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EFFECTIVENESS OF BEMO: AN ANDROID-BASED EDUCATIONAL GAME AS A LEARNING MEDIA ON MOLECULAR SHAPE MATERIAL

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Abstract

This study analyzes the effectiveness of the android-based BEMO game as a learning media on molecular shape material. The trial in this study was conducted on one of the XI classes at SMA Kartika IV-3 Surabaya, namely class XI E with 30 students. Effectiveness is based on pretest and posttest results comprising 15 questions and questionnaire results comprising 12 statements. Learning outcomes were analyzed with the help of the SPSS program, while the questionnaire results were analyzed by quantitative description. The results of the analysis with the help of SPSS show that the use of the android-based BEMO game as a learning media on molecular shape material is effective for improving student learning outcomes by conducting the Paired Samples T-Test test which is known t table with df = 29, α 5% = 1.669 while t count = 26.133. Based on these results it can be seen that the calculated t value is in the H_0 rejection area, this means that H_0 is rejected and H_1 is accepted. This shows a significant difference in students' learning outcomes on molecular shape material between the pretest and posttest. The posttest results were also analyzed with classical completeness getting a percentage of 86.67%. Based on the data obtained from the students' response questionnaire, it is known that students feel happy to learn when using the BEMO game so that students can participate actively, have increased concentration and willingness to learn and feel comfortable when undergoing the learning process. Based on this data, it can be concluded that using android-based BEMO game as a learning media on molecular form material is effective in significantly improving students' learning outcomes

Keywords: BEMO Game, Educational Game, Chemistry, Molecular Shapes

1. Introduction

In the current era of globalization, science and technology which is growing rapidly influences the world of education. The world of education must continue to adjust to the advancement of science and technology in improving the quality of education, especially in the learning process. Based on this, teachers are expected to be able to make various learning innovations that can be applied when teaching according to the characteristics and conditions of the students being taught. Using learning media is one of the innovative things that teachers can do.

Using learning media in learning activities can foster new interests and desires, foster learning motivation, and provide psychological effects on learning (Febrita & Ulfah, 2019). Motivation determines the amount of activity or information that can be learned (Utami &

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Oktarina, 2013). Motivated learners show high cognitive processes in learning, absorbing, and remembering what has been learned (Utami & Oktarina, 2013). Motivation and learning outcomes are inseparable and must go hand in hand (Lutfi, 2014). Learning motivation can decrease because it is influenced by several factors, one of which is learning material that is too difficult or easy (Anggraini, 2015).

Chemistry is a material that is difficult to understand and abstract, so learning requires learning media (Palma et al., 2021). Some basic concepts in chemistry require more understanding because they have abstract theories that require submicroscopic or unobservable level analysis (Nisa & Dwiningsih, 2022). One of these materials is molecular shape material. Molecular shape material discusses the three-dimensional arrangement of the atoms of a molecule. Some abstract concepts in molecular shape material are the repulsive force between the free electron pair, the bonding electron pair and the angle change caused by the repulsion between electron pairs (Sholehah & Azhar, 2019). For this reason, students are expected to have representational skills to understand molecular shape material. Representational abilities can be expressed in simple ways by using computer technology, namely using text, diagrams/drawings, 2D models, and 3D models both still and moving. (Dewi, 2022).

Based on pre-research conducted in class XI E SMA Kartika IV-3 Surabaya, 28 out of 30 students stated that during the learning process the molecular shape material had never used learning media but only used teaching materials in the form of LKS books. This limited insight can make students feel bored when listening to explanations that cannot be understood, seen, or touched. This, of course, can affect the learning outcomes of students, the average daily assessment of molecular shape material obtained is low.

The rapid development of technology today can be utilized to improve the quality of education, especially in the learning process, for example, using Android as a learning media. Various examples of learning media use Android, which is educational game. Games are used as learning media or educational games, which are activities that are very fun and can be a way or educational tool that is educational (Fatmawati, 2020). For this reason, an android-based BEMO game application was developed on molecular shape material that can increase learning motivation and increase students' cognitive learning outcomes.

