig.) of 0.350 for posttest. Both of these data have fulfilled the assumption of normality where Sig.>0.05 means the data distribution on the research variables (pretest and posttest scores) is normally distributed. According to Suardi's research (2019), if the significance value is > 0.05 (Sig.>0.05), the data is decided to be normally distributed (Suardi, 2019). And this is supported by Ningsih and Adesti's research (2020) that the result of the normality test achieved is normally distributed data, based on the SPSS test with sig values 0.678 before the test (pretest) and 0.733 after the test (posttest). This value is above 0.05, it can be declared that the data are normally distributed (Ningsih & Adesti, 2020).

After carrying out the normality test, the test results were continued with the Paired Sample T-Test to state whether there is significant differentiation between the average of pretest and posttest scores (before and after being given media) using the IBM SPSS Statistics 26 application. Paired Sample T-Test data is declared to have a differentiation in the average score between the pretest and posttest if the significance value (2-tailed) is less than 0.05 (Wibawa, 2019). The results test can be seen in Table 8.

Table 9. The result of Paired Sample T-Test

Group	Test	Mean	SD	T	Df	p
Pair 1	Pretest-posttest	-53.486	11.723	-26.991	34	0.000

Based on the Paired Sample T-Test calculation in Table 9, the significance value of the pretest-posttest is less than 0.05, namely p < 0.05. With the conclusion that Ha is accepted and Ho is rejected. Because based on the hypothesis, Ho showed no significant differentiation between the pretest and the posttest, and Ha showed

significant differentiation between the pretest and the posttest. It means there is an effect of using the "ABC - Acid & Base Chemistry" media on student learning outcomes because it has a significant differentiation in learning outcomes between the initial variable (pretest) and the final variable (posttest). Ningsih and Adesti's research (2020) states that the paired sample t-test, Android-based mobile learning corresponds to a sig (2-tailed) value of 0.000. Values (2-tailed) are less than 0.05, indicating that Android-based mobile learning significantly impacts student learning outcomes (Ningsih & Adesti, 2020).

"ABC - Acid & Base Chemistry" mobile learning media is stated to be very effective in improving student learning outcomes on Acid-Base. Muyaroah and Fajartia (2017) declare that there is an effective use of learning media based on Android with learning outcomes obtained by students. The intended effectiveness refers to the success of systematic efforts that involve students in active and independent learning (Muyaroah & Fajartia, 2017).

Students' Learning Motivation

The effectiveness of the "ABC - Acid & Base Chemistry" media was also obtained from a student learning motivation questionnaire which aims to increase students' learning motivation after using learning media. The student learning motivation questionnaire has 22 positive and negative statements, assessing several aspects. The aspects of the assessment are based on indicators of learning motivation according to the theory developed by Uno (in Krismony et al., 2020), namely: 1) There is a desire to succeed in students, 2) There is a motivation and learning needs for students, 3) There are hopes and aspirations for the future of students, 4) There is appreciation in the learning process of students, 5) There are activities that attract interest in learning, and 6) The existence of a conducive learning environment (Krismony et al., 2020). The results of the recapitulation of the students' learning motivation questionnaire are listed in Table 10.

Table 10. The result of Students' Learning Motivation Questionnaires

No.	Learning Motivation Indicators	Percentage (%)	Category
1	There is a desire to succeed	97	Very Effective
2	There are motivation and learning needs for students	96	Very Effective
3	There are hopes and aspirations for the future	94	Very Effective
4	There is an appreciation for the learning process	97	Very Effective
5	Some activities attract interest in learning	95	Very Effective
6	The existence of a conducive learning environment	93	Very Effective

Based on the recapitulation results in Table 10, the indicator of "There is a desire to succeed" got a percentage of 97% with a very effective category. It means the "ABC - Acid & Base Chemistry" media can make students have a strong desire to successfully dominate the material well and get high marks in learning activities. According to research by Emda (2017), learning motivation can appear if students desire to be successfully supported by appropriate learning media (Emda, 2017a).

