Development of Android-based Kimi Kimo Adventure Game as Learning Media on Chemical Bonds

Rivaldi Dwi Kurniawan✉, Rusly Hidayah

Universitas Negeri Surabaya, Indonesia

Article Info	Abstract
	This research aims to test the development of an android-based Kimi Kimo Adventure game which is feasible as a learning media for Chemical Bonding material at SMK Negeri 1 Driyorejo Gresik. The feasibility of the Kimi Kimo Adventure game is reviewed in terms of validity, practicality, and effectiveness. Validity in terms of content validity and construct validity obtained from the validation results of 3 experts, namely 2 chemistry lecturers at Universitas Negeri Surabaya and 1 chemistry teacher at SMK Negeri 1 Driyorejo Gresik. Practicality was obtained from the results of student observations and student response questionnaires. While the effectiveness is obtained from the students learning outcomes. The research method that was used is research and development carried out until a limited trial. The limited trial was carried out in 18 students from class X at SMK Negeri 1 Driyorejo Gresik. The data that has been obtained from the limited trial of the Kimi Kimo Adventure game has a percentage assessment of (1) Validity consisting of content validity which is very valid and construct validity which is very valid, (2) Practicality consisting from the observation result of student activities which is very practical and the results of the response questionnaire which is very practical, (3) Effectiveness consists the value of students' learning outcomes and the classical completeness between the pretest and posttest has increased. It means the Kimi Kimo Adventure game as a learning media can increase the students' learning outcomes which means the game that has been developed is very effective for use as learning media on chemical bonds. Based on the results of the research, it can be concluded that the Kimi Kimo Adventure game is appropriate for use as a learning medium.

INTRODUCTION

One of the main foundations of 21st-century learning is mastering the development of information technology. This has a good impact on life, one of which is in education because the 21st-century education paradigm emphasizes the ability of students to think critically, be able to develop knowledge in the real world, be able to master information technology, and be able to communicate and collaborate. Education is a learning process so the students can develop their potential (Depdiknas, Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 Tentang Pendidikan Nasional, 2003).

One of the ways to develop the students' potential is through effective learning with effective media. Effective learning is learning that involves the activities of students to be able to achieve the learning goals optimally. The essence of the learning process is the communication process between the message source (teacher) and the message recipient (students). To facilitate the process of conveying messages, a learning media is needed and it must match the characteristics of the material to be conveyed. Especially during the Covid-19 pandemic, the use of learning media is important in providing educational facilities for distance learning or face-to-face learning. The use of appropriate learning media in the learning process can generate new desires and interests, generate challenges, motivation of students to take an active role, and stimulate learning activities that can have a psychological influence on students (Yunitasari & Agustini, 2013). Challenges can be in the form of distractions or threats during play or failure in the game (Siagian, 2013).

Chemistry is a branch of natural science that studies everything about matter including contexture, configuration, properties, and alteration in energy and matter, which requires skill to reasoning because chemistry is an abstract concept that requires a media that appropriate to help students understand chemistry well (Erlina, 2011). As an educator, the teacher must also be able to make students become competent individuals, not only making students know and understand but also being able to make students being creative individuals. Students are required to have thinking and acting skills, namely creative, productive, critical, independent, collaborative, and communicative through a scientific approach as a development of what's learned in educational units and other sources independently.

To facilitate the process of conveying messages, a learning media is needed and it must match the characteristics of the material to be conveyed. A subject in chemistry that is difficult for students to learn is Chemical Bonding. This subject requires a serious understanding of fun and effective media. One of the fun media is a game. Game media is a learning media that can provide fun as well as knowledge. Based on the characteristics of chemistry which is an abstract material and full of mathematical concepts that are sometimes not simple, media is required to assist students to understand the concept. Mobile learning also can be wont to assess students learning outcomes. As an educational media, the game has several advantages which are fun, entertaining to try and do, allows the active participation of students to find out, can provide direct feedback, can apply certain concepts or roles into actual situations, flexible, easy to create, and easy to reproduce (Antunes, Pacheco, & Giovanela, 2012).

The game can be used as a learning media when they can develop cognitive and operational abilities such as problem-solving. Cognitive abilities are related to the competence to distinguish objects, events, or stimuli, and apply the rules and solve the problems (Antunes, Pacheco, & Giovanela, 2012). Educational games are a part of mobile learning. Mobile learning is learning that refers to the use of information and communication technology as a learning media so the students can access materials, directions, and applications related to learning anywhere and anytime. The advantages of mobile devices are the portability, can be connected to the network anytime and anywhere, more flexibility in accessing learning resources, the proximity of information, and students can be actively involved (Woodill, 2010).