The BEMO game is an image-guessing game that will give students several clues on how to find an object. At each level of the BEMO game, there are three energy levels. Energy is the opportunity for students to guess the picture from the clue given. In guessing the picture, students are given 30 seconds. If students can find the meaning of the clue, then students will be given practice questions about molecular shape material.

Figure 1. Giving clues in the BEMO game

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The material of molecular shapes requires students' representational skills, so the developed game also presents several images, animations, videos, and a virtual laboratory PhET Simulations: Molecule Shapes to improve students' representational skills.

Figure 2. Material view

Game media is identic with fun activities, but when games are well-designed to support the learning process, they can help students succeed. This study aimed to analyze the effectiveness of using the Android-based BEMO game as a learning media on molecular shape material.

2. Methods

This research was conducted on one of the XI classes at SMA Kartika IV-3 Surabaya is class XI E with 30 students. It used the One-Group Pretest-Posttest Design method. Before learning begins, students are given a pretest sheet. Then, students are given treatment, namely learning to use Android-based BEMO games as learning media. After using the BEMO game, students are given a post-test sheet and questionnaire. The research design is presented in the Figure 3.

O_1	**X**	**O_2**

Figure 3. Research design

Description:
O_1: Pretest score (before treatment)
X: Learning treatment using the BEMO game
O_2: Posttest score (after given treatment)

Before the test, the pretest-posttest instrument sheet and questionnaire were validated first. The validation process in this study was assessed by 3 validators, consisting of 2 chemistry lecturers and 1 chemistry teacher. The pretest and posttest questions consisted of 15 questions assessed based on the suitability of the questions with the question indicators, the cognitive domain used was at least in accordance with the question indicators, and the language used was not double meaning. The student response questionnaire consists of 12 statements, which are assessed based on content validity (the suitability of the statement with the objectives to be achieved) and construct validity (correctness of the format, ease of use, and the use of good and understandable language). After receiving criticism and suggestions

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from the validator, improvements were made until the results obtained met the validity level so that the instrument sheet could be used to collect data in the study.

Knowing the BEMO game's effectiveness, the learning outcome score was analyzed and supported by analyzing the students' response questionnaire. Learning outcome scores were analyzed using the Paired Samples T-Test test and the classical completeness with criteria greater than or equal to 85% individual completeness (Basid, 2022). The analysis of the student's response questionnaire uses a Guttman scale (Yes or No), which is then analyzed in a quantitative description using a percentage (%) with the criteria for each statement item to at least get a percentage of ≥61%, which has a good to very good category. The criteria for the student's response questionnaire are presented in Table 1.

Table 1. Response questionnaire criteria.

No	Presentations (%)	Criteria
1	81-100	Very good
2	61-80	Good
3	41-60	Enough
4	21-40	Bad
5	0-20	Very bad

3. Result and Discussion

3.1 Results of Learner Response Questionnaire

This aspect relates to the comfort and ease of use, which can be reviewed through students' experiences. Student responses can measure data on students' learning experiences when using BEMO game media.

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Table 2. students' questionnaire results

No.	Statements	Percentage of Responses
1.	Teaching and learning activities are more fun with BEMO games	96,67%
2.	Teaching and learning activities are boring when using BEMO game media.*	96,67%
3.	Using BEMO games makes me more active in participating in chemistry lessons on molecular shapes.	96,67%
4.	I am not interested in playing again when the game is declared over*	80,00%
5.	I feel motivated to study harder by the BEMO game.	96,67%
6.	I was able to play the BEMO game smoothly	93,33%
7.	The instructions for using the game in this learning media guidebook are easy to understand	96,67%
8.	I understand the rules of the BEMO game	96,67%
9.	BEMO games use language that is difficult to understand*	96,67%
10.	The selection of fonts, sizes, and spaces used in the BEMO game is appropriate and accessible to read	100%