The indicator of "There is a motivation and learning needs for students" obtained 96% with a very effective category. It reveals that students are encouraged to be more active and need to learn acid-base material using the "ABC - Acid & Base Chemistry" media. According to research by Supriyono and Arsagita (2021), using Android applications can increase students' learning motivation in chemistry subjects (Supriyono & Arsagita, 2021).

The indicator "There are hopes and aspirations for the future" got a percentage of 94% with a very effective category. The result means that by using the "ABC - Acid & Base Chemistry" media, students have high expectations for themselves in the future so that their goals can be realized. According to the research of Nora and Lutfi (2022), the indicator of motivation for there is hope in the future got a percentage of 100%, which shows that learning media based on Android can grow dreams of success in the future for students, especially in chemistry (Nora & Lutfi, 2022).

The indicator of "There is an appreciation in the learning process" got 97%, with a very effective category. The result reveals that almost all students agree that they feel happy when the teacher gives appreciation to students who are active during the learning process and students who get high scores. According to Loysiana's research (2016), verbal statements or other forms of appreciation for learning outcomes or good behavior are the easiest and most effective ways to increase students' motivation (Loysiana, 2016).

The indicator "There are activities that attract interest in learning" got 95%, with a very effective category. Learning with "ABC - Acid & Base Chemistry" media is one of the activities that can influence students' attention. According to Anditiasari, et al. (2021), in their research, teachers must be creative in generating students' learning motivation because creative teachers make students enthusiastic when participating in the learning process (Anditiasari et al., 2021). Furthermore, according to the research of Kurniasari et al. (2020), the use of exciting learning media based on Android has a significant effect on increasing the learning motivation of high school students (Kurniasari et al., 2020).

The indicator of "The existence of a conducive learning environment" obtained a percentage of 93% with a very effective category. A conducive learning environment is one of the incentive factors for student learning. It shows that the "ABC - Acid & Base Chemistry" media can adapt to students' conditions and learning styles, as seen by those who feel comfortable in their study environment. Learning media based on Android is one of the current learning styles that can improve students' academic and learning motivation. A conducive learning environment can be created where individuals can effectively carry out the learning process (Firdaus et al., 2021).

Table 10 shows that mobile learning "ABC - Acid & Base Chemistry" can increase students' motivation in the learning process, as seen from the percentage results obtained on each indicator of learning motivation which is relatively high, and the overall average percentage got 95%. According to the research results of Muyaroah and Fajartia (2017), explaining that learning using learning media is more effective than lecture learning because media can be used anywhere and anytime (Muyaroah & Fajartia, 2017).

CONCLUSION

Based on the research results, the mobile learning "ABC-Acid and Base Chemistry" has been declared suitable for use as a learning media on acid-base

materials. The media fulfilled the aspects of validity, practicality, and effectiveness. It can be seen from the validity test score, which has more than three in the valid category. From the results of the questionnaire response, students got an overall assessment 96% with a very practical category. Based on the Paired Sample T-Test calculation results, the value of Sig. (2-tailed) $0.00 < 0.05$. That means there is a significant difference between the pretest and posttest scores with a classical completeness percentage of 88.5%, proving that it improves student learning outcomes. The research results of students' learning motivation questionnaires, the average overall assessment was 95%, with a very effective category. Therefore, mobile learning "ABC - Acid & Base Chemistry" can be used as a learning media to improve learning outcomes and students' motivation on Acid-Base materials.

RECOMMENDATION

Researchers expect that further studies on mobile learning need to be enriched regarding the animation of acid-base reactions. In addition, research is necessary to develop other media such as virtual laboratory learning to facilitate and increase students' interest, motivation, and curiosity during the learning process, especially in chemistry subjects. The learning media in this research is very appropriate for educators to help students during the teaching and learning process.

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DECLARATION OF INTEREST

There are no conflicts of interest declared by the authors.

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