Using mobile learning, teachers can help students to more easily understand the material being studied. It is because the students can link the concepts of subject matter according to their thinking so it can stimulate students to more easily understand the material (Arsyad, 2010). The advantages of mobile learning can be used to overcome the limitations of the personal computer (PC). Mobile learning is learning that is carried out by utilizing mobile devices and mobile networks. Thus, mobile learning is learning by using mobile devices and mobile networks so students can access learning materials anywhere and anytime. The advantages of mobile devices include being easy to carry, being able to connect to the network anytime and anywhere, more flexible in accessing learning resources, students can be involved and active (Woodill, 2010).

Unfortunately, using the game as a learning media has not been widely implemented in schools. The lack of use of the game as a medium to study chemistry is due to the limited information from the teacher about game-based learning media (Fatimah & Hidayah, 2020). Based on the described things above, the researcher wants to develop an android-based game as learning media in chemical bonding called Kimi Kimo Adventure. In addition, researchers also want to know the validity, practicality, and effectiveness of these games in learning chemical bonding by tested it on SMK Negeri 1 Driyorejo Gresik. The other purpose of this research is also to introduce the android-based game as learning media in chemistry lessons for the teacher.

METHODS

This study uses research and development (R&D) methods that are intended to provide certain products as well as test the product's validity, practicality, and effectiveness within the learning process using media (Sukmadinata, 2016). This research is the development of the Kimi Kimo Adventure game as a learning media for Chemical Bonding material based on the research and development method. The steps in this method are potential and problems, collecting information, product design, design validation, design improvement, limited trial, broad trial, product improvement, and mass production of products. This research only reached the limited trial step because it was only used for feasibility trials. This research was conducted at SMK Negeri 1 Driyorejo Gresik with the research subject of 18 students.

The instruments used in this study were validation sheets, student response questionnaire sheets, student activity observation sheets, pretest question sheets, and posttest question sheets. Data collection techniques were carried out in four ways, namely (1) students questionnaire and interview one of a chemistry teacher, (2) giving validation questionnaires to 3 validators, (3) giving student observation sheets to observers and giving student response questionnaire sheets to students, and (4) giving pretest and posttest questions related to chemical bonding material to determine effectiveness. The preliminary field testing step was conducted using one group pretest-posttest design. The researcher gives the pretest before the treatment (O_1). After the treatment (X), the researcher gives the student posttest (O_2) to measure the effectiveness of the game as a learning media (Setyosari, 2016).

Students questionnaire and the interview that was conducted with one of the chemistry teachers in SMK Negeri 1 Driyorejo Gresik aims to know the method and the media that is used to explain chemical bonding materials. It is also to get information about the obstacles during chemical bonding learning. A questionnaire is an instrument in the form of several written questions, the aim of which to obtain information from respondents about what they have experienced and know (Siyoto & Sodik, 2015).

Giving validation questionnaires to 3 validators consisting of 2 Chemistry lecturers at Universitas Negeri Surabaya and 1 Chemistry teacher at SMK Negeri 1 Driyorejo Gresik to determine the validity using Likert scale 1-5, which are not valid, less valid, quite valid, valid, and very valid (Riduwan, 2015). The Likert scale is used to measure a person's attitudes, opinions, and perceptions about something (Herlina, 2019).

Table 1. Likert scale (Riduwan, 2015).

Statement	Score
Not Valid	1
Less Valid	2
Quite Valid	3
Valid	4
Very Valid	5

From the results of the assessment, the percentage of validity can be calculated using the formula below:

$$\frac{\text{Total score of validators}}{\text{Maximum score}} \times 100\%$$

Based on the Likert scale score in Table 1, the game is said to be valid if the percentage of validity of each indicator is in the valid category or reaches a score of ≥61% according to Table 2 (Riduwan, 2015).

Table 2. Game validity category (Riduwan, 2015).

Percentage (%)	Category
0 – 20	Not Valid
21 – 40	Less Valid
41 – 60	Quite Valid
61 – 80	Valid
81 – 100	Very Valid

Observation sheets and students' response questionnaire sheets aim to determine practicality using the Guttman scale. There are two options in the sheets, "yes" and "no". For

the positive statement "yes" has a value of 1, while "no" has a value of 0. For the negative statement "yes" has a value of 0, while "no" has a value of 1. The percentage of practically can be calculated using the formula below:

$$\frac{\text{Total score}}{\text{Ideal score}} \times 100\%$$

Ideal score = highest score x number of respondents

The observation sheet uses four indicators, which are the installation process of the game in students' android, students' interest, students' learning activities using games, and students' understanding of the material that has been given. The indicators are developed into seventeen statements to observe students' activity during the lesson. The indicators used in the students' response questionnaire are students' interest in games as learning media, ease of understanding the material in the game as a learning medium, and ease of using a game as learning media, which are developed into fifteen questions. The results of the observation sheet and students' response questionnaires were used to determine the practicality of the Kimi Kimo Adventure game media by using the interpretation of the score as follows (Riduwan, 2015).

Table 3. Game media practicality scale (Riduwan, 2015).