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No.	Statements	Percentage of Responses
11.	The images and videos used in BEMO games are clear and easy to understand.	96,67%
12.	The use of BEMO games helps develop my abilities in chemistry lessons, especially in molecular shape material.	100%

Students' interest in BEMO games is a criterion related to the feeling of pleasure in learning by using BEMO games so that students will participate actively, have increased concentration and willingness to learn, and feel comfortable when undergoing the learning process. In this aspect, there are statements number 1-5. Statement 1, namely "Teaching and learning activities are more fun with the BEMO game," received a percentage of 96.67%. From the percentage results obtained, it can be seen that almost all students feel happy playing the BEMO game media. The game comes from the word "play," which means an activity carried out to get pleasure (Nihayati & Agustriasih, 2021). This is supported by statement 2, "Teaching and learning activities feel boring when using BEMO game media," which is a negative statement with a percentage of students answering "No" 96.67%. The boredom experienced by students usually occurs due to a lack of innovation in learning activities so interest in learning becomes low because there is no interest in students to learn (Lumbantobing et al., 2022). Furthermore, statement 3, namely "The use of BEMO games makes me more active in participating in chemistry lessons on molecular shape material," received a percentage of 96.67%. Teachers, as facilitators, are expected to make it easy for students to learn by presenting learning media so that students become more active. Using BEMO game media, students can participate actively in learning by answering questions at each level and discussing.

Statement 4, namely "I am not interested in playing again when it is declared the game is over," is a negative statement with a percentage of students answering "No" of 80.00%. This statement has the lowest percentage, this is because there are several obstacles experienced by some students in the use of BEMO game media during the learning process, such as the narrative text at each level does not appear, the cellphones of the students becoming slow in the middle of the game, causing full memory on the students' cellphones. In statement number 5, namely "I feel motivated to study harder with the BEMO game," getting a percentage of 96.67%. The results of the percentage obtained show that almost all students feel motivated to play the BEMO game media. Learning motivation for students themselves is essential because students will be encouraged by their awareness to study more diligently and have a competitive spirit to try to improve their knowledge and skills so that the learning outcomes achieved can be obtained optimally (Pratiwi & Faudah, 2020).

The ease of use of the game as a learning media is a criterion related to the interaction between students and the BEMO game media during the learning process. In this aspect, there are statements number 6-10. Statement number 6, "I was able to play the BEMO game smoothly," received a percentage of 93.33%. From this acquisition, it can be seen that students can operate the BEMO game media well. The ease of use of the BEMO game is due to the provision of a BEMO game guidebook that has been distributed to students so that it can guide students in the operation of the game. This is supported by the 7th statement, "Instructions for use in the learning media guidebook are easy to understand," and the 8th statement, "I understand the rules of the

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BEMO game," which both obtained a percentage of 96.67%. The game manual contains a gradual explanation of the operation of the BEMO game. This guidebook has a preface, introduction, instructions on installing the application, button functions, game rules, and the operation of the BEMO game application. This guidebook explains the game verbally and is accompanied by illustrations of images and descriptions to make it easier for students to operate the game. The 9th statement, "The BEMO game uses language that is difficult to understand," is a negative statement, with a percentage of students answering "No" 96.67%. The use of language in learning media must be clear and easily understood by students, and the use of terms needs to be adjusted so that learning runs effectively (Indrawan et al., 2020). The 10th statement, "The selection of fonts, sizes, and spaces used in the BEMO game is appropriate and easy to read," obtained a percentage of 100%. Text is the basis of word processing and information in learning media. Therefore, the text in the media must be made as interesting as possible and read clearly so that the information presented can be conveyed to the reader. For this reason, the text on the learning media presented must pay attention to the use of fonts, font sizes, colors, thickness, and spaces (Indrawan et al., 2020).