Percentage (%)	Category
0 – 20	Not Practical
21 – 40	Less Practical
41 – 60	Practical Enough
61 – 80	Practical
81 – 100	Very Practical

Based on Table 3, the game can be said to be practical if the percentage of practicality for each indicator is ≥61% or is in the valid category (Riduwan, 2015).

Data analysis of student learning outcomes was obtained from the results of the pretest conducted before the use of the game and the posttest which was carried out after the students used the Kimi Kimo Adventure game as a learning medium. Learning outcomes data is used to determine the students' learning completeness by comparing the results of the pretest and posttest scores. Individual completeness is determined by a score of individual minimum completeness which is ≥75. Classical completeness is determined by a score

of ≥80% (Riduwan, 2015). To determine individual completeness using the following formula:

$$\frac{\text{Total score obtained}}{\text{Maximum score}} \times 100\%$$

For classical completeness can be known using the following formula:

$$\frac{\text{Number of students who completed}}{\text{Total number of students}} \times 100\%$$

The result of pretest and posttest scores can be analyzed using the Kolmogorov-Smirnov test to see the normality. If the Sig. Kolmogorov-Smirnov shows a value of more than 0.05 which means that the data distribution is normal (Arifin, 2017). To see the effectiveness of the Kimi Kimo Adventure game, the pretest and posttest scores are analyzed using the Left-Sided One T-Test using the SPSS application. Statement of H_0 is the score of pretest or posttest are ≥75, while H_a is the score of pretest or posttest are <75. In the left-sided test, if the t-count value is ≥ t-table, then H_0 is accepted (Sudjana, 2005).

In addition, to show that there are differences in students' pretest and posttest scores after being given the Kimi Kimo Adventure game media, Paired Sample T-Test can be used. The statement of H_0 is there is no difference in students' pretest and posttest scores after being given the Kimi Kimo Adventure game media, while H_a is there is a difference in students' pretest and posttest scores after being given the Kimi Kimo Adventure game media. If the average posttest score is greater than the average pretest score and the significance value is less than 0.05 then Ha is accepted (Sudjana, 2005).

RESULTS AND DISCUSSION

Students Questionnaire

The students at SMK Negeri 1 Driyorejo Gresik were asked to fill out a questionnaire. This questionnaire aims to find out the students' experiences and the learning media that used while studying chemistry at school. The questionnaire uses four indicators, which are knowing the difficulties of students in chemistry lessons, students' learning styles, characteristics of chemistry learning that used, and students' interest in games as learning media. The indicators are developed into some questions and concluded in Figure 1.
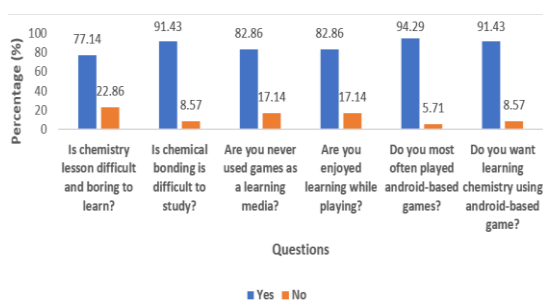
Figure 1. Result of students' questionnaire

Based on the data in figure 1, it was found that 77.14% of students stated that chemistry lessons were difficult and boring to learn with 91.43% of students stated that the difficult material is Chemical Bonding because students are difficult to understand it with the methods and learning media which commonly used by the teacher. This is supported by 82.86% of students who stated that they never used games as a learning media. Meanwhile, based on the results of the questionnaire, it was known that 82.86% of students enjoyed learning while playing and 94.29% of students most often played Android-based games. As many as 91.43% of students also expect that chemistry learning to used android-based games. So, it is known that Android-based games are needed to meet the needs of students who enjoyed learning while playing.

Teacher's Interview

This interview aims to know the teacher's profile in teaching at school, including a method and learning media that is wont to teach. The teacher who was interviewed was one of the chemistry teachers at SMK Negeri 1 Driyorejo, Gresik. The teacher said that the teacher experienced a bit difficulty within the chemistry learning process, especially during the Covid-19 pandemic due to the limited available learning media. During learning, the teacher only used available learning media as much as possible and never used other learning media like games. Therefore, the student's learning outcomes are less than expected. So, the teacher expects an effective and appropriate learning media that can be used anywhere and anytime which makes it is more practical and also the students don't mind always carry it, especially if the learning media is fun so it can attract students' interest and the learning is not boring anymore. To overcome this problem, mobile learning using Android-based game media is a learning media that is following the media that is needed by the teacher, because students can access it anywhere and anytime. Students should also have no objection to bring it anywhere because it is

already on their smartphone. It is following the current phenomenon because right now the students are never leaving their smartphones, and with the existence of games as a learning media, students can learn as well as play.

According to the chemistry teacher at SMK Negeri 1 Driyorejo, the Kimi Kimo Adventure game can help in the teaching and learning process in the pandemic conditions, due to the compatibility of applications that can be installed on Android-based devices, which are very commonly used by students. In addition, packaging questions in the game as an obstacle in order to complete the game is also very helpful in motivating students to complete learning as well as possible. The game system that is simple, relaxed, fun, also does not only focus on the question and answer process can make students feel the sensation of "playing" so that students do not feel bored quickly.

The Validity of Kimi Kimo Adventure game

The validation process was carried out by experts, namely two chemistry lecturers at the Universitas Negeri Surabaya and one teacher at SMK Negeri 1 Driyorejo Gresik to obtain comments and suggestions so that the game developed was following the criteria that had been made on the validation sheet. The criteria that assessed are consisting of content validity and construct validity. The average percentage of the content validity and construct validity of the Kimi Kimo adventure game from the validators are in Figure 2.
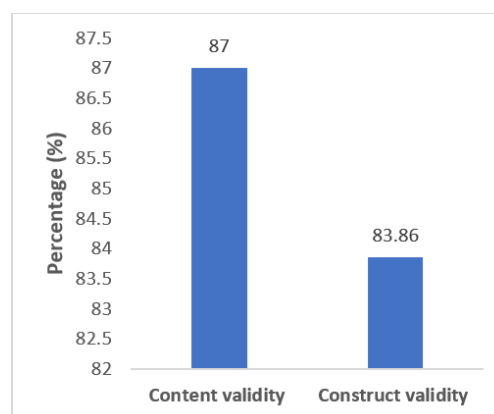

Figure 2. The average percentage of content validity and construct validity

Based on Figure 2, the average percentage for content validity of Kimi Kimo Adventure game is 87% which includes very valid and the average percentage for construct validity of Kimi Kimo Adventure is 83.86% which also includes very valid.

Content validity relates to the up-to-date and correctness of concepts in the game (Slameto & Hidayah, 2010). In addition, the game must have goals according to the learning objectives and learning indicators that have been set (Lutfi, Suyono, & Nur, 2014).

In the game also must have instructions or directions for players to achieve the expected goals and rules that has been made in the game and cannot be changed by the player or user (Rusman, 2013). Furthermore, the game has a display games as learning media (colors, sizes, graphics, and animations that are adapted to the age of the players and the message conveyed), standard or limit for success after using the game as a learning medium, and options for players to determine or ensure the activities that can be carried out (Prasetyo, 2013).

The Practicality of Kimi Kimo Adventure game

The practicality of the game can be analyzed through the observation sheet and student's response questionnaire. In observing student activities, a researcher observed 1 class containing 18 students of class X APL 2 SMK Negeri 1 Driyorejo Gresik. The limited trial was held on Tuesday, June 8, 2021, and was assisted by 4 observers who take a role in observing students playing the Kimi Kimo Adventure game. The results of this observation are used to determine the practicality of the game. The results of the observations are presented in Figure 3.
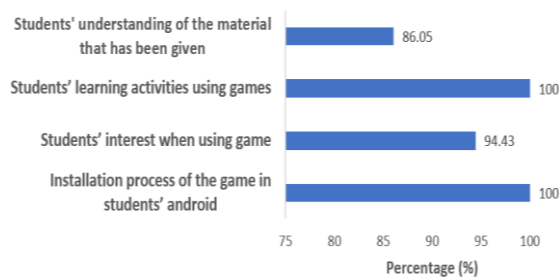

Figure 3. Students observation results

Based on Figure 3, the average percentage for the first indicator, namely "installation process of the game in students' android" is 100% with a very practical category. This indicator has two aspects to observe, namely "students install games on their devices according to the instructions in the guidebook" and "students open the Kimi Kimo Adventure application according to the guidebook" with each aspect getting a percentage of 100% with a very practical category. This shows that the guidebook provided is appropriate, making it easier for students to install and open the game.

The second indicator, namely "students' interest when using games" gets the average percentage of 94.43% with a very practical category. This indicator has three aspects to observe, namely "students continue to play when they fail" with a percentage of 100% with a very practical category, "students play the game again when they have finished the previous game" with a percentage of 100% with a very practical category, and "students share game applications to other classes" with a percentage of 83.3% with a very practical category. This shows that the games that developed attract the interest of students so that they are still played when they lose or when they are successful. However, there are still some students who have not shared the game with other classes because the researcher only carried out a limited trial in one class, so it took more time to share it with other classes. Games if used wisely and appropriately can relieve stress in the learning environment, inspire students to be fully involved, and increase enthusiasm in the learning process (Mustari, 2014).

Figure 4. Limited trial of Kimi Kimo Adventure

In the third indicator, namely "students' learning activities using games", the average percentage is 100% with a very practical category. This indicator has ten aspects to observe, namely "students choose the language used in the game", "students open and read instructions before starting the game", "students open and read basic competencies and indicators before starting the game", "students open and read the material and view the available videos before starting the game", "students answer the questions contained in the game", "students take blue diamonds to open the chests contained in each level", "students play the game at level 1", "students play games at level 2", "students play games at level 3", and "students play games at level 4" with each aspect getting a percentage of 100% with a very practical category. This shows that students' learning activities when using games are classified as very practical because the activities are structured from the beginning to the end of learning. In addition, the use of games in learning activities can avoid boredom, leave a long impression in the memory of

students, and provide opportunities for students to learn in a more pleasant atmosphere without leaving the learning objectives (Slameto & Hidayah, 2010).