The clarity of the material is a criterion related to the achievement of students' learning experience related to the understanding of molecular shape material through the BEMO game media used. In this aspect, there are statements number 11 and 12. The 11th statement, "The images and videos used in the BEMO game look clear and easy to understand," getting a percentage of 96.67%. Image media delivers information in the visual form used to describe something more clearly and interesting. Meanwhile, the video also has an equally important role: presenting information and emphasizing certain aspects. Video is an essential characteristic in multimedia applications for educational purposes, besides supporting the use of text, videos also facilitate learners with poor reading skills or learners who prefer to hear and watch videos rather than read. Furthermore, the last statement, "The use of BEMO games helps develop my abilities in chemistry lessons, especially in molecular shape material," received a percentage of 100%. One of the benefits of learning media is that it can provide illustrations of basic concepts that are correct, concrete, and realistic so that learning media can provide a comprehensive experience from concrete to abstract (Indrawan et al., 2020). This BEMO game contains molecular shape material ranging from theoretical explanations, virtual labs, and questions so that students can understand molecular shape material well.

The answers to the response questionnaire from students were obtained very well. This proves that the developed media can generate students' attraction and interest in carrying out the learning process. Learning interest, according to Asih and Imami (2021), namely (1) having a feeling of pleasure in carrying out learning, (2) having special attention in learning, (3) having an interest in participating in learning, (4) having a disciplined attitude in learning. In addition, students do not find it difficult to play the game. This is because it is supported by the narration at each level to guide students in playing the game, and there is also a guidebook that helps students understand the BEMO game. Similarly, the game as a learning media is designed simply so students can play it easily (Suryati et al., 2019). The results of the students' responses show that games as learning media can be used more efficiently to understand the material studied because the material in the game is presented clearly. Students feel happy and interested and do not feel bored when they are happy to learn chemistry while playing, thus making students want to continue learning chemistry. This is supported by

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the pretest and posttest results of students who experienced increased learning outcomes from using BEMO games.

Using appropriate learning media can increase interaction in the learning process and make students feel happy because the media can optimize the quality of student learning outcomes (Hasan et al., 2021). Game media is synonymous with fun activities, but when games are well designed to support the learning process, games can help students' learning success. According to Indrawan (2020), the advantages of games include (1) Games are fun and entertaining activities. The BEMO game is a game of guessing images from clues given with clues that are made as interesting as possible so that students have high curiosity and are challenged to guess the image in question. (2) The game trains learners' active participation in learning. This can be seen from the activities carried out by students during the use of the BEMO game; namely, students actively answer and discuss the questions given in the molecular form material. (3) The game makes it easy for students to understand a concept. The game developed presents several images, animations, videos, and virtual laboratory PhET Simulations: Molecule Shapes to help learners visualize the geometry of molecular shapes.

Learning media must convey information in an attractive, valid, easy-to-understand manner and provide a pleasant atmosphere to meet students' needs (Hasan et al., 2021). By using BEMO game media, students can achieve learning objectives and obtain satisfactory learning outcomes.

3.2 Student Learning Outcomes

The effectiveness of learning media is related to student learning outcomes before and after using BEMO game media. The effectiveness of this study can be seen in students' learning outcomes after using the BEMO game, which is greater than the learning outcomes of students before using the BEMO game. The pretest and posttest questions comprised 15 multiple-choice questions about molecular shape material. The data from the pretest and posttest results above were analyzed by hypothesis testing. Hypothesis testing is done with N-Gain analysis and the data obtained is normally distributed. N-Gain aims to determine the increase in student learning outcomes. N-Gain can be calculated using the formula:

$$\text{N-Gain} = \frac{Posttest\ Score - Pretest\ Score}{Maximum\ Score - Pretest\ Score}$$

The results of the N-Gain calculation are interpreted based on the following Table 3.

Table 3. Interpretation of the N-Gain Score

N-Gain Score (<g>)	Category
<g> ≥ 0,7	High
0,7 > <g> ≥ 0,3	Medium
<g> <0,3	Low

(Sundayana, 2014)

The results of the pretest and posttest of students are analyzed with N-Gain in the following table.