In the fourth indicator, namely "students' understanding of the material that has been given" the average percentage is 86.05% with a very practical category. This indicator has two aspects to observe, namely "students do not ask questions while playing" with a percentage of 83.3% with a very practical category and "students can do posttest easily" with a percentage of 88.8% with a very practical category. This shows that the role of the teacher is still needed to guide students and help them understand the material that has been given. In learning activities, students who have a high interest in learning will feel happy and interested in the subject matter provided by the teacher (Nur, 2008).

Based on Figure 3, it can be concluded that the average percentage of all indicators is 93.38% which reaches a percentage of ≥81%. This shows that the android-based Kimi Kimo Adventure game is very practical to use as a learning medium on chemical bonding material based on the results of observing student activities. Furthermore, the practicality of learning media can be seen from the results of student response questionnaires. The results of the student response questionnaires are presented in Figure 5.
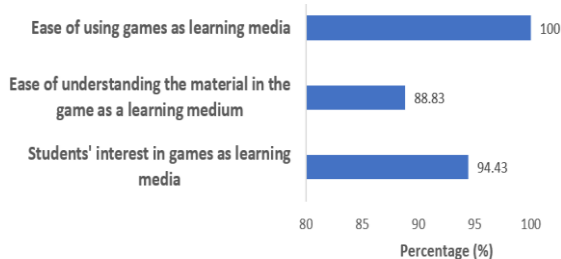

Figure 5. Students response questionnaires results

Based on Figure 5, the average percentage for the first indicator, namely "students' interest in games as learning media" is 94.43% with a very practical category. This indicator has eight questions to observe and each question reaches a very practical category, the first question was "is the Kimi Kimo Adventure game a fun learning medium?" got a percentage of 100% of students answered "yes", the second question was "is the game Kimi Kimo Adventure very boring?" got a percentage of 100% of students answered "no", the third question was "do the steps in the game Kimi Kimo Adventure make you interested in playing it again?" got a percentage of 83.3% of

students answered "yes", the fourth question was "are you not interested in participating in learning using the Kimi Kimo Adventure game?" got a percentage of 94.4% of students answered "no", the fifth question was "do you want to play the Kimi Kimo Adventure game outside of learning hours?" got a percentage of 100% of students answered "yes", the sixth question was "do you recommend the game Kimi Kimo Adventure for friends who have never played this game?" got a percentage of 94.4% of students answered "yes", the seventh question was "do you want other games for the learning process?" got a percentage of 100% of students answered "yes", the eighth question was "does the material presented in the Kimi Kimo Adventure game not interest you in learning?" got a percentage of 83.3% of students answered "no". This shows that students are very interested in the game Kimi Kimo Adventure to be used as a medium for learning chemical bonds, so the students also expect other games that can be used as learning media as well.

Learning activities which are interesting make students can construct their knowledge as an active learner (Anisa, 2016). Active student involvement in learning activities can maximize the learning process. Based on constructivism learning theory, student involvement can make it easier for students to construct their knowledge. Constructivism learning activity is based on learning that occurs through the active involvement of students in the construction of meaning and knowledge (Sugrah, 2019). Knowledge is not a gift from the teacher, but the result of the construction process carried out by each individual (Isti'adah, 2020).

A theory related to constructivism learning theory is Piaget's theory of cognitive development. Piaget stated that cognitive structures are the result of a child's development process. The development level of cognitive structures occurs maximally, the adolescents can think logically and use scientific reasoning (Slavin, 2017).

The second indicator, namely "ease of understanding the material in the game as a learning medium" gets an average percentage of 88.83% with a very practical category. This indicator has four questions to observe and each question is categorized as very practical, the first question was "does Kimi Kimo Adventure game help you to understand Chemical Bonding Materials?" got a percentage of 94.4% of students answered "yes", the second question was "is the chemical bond material still difficult after playing the game Kimi Kimo Adventure?" got a percentage of 88.8% of students answered "no", the third question was "can you easily do the posttest questions after using the Kimi Kimo

Adventure game?" got a percentage of 88.8% of students answered "yes", and the fourth question was "are the questions in the game classified as difficult questions?" got a percentage of 83.3% of students answered "yes". This shows that the Kimi Kimo Adventure game can help students understand chemical bonding material. Furthermore, this game can also be used as a medium for practice because it contains questions that are classified as difficult.