Table 4. N-Gain Score of Student Learning Outcomes

No.	Pretest	Posttest	N-Gain
1.	27	73	0,630137
2.	27	73	0,630137

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No.	Pretest	Posttest	N-Gain
3.	53	80	0,574468
4.	33	73	0,597015
5.	60	93	0,825
6.	33	87	0,80597
7.	40	87	0,783333
8.	20	80	0,75
9.	60	93	0,825
10.	40	80	0,666667
11.	67	87	0,606061
12.	33	80	0,701493
13.	47	93	0,867925
14.	47	93	0,867925
15.	40	87	0,783333
16.	40	100	1
17.	33	87	0,80597
18.	33	80	0,701493
19.	60	100	1
20.	47	87	0,754717
21.	47	87	0,754717
22.	40	87	0,783333
23.	33	80	0,701493
24.	47	87	0,754717
25.	60	93	0,825
26.	47	87	0,754717
27.	47	80	0,622642
28.	40	87	0,783333
29.	33	67	0,507463
30.	47	87	0,754717

Based on the table above, the N-Gain score data obtained results with a vulnerability of 0.5 - 1 so that the increase in learning outcomes is in the medium to high category.

Normality test on pretest and post-test data on molecular shape material needs to be done to meet the requirements of normal distribution. The Shapiro-Wilk normality test was carried out with the help of SPSS software in this study. In the Shapiro-Wilk normality test, data is normally distributed if it has a significance value (a) ≥ 0.05. The normality test results with the help of SPSS software can be presented as follows.

Table 5. normality test

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.

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Hasil Pretest	.153	30	.072	.950	30	.165
Hasil Posttest	.227	30	.000	.931	30	.052

a. Lilliefors Significance Correction

The acquisition of these values shows that the significance score meets the criteria for normally distributed data with a minimum significance score ≥ 0.05. The data from the pretest and posttest results of molecular shapes were then analyzed with the paired sample t-test hypothesis test. The t-test results are presented in the following Table 6.

Table 6. Paired sample t-test results

Paired Samples Test

		T	Df	Sig. (2-tailed)
Pair 1	Hasil Pretest - Hasil Posttest	-26.133	29	.000

It is known that the t table with Df = 29, α 5% = 1.669, while the results of the Paired Samples T-Test above show that t count = -26.133. Based on these results, it can be seen that the t value is in the H_0 rejection area; this means that H_0 is rejected and H_1 is accepted. This shows that students' learning outcomes after using the BEMO game are greater than those of students before using the BEMO game. The classical completeness obtained between the pretest and posttest scores are presented in the following figure.

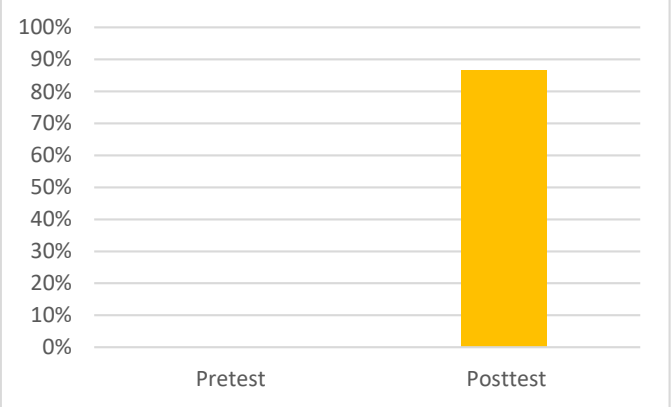

Figure 4. Results of Classical Completeness

Based on the picture above, the classical completeness of students has increased from 0% to 86.67%. The pretest results obtained are included in the low category. This is because the material of molecular shapes has been studied in the odd semester so many students do not have good preparation in working on pretest questions. The low learning outcomes of students can also be caused by several factors, namely health factors, interest, perseverance, learning motivation and lesson planning used during the learning process (Putra et al., 2022). The posttest results were obtained because using BEMO games makes it easier for students to understand molecular shape material. Providing an interesting and fun learning atmosphere will make it easier for students to