The third indicator, namely "ease of using a game as learning media" gets an average percentage of 100% with a very valid category. This indicator has three questions to observe and each question is categorized as very practical. The first question was "can you easily install Kimi Kimo Adventure game?" got a percentage of 100% of the students answered "yes", the second question was "do you have difficulty operating the Kimi Kimo Adventure game?" got a percentage of 100% of students answered "no", the third question was "do you have difficulty understanding the rules of the game and the steps for completing the game?" got a percentage of 100% students answered "no". This shows that the Kimi Kimo Adventure game is a game that's very easy to use including from the installation process until the operation of the game.

Based on Figure 5, it can be concluded that the average percentage of all indicators is 94% which reaches a percentage of ≥81%. This shows that the android-based Kimi Kimo Adventure game is very practical to use as a learning medium on chemical bonding material based on the results of students' response questionnaire.

The Effectiveness of Kimi Kimo Adventure game

The effectiveness of the Kimi Kimo Adventure game can be analyzed through the score of pretest and posttest. Data from pretest and posttest can be calculated for the classical completeness. There is two statistics analysis that used to analyze the pretest and posttest result. The first is the Normality Test using the Kolmogorov-Smirnov test to see the normal distribution of data and the second is the Left-Sided One T-Test to see the effectiveness of Kimi Kimo Adventure game as media in chemical bonding learning. In addition, to find out more about the effectiveness of the Kimi Kimo Adventure game, statistical tests can also be carried out using the Paired Sample T-Test to show that there are differences in students' pretest and posttest scores after being given the Kimi Kimo Adventure game media.

Normality test aims to determine the distribution of the data obtained is normally distributed or not. If it is normal, then the data from the research can be analyzed further. Test the normality of the data in this study using the Kolmogorov-Smirnov through the SPSS application. The research data is declared normal if the Kolmogorov-Smirnov test results produce a Sig value > α (Wardana, 2020).

The results of the normality test using the Kolmogorov-Smirnov test on the pretest and posttest are presented in Table 4.

Table 4. One-Sample Kolmogorov-Smirnov Test

		Pretest	Posttest
N		18	18
Normal Parameters[a]	Mean	38.8889	92.7778
	Std. Deviation	18.43554	8.26442
Most Extreme Differences	Absolute	.254	.309
	Positive	.254	.191
	Negative	-.135	-.309
Kolmogorov-Smirnov Z		1.077	1.311
Asymp. Sig. (2-tailed)		.197	.064

a. Test distribution is Normal.

Based on Table 4, the data of students' pretest and posttest scores were declared normal because the results of the Kolmogorov-Smirnov test showed the Sig value for the pretest was 0.197 while the Sig value for the posttest was 0.064. This value is greater than the real level (α) used, which is 0.05. If the Sig. Kolmogorov-Smirnov shows a value of more than 0.05 which means that the data distribution is normal (Arifin, 2017).

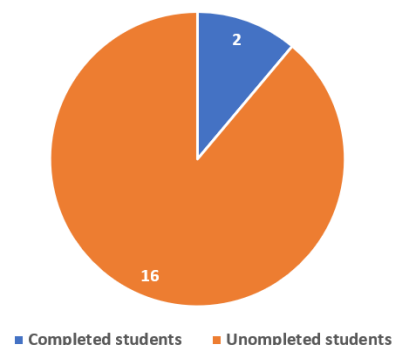The results of students' completeness in the pretest are presented in Figure 6.

Figure 6. Students' completeness in the pretest

Based on Figure 6, only 2 students completed from a total of 18 students so the classical completeness that obtained was 11.11%. This is

not as expected by the chemistry teacher, so other learning media are needed that can increase students' learning outcomes. An important component in learning is the organization of the information learned, the previous knowledge that students have mastered, and some processes involve understanding, meaning, storing, and retrieving information (Hasanuddin, 2017).

Figure 7. Students playing Kimi Kimo Adventure game

When the students play the Kimi Kimo Adventure game, some processes involve understanding, meaning, storing, and retrieving information. Games can provide immediate feedback, real experiences, can be repeated as many times as desire, and help students who have difficulty learning with conventional methods (Sugiyono, 2015). Therefore, it is easier for students to understand and remember chemical bonding material. So, the Kimi Kimo Adventure game has an impact on students' learning outcomes as seen in the posttest results presented in Figure 8.
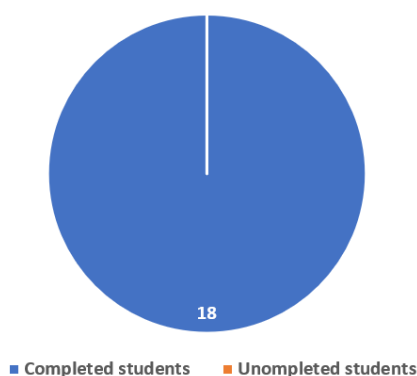

Figure 8. Students' completeness in the posttest

Based on Figure 8, all of 18 students completed so the classical completeness that obtained was 100%. In addition, statistical tests

can also be carried out using the Left-Sided One T-Test to see the effectiveness of the Kimi Kimo Adventure game as media in chemical bonding learning.