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understand, remember, and understand learning (Indrawan et al., 2020). In the BEMO game, there are several levels with different learning objectives to help students build their knowledge about molecular shape material. To complete each level, students must answer questions thoroughly. The completeness in each level of the game is different; the completeness in question is the minimum requirement to answer the questions correctly. Game media cannot be separated from fun activities, but when games are well-designed to support the learning process, games can help students' learning success (Indrawan et al., 2020). The entry of information into long-term memory occurs when it causes pleasure so that the learning process will flow without compulsion (Lutfi & Nugroho, 2019). Learners will be faster in receiving material when learning in a pleasant atmosphere because something pleasant will always be remembered and stored in memory (Indrawan et al., 2020). For this reason, the selection of learning media in learning activities is very important because it determines the final results achieved by students.

Learning effectiveness can be achieved with a good planning process. Teachers must plan good teaching so that students can master the learning material provided (Simatupang, 2016). One form of planning that needs to be done is to prepare learning media for the teaching and learning process (Setiawan et al., 2022). The position of learning media is an important part of the learning process. The selection process of suitable learning media can be done by teachers who can identify learning media that are to the needs of the teaching and learning process. Teachers, in choosing teaching tools, are adjusted to students' interests and learning needs (Sugria et al., 2023). The benefit of learning media specifically is that it improves the quality of student learning outcomes (Indrawan et al., 2020). Learning outcomes can be interpreted as students' results after participating in learning activities. This can be in the form of knowledge, attitudes, and skills-related abilities (Rahman, 2021). Using learning media can arouse new interests, generate motivation stimulate learning activities, and even psychologically affect learning (Indrawan et al., 2020).

The relationship between aspects of learning motivation and learning outcomes is very close. With motivation, students will be encouraged to study harder to achieve learning goals and objectives. Games as learning media can increase students' learning motivation, not cause boredom during the learning process, and help students understand a concept (Lutfi et al., 2021). In the BEMO game, there is a material that provides a stimulus to students regarding molecular shape material. After reading the material, students play the game by guessing the picture, and then students are given questions about molecular shape material. In answering the questions, students will be given results regarding whether the answer is correct or wrong. If students answer the question correctly, an explanation will be given. However, suppose the learners answer the questions incorrectly and do not reach the predetermined completeness at each level. In that case, the learners are given a penalty, namely having to re-read the material and then try to answer the questions again. If students complete all levels well, then students will be given a prize in the form of an online certificate sent via email to each student. This follows the statement from Rahman (2021), namely that there are several ways to give learning motivation to students, including (1) The existence of prizes, (2) The existence of competition or competence, (3) Giving tests, (4) Knowing the results (5) The existence of punishment (6) The desire to learn (7) The existence of learning interests.

The BEMO game developed as a learning media on molecular shape material contains material about VSEPR theory and electron domains in which images,

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illustrations, and videos are presented. In the BEMO game, there is also a virtual laboratory to support students' learning process to achieve learning objectives (Harefa et al., 2021). The presence of images, illustrations, videos, and virtual laboratories will help students visualize the geometry of molecular shapes easily. The results showed that students' learning outcomes after using the BEMO game reached the classical completeness and the score of students' learning outcomes after using the BEMO game was greater than the score of students' learning outcomes before using the BEMO game. Using this BEMO game can help students achieve learning objectives optimally.

4. Conclusion

Based on the research that has been done, it can be concluded that using an android-based BEMO game as a learning media on molecular shape material is effective for improving student learning outcomes which are reviewed from the scores of student posttest results analyzed by classical completeness which gets a percentage of 86.67% and the Paired Samples T-Test test which is known t table with df = 29, α 5% = 1.669 while t count = 26.133. Based on these results it can be seen that the calculated t value is in the H_0 rejection area, this means that H_0 is rejected and H_1 is accepted. This shows that the students' learning outcomes after using the BEMO game are greater than the students' learning outcomes before using the BEMO game. It can be seen through the students' response questionnaire, which shows that students feel happy in learning, have increased concentration and willingness to learn, and feel comfortable when undergoing the learning process. Teachers can utilizing the BEMO game to improve students' understanding of molecular shape material.

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6. References

Anggraini, I. S. (2015). *Motivasi Belajar Dan Faktor-Faktor Yang Berpengaruh: Sebuah Kajian Pada Interaksi Pembelajaran Mahasiswa*.

Asih, & Ihsan Imami, A. (2021). Analisis Minat Belajar Siswa SMP pada Pembelajaran Matematika. *Jurnal Pembelajaran Matematika Inovatif*, *4*(4). https://doi.org/10.22460/jpmi.v4i4.799-808

Basid, A. (2022). Meningkatkan Aktivitas Dan Hasil Belajar Melalui Penerapan Pembelajaran Kooperatif Model Arcs Mata Pelajaran Matematika Siswa Kelas 6 Di SD Negeri 2 Peleyan Kapongan Tahun Pelajaran 2021/2022. Jurnal Cendikia Pendidikan, 1(2). https://doi.org/10.36841/cendekiapendidikan.v1i2.2715

Dewi, N. S. (2022). Meningkatkan Kemampuan Representasional Pada Konsep Larutan Penyangga Dengan Prototype E-Book Berbasis Intertekstual. *Temu Ilmiah Nasional Guru XIV*, *14*(1), 127–136.

Fatmawati, D. (2020). Penerapan Metode Permainan Edukatif Terhadap Pembentukan Karakter Peserta Didik di SD IT Rabbani Watampone. *Dewi Fatmawati | 21 Al-Qayyimah*, *3*(2), 21–40.

Febrita, Y., & Ulfah, M. (2019). Peranan Media Pembelajaran Untuk Meningkatkan Motivasi Belajar Siswa. *Diskusi Panel Nasional Pendidikan Matematika*, 181–188.

Harefa, D., Ge'e, E., Ndruru, K., Ndruru, M., Dian, L., Ndraha, M., Telaumbanua, T., Sarumaha, M., & Hulu, F. (2021). Pemanfaatan Laboratorium IPA Di SMA Negeri 1 Lahusa. *Edumatsains*, *5*(2), 105–122. http://ejournal.uki.ac.id/index.php/edumatsains

Hasan, M., Milawati, Mp., Darodjat, Mp., & DrTuti Khairani Harahap, Ma. (2021). *Media Pembelajaran*. Tahta Media Group.

This is an open access article under the CC BY-SA license.
Copyright ©2022 by Author. Published by Universitas Kristen Indonesia

Indrawan, I., Wijoyo, H., Wiguna, M. A., & Wardani, E. (2020). *Media Pembelajaran Berbasis Multimedia* (M. Latif, Ed.). CV. Pena Persada.

Lumbantobing, W. L., Silvester, S., & Dimmera, B. G. (2022). Penerapan Media Permainan Ular Tangga untuk Meningkatkan Minat dan Hasil Belajar Peserta Didik Sekolah Dasar Di Wilayah Perbatasan. *Sebatik*, *26*(2), 666–672. https://doi.org/10.46984/sebatik.v26i2.2170

Lutfi, A. (2014). Memotivasi Siswa Belajar Sains Dengan Menerapkan Media Pembelajaran Komik Bilingual. *Jurnal Pendidikan dan Pembelajaran* , *20*(2), 152–159

Lutfi, A., Aini, N. Q., Amalia, N., Umah, P. A., & Rukmana, M. D. (2021). Gamifikasi Untuk Pendidikan: Pembelajaran Kimia Yang Menyenangkan Pada Masa Pandemi COVID-19. *Jurnal Pendidikan Kimia Indonesia*, *5*(2), 94–101.

Lutfi, A., & Nugroho, A. (2019). Minat Belajar dan Keberhasilan Belajar Partikel Penyusun Atom dengan Media Pembelajaran Permainan CHEM MAN. *Jurnal Pembelajaran Kimia*, *4*, 39–50.