The data criteria that can be analyzed using a One-Sample T-Test are quantitative and normally distributed (Muhid, 2019). The researcher used the Left-Sided One T-Test to analyze the data further. The Left-Sided One T-Test aims to analyze students' posttest completeness after learning using the Kimi Kimo Adventure game as a learning media. Statement of H_0 is a score of pretest or posttest are $\geq$ 75, while H_a is a score of a pretest or posttest are < 75. In the Left-Sided One T-Test, H_0 is accepted if the t-table value is greater than the calculated t-value (Sudjana, 2005). The results of the Left-Sided One T-Test are presented in Table 5.

Table 5. Left-Sided One T-Test

					95% Confidence Interval of the Difference	
			Sig. (2-tailed)	Mean Difference		
	t	df			Lower	Upper
Post test	9.126	17	.000	17.77778	13.6680	21.8876

Based on Table 5, the results of the analysis using the SPSS application, it was found that the t-value was 9.126. The t-table value obtained is 1.74. When compared between the two values, the value of t-value is greater than the t-table. This proves that H_0 is accepted, namely the average posttest score of students has exceeded the specified minimum completeness criteria which are 75.

To show that there are differences and increases between the students' pretest and posttest scores after being given the Kimi Kimo Adventure game media, Paired Sample T-Test can be used. The statement of H_0 is there is no difference in students' pretest and posttest scores after being given the Kimi Kimo Adventure game media, while H_a is there is a difference in students' pretest and posttest scores after being given the Kimi Kimo Adventure game media. If the average posttest score is greater than the average pretest score and the significance value is less than 0.05 then Ha is accepted (Sudjana, 2005). The results of the Paired Sample T-Test are presented in Table 6 until Table 8.

Table 6. Paired Sample Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Pretest	38.8889	18	18.43554	4.34530
Posttest	92.7778	18	8.26442	1.94794

From the results of Table 6, it can be seen that the average pretest and posttest scores of students in the use of the Kimi Kimo Adventure game media are significantly different. The average posttest score is greater, namely 92.78 than the average pretest score which is only 38.89. This shows that H_a is accepted.

Table 7. Paired Sample Correlations

	N	Correlation	Sig.
Pair 1 Pretest and Posttest	18	.716	.001

From Table 7, it can be seen that there is a correlation between the pretest and posttest score data. The resulting significance value is 0.001 which is smaller than the 0.05 value or the real level used. In this case, H_a is accepted and H_0 is rejected.

Table 8. Paired Sample T-Test

	Paired Differences							
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Pair 1 Pretest and Posttest	-5.38889E1	13.77931	3.24781	-60.74118	-47.03660	-16.592	17	.000

Based on Table 8, the t-count value is 16.592 with a significance value of 0.000 and degrees of freedom 17. This shows that there are differences in the students' pretest and posttest scores after being given the Kimi Kimo Adventure game media which means it is effective to be used as a medium for learning chemical bonds.

An increase in posttest scores because students are more interested in learning to use the provided game media. Besides, the Kimi Kimo Adventure game also takes several examples of chemical bonding in daily life so the students can associate the materials with the daily life aspect. It was generally agreed that a very important reason why games have a positive effect on learning is that games provide the live experience of user involvement (Cheng, Chen, & Chen, 2015).
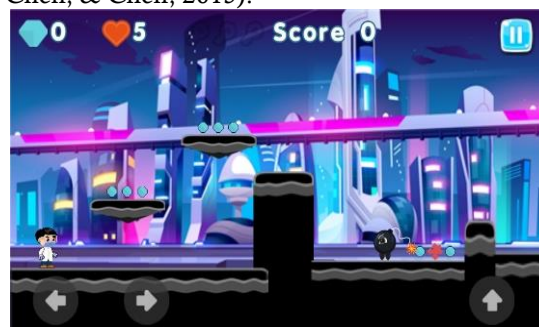
Figure 9. Kimi Kimo Adventure display of level 1

Android-based Kimi Kimo Adventure game was proven effective in improving students' learning outcomes and their skills. The students acquired the skill through observation, active interaction with the characters, performing repetitious experiments, and interpreting the main part of the games associated with environmental effect in real life (Putra & Iqbal, 2016).

CONCLUSION

Based on the result and data analysis, the android-based Kimi Kimo Adventure game is appropriate to use as a learning media on chemical bonds. The result of validity of the Kimi Kimo Adventure game which is consisting the content validity is 87% which is very valid and the construct validity is 83.86% which is very valid. It means that this game is valid and proper to use as a learning media. The practicality of the Kimi Kimo Adventure game consisting of the observation result of student activities is 93.38% which is very practical and the results of the response questionnaire are 94% which is very practical. It means that using this game as a learning media in chemical bonding material makes the students' learning activities very active. The effectiveness of Kimi Kimo Adventure game consists of the value of students' learning outcomes with the classical completeness at the pretest is 11.11%, while in the posttest reaches 100%. It means the Kimi Kimo Adventure game as a learning media can increase the students' learning outcomes which means the game that has been developed is very effective for use as learning media on chemical bonds.