Nisa, A., & Dwiningsih, K. (2022). Analisis Hasil Belajar Peserta Didik Melalui Media Visualisasi Geometri Molekul Berbasis Mobile Virtual Reality (MVR). *PENDIPA Journal of Science Education*, *6*(1), 135–142. https://doi.org/10.33369/pendipa.6.1.135-142

Palma, Y., Saputra, R., Ulfah, M., Rasmawan, R., & Putra Sartika, R. (2021). Pengembangan Media KIT Bentuk Molekul Di Kelas X SMA Negeri 8 Pontianak. *Jurnal Education and Development*, *9*(3), 86–91.

Pratiwi, A. B., & Fuadah, A. (2020). Permainan tradisional engrang dari Provinsi Banten dan pembentukan karakter menghargai prestasi peserta didik MI/SD di Indonesia. *Madrosatuna : Jurnal Pendidikan Guru Madrasah Ibtidaiyah*, *3*, 13–37.

Putra, D. E., Hefni, & Erningsih. (2022). Faktor Penyebab Rendahnya Hasil Belajar Siswa dan Strategi Guru Meningkatkan Pemahaman Konsep Siswa. *Jurnal Pendidikan Tambusai*, *6*(2).

Rahman, S. (2021). Pentingnya Motivasi Belajar Dalam Meningkatkan Hasil Belajar. *Merdeka Belajar Dalam Menyambut Era Masyarakat 5.0*, 289–302.

Setiawan, U., Amit, H., Malik, S., Megawati, I., Wulandari, D., Nurazizah, A., Nurjaman, D., Nurhasanah, T., Nuranisa, V., Koswarini, D., & Mulyana, C. M. (2022). *MEDIA PEMBELAJARAN (Cara Belajar Aktif: Guru Bahagia Mengajar Siswa Senang Belajar)* (A. Masruroh, Ed.). WIDINA BHAKTI PERSADA BANDUNG. www.penerbitwidina.com

Sholehah, P. S., & Azhar, M. (2019). Pengembangan Modul Bentuk Molekul Berbasis Inkuiri Terstruktur dengan Penekanan pada Level Submikroskopik Menggunakan Pemodelan untuk Kelas X SMA. *EduKimia*, *1*(1), 60–69.

Simatupang, N. I. (2016). Penggunaan Media Power Point pada Model Pembelajaran Kooperatif Tipe Numbered Head Together (NHT) untuk Meningkatkan Hasil Belajar Kimia Siswa. In *Jurnal EduMatSains* (Vol. 1, Issue 1).

Sugria F. A., Mawardi, M., & Isnaeni, F. (2023). Pengembangan Bahan Ajar Untuk Menunjang Pembelajaran Kurikulum Merdeka Pada Materi Bentuk Molekul Fase F SMA/MA. *EduMatSains : Jurnal Pendidikan, Matematika Dan Sains*, 35–45. https://doi.org/10.33541/edumatsains.v8i1.4918

Sundayana, R. (2014). *Statistika Penelitian Pendidikan*. Bandung: Alfabeta

Suryati, T., Suryana, & Kusnendi. (2019). The Effect of E-Learning Based on Schoology and Student Interest to Metacognitive Thinking Skill of Vocational High School Students in Archival Subject. *International Journal of Research & Review*, *6*(12), 397–404. www.ijrrjournal.com

Utami, W. S., & Oktarina, N. (2013). Metode Talking Stick Dengan Media Audio Untuk Meningkatkan Motivasi Belajar Siswa Pada Mata Pelajaran Stenografi. *Jurnal Pendidikan Ekonomi Dinamika Pendidikan*, *8*(2), 85-91.

Wardah Nihayati, C., & Agustriasih, N. (2021). Penggunaan Permainan untuk Meningkatkan Semangat dan Minat dalam Pembelajaran Bahasa Arab di Sekolahan. *Seminar Nasional Bahasa Arab Mahasiswa V*, 423–438.

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