REFERENCES

Anisa, I. (2016). Enhancing Student's English Proficiency Through Experiential Learning.

International Journal of Active Learning 1 (1), 5-11.

Antunes, M., Pacheco, M., & Giovanela, M. (2012). Design and Implementation of an Educational Game for Teaching. Journal of Chemical Education, 517-521.

Arifin, J. (2017). SPSS 24 untuk Penelitian dan Skripsi. Jakarta: PT Elex Media Komputindo.

Arsyad, A. (2010). Media Pembelajaran. Jakarta: PT. Raja Grafindo Persada.

Cheng, M., Chen, J., & Chen, S. (2015). The Use Of Serious Games In Science Education: A Review Of Selected Empirical Research From 2002 To 2013. Journal of Computers in Education, 353-375.

Depdiknas. (2003). Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 Tentang Pendidikan Nasional. Jakarta: Direktorat Jendral Manajemen Pendidikan Dasar dan Menengah, Direktorat Pendidikan Sekolah Menengah Atas.

Erlina. (2011). Deskripsi Kemampuan Berpikir Formal Mahasiswa Pendidikan Kimia Universitas Tanjungpura. Jurnal Visi Ilmu Pendidikan, 631-640.

Fatimah, N., & Hidayah, R. (2020). Student's Motivation in Learning Chemistry and Implementation of Chemmo Configuration as A Learning Media in Periodic System Materials. Seminar Nasional Kimia 2020.

Hasanuddin. (2017). Biopsikologi Pembelajaran : Teori dan Praktik. Banda Aceh: Syiah Kuala University Press.

Herlina, V. (2019). Panduan Praktis Mengolah Data Kuisioner Menggunakan SPSS. Jakarta: Alex Media Komputindo.

Isti'adah, F. (2020). Teori-teori Belajar Dalam Pendidikan. Tasikmalaya: Edu Publisher.

Lutfi, A., Suyono, & Nur, M. (2014). Penilaian Permainan Bersarana Komputer Sebagai Media Pembelajaran Ilmu Pengetahuan Alam. Unesa Journal of Chemical Education.

Muhid, A. (2019). Analisis Statistik : 5 Langkah Praktis Analisis Statistik Dengan SPSS For Windows. Sidoarjo: Zitafama Jawara.

Mustari, M. (2014). Media Pembelajaran. Jakarta: Gaung Persada Press.

Nur, M. (2008). Pemotivasian Siswa untuk Belajar. Surabaya: PSMS Unesa.

Prasetyo, E. (2013). Mining: Konsep Dan Aplikasi Menggunakan Matlab. Yogyakarta: Andi Publisher.

Putra, P., & Iqbal, M. (2016). Implementation Of Serious Games Inspired By Baluran National Park To Improve Students' Critical Thinking Ability. Jurnal Pendidikan IPA Indonesia 5, 101-108.

Riduwan. (2015). Skala Pengukuran Variabel-Variabel Penelitian. Bandung: Alfa Beta.

Rusman. (2013). Belajar dan Pembelajaran Berbasis Komputer. Bandung: Alfabeta.

Setyosari, P. (2016). Metode Penelitian Pendidikan dan Pengembangan. Jakarta: Prenadamedia Group.

Siagian, K. (2013). Strategi Pembelajaran dan Media Pembelajaran. Jurnal Teknologi Pendidikan.

Siyoto, S., & Sodik, A. (2015). Dasar Metodologi Penelitian. Yogyakarta: Literasi Media.

Slameto, F., & Hidayah, R. (2010). Pengembangan Permainan Catch The 3. Unesa Journal of Chemical Education, 695-702.

Slavin, R. (2017). Psikologi Pendidikan Teori dan Praktik. Jakarta: Indeks.

Sudjana. (2005). Metoda Statistika. Bandung: Tarsito.

Sugiyono. (2015). Metode Penelitian Kombinasi. Bandung: Alfabeta.

Sugrah, N. (2019). Implementasi Teori Belajar Konstruktivisme Dalam Pembelajaran Sains. Humanika, Kajian Ilmiah Mata Kuliah Umum, 121-138.

Sukmadinata, N. (2016). Metode Penelitian Pendidikan. Bandung: PT Remaja Rosdakarya.

Wardana. (2020). Pengantar Aplikasi SPSS Versi 20. Yogyakarta: LPPM Universitas Muhammadiyah Buton Press.

Woodill, G. (2010). The Mobile Learning Edge: Tools and Technologies for Developing Your Teams. New York:: McGraw-Hill Professional.

Yunitasari, F., & Agustini, R. (2013). Pengembangan Media Permainan 7 Icon Chemistry pada Materi Pokok Ikatan Kimia untuk Meningkatkan Hasil Belajar Siswa Kelas X SMA 2. UNESA Journal of Chemical Education, 98-102.