

Development of Pisa-Based Buffer Solution Material Problems and Their Application Using the Kahoot Platform

Abdul Gani^{1*}, Qurratun 'Akyun¹, Muhammad Nazar¹

¹Program Studi Pendidikan Kimia, Fakultas Keguruan Dan Ilmu Pendidikan, Universitas Syiah Kuala, Banda Aceh, Indonesia.

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Corresponding Author:

Abdul Gani

abdulgani051266@gmail.com

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Abstract: An innovation in media technology that can be used in the field of education is Kahoot. Kahoot is an online application in the form of a platform. Kahoot app as a learning technology platform can combine the implementation of interactive quizzes. The problems that exist in SMA Negeri 3 Banda Aceh for students in learning chemistry are about understanding concepts that are still lacking. For this reason, it is necessary to conduct research on "Development of Pisa-Based Buffer Solution Material Problems and Its Application Using the Kahoot Platform". The purpose of this study is developing an interactive quiz media based on Kahoot educational games on buffer solution, to describe teacher responses to the use of interactive quiz media based on Kahoot, and to describe students' responses to the use of interactive quiz media based on Kahoot. This study uses a quantitative approach with the type of Research and Development (R&D) research using the ADDIE model. The result of the research is that the feasibility of interactive quiz media based on the educational game Kahoot on the material of the buffer solution carried out by the lecturer of the Department of Chemistry Education still needs a feasibility test through one stage of improvement. The teacher's response to the four indicators received a positive response. Students' responses to the use of the quiz media also received positive responses from students, besides that it also increased student learning outcomes and did not cause students to feel monotonous.

Keywords: Interactive Quiz; Buffer Solution Material; Development; Kahoot Platform

Introduction

Appropriate use of technology in the field of education will bring major changes, such as: easy search for learning references, many choices in using and using information and communication technology (ICT), as well as the advancing role of media and multimedia in learning (Budiman, 2017).

A media technology innovation that can be used in the education sector is Kahoot. Kahoot is an online application in the form of a platform resulting from the relationship between the Norwegian University of Technology and Science and Johan Brand and Jamie Brooker which is equipped with online quizzes, surveys, discussions, jumbles/mixes, where there are various ways to play it. Teaching and learning with the Kahoot

application require internet access, computers, infocus, and cellphones (Fauzan, 2019).

The Kahoot application as a learning technology platform can combine the implementation of interactive quizzes before educational game-based learning that is equipped with a monitoring system for student activities. The use of Kahoot as an interactive quiz medium before or after learning is carried out based on: 1) The teacher will create a free account linked to your Google account on the website <https://kahoot.com/>. 2) The teacher will make functions and questions arranged according to the material. 3) If the materials are ready, the teacher will provide a Kahoot pin that will be accessible. Ask students to visit the website <https://kahoot.itf>. 4) the infocus device will display a question on the screen; 5) Students choose the right answer at the given time. 6) The student who answers

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the fastest and most accurately will get the highest score in the competition. 7) At the end of the game, the teacher can save each student's answer as an evaluation assessment.

The problems found in SMA Negeri 3 Banda Aceh for students in chemistry learning are about understanding concepts that are still lacking. This problem can be seen based on data from the Try Out results for chemistry subjects in the 2019/2020 academic year at SMA Negeri 3 Banda Aceh showing a low average score of 28.44 with 16 participants participating. Supported by data on the percentage of mastery of buffer solution material in the National Examination which is still relatively lacking and has decreased each period.

Based on these data from the Education Assessment Center of the Ministry of Education and Culture at the Regency/City level in the 2015/2016 school year the number shows 52.61, decreasing to 38.17 in the 2016/2017 school year to 22.25 in the 2018/2019 school year. At the provincial level in the 2015/2016 school years, it decreased from 42.75 to 32.89 in the 2016/2017 school year and 21.27 in the 2018/2019 school year. At the national level in the 2015/2016 school year, it decreased from 54.65 to 49.80 in the 2016/2017 school year and 29.26 in the 2018/2019 school year.

Daily test scores also show the same thing. The average daily test score for the 2018/2019 academic year for buffer solution material in class XII MIPA 8 was 47.3 and in class XII MIPA 7 was 44.5. Based on data from the National Examination, Try Outs and Daily Tests in recent years, the conclusion is that learning chemistry, especially the buffer solution material, has not achieved maximum results and has not reached the Minimum Completeness Criteria (KKM) of 75. Based on observations and interviews with high school chemistry class XI teachers Negeri 3 Banda Aceh shows that the quizzes that are held before and after learning are still written on paper. Even in the implementation of learning, the use of media is still categorized as rare. This is a cause of the low value of the buffer solution material.

Based on Rosyida (2017) research, the learning motivation of students in the buffer solution material using the problem posing strategy with media is higher than students who are taught without using media. Utilization of Kahoot as an interactive quiz media before or after the implementation of learning is one way that is expected to help quiz activities become interesting, interactive, and conducive, especially on buffer solution material. According to research conducted by Wang (2015) stated that game-based student responses succeeded in increasing student engagement, motivation and learning after using it repeatedly for five months. Besides that, Nokham (2017) also conducted research which stated that the use of Kahoot also made students more concentrated, more cooperative,

comfortable in learning, and increased learning motivation.

According to Christiana (2022), the Kahoot application is very suitable for use in the learning process, namely when carrying out evaluations or assessments of chemistry subjects during Limited Face-to-Face Learning. This is because using the Kahoot application can improve student learning outcomes, improve thinking skills, and student interest. This is because the Kahoot application can be used as a learning evaluation medium in the form of interactive quizzes which are very effective, fun, and make students more enthusiastic about learning. Evaluation of learning can be given to students as assignments, quizzes, daily assessments, midterm assessments, and end of semester assessments. The kahoot application is an online interactive game, where one of the obstacles it faces is the stability of the internet network from providers in each region. So that online evaluation using kahoot will be optimal if the internet network is stable, as well as the readiness of educators and students to use it in teaching and learning activities. Other research also conducted by Kocakoyun (2017) shows that Kahoot is an application that is in great demand as a learning medium. Research on kahoot has been conducted by Romiyarti and Sari (2017) explaining that kahoot can evoke students' emotions.

Relevant research shows that the use of Kahoot as a learning medium and evaluation tool has a positive impact on the education sector. The case is proven like the research of Iwamoto et al. (2017) that students like the Kahoot game because it helps them memorize core concepts in class, it also increases the competitive aspect of students. In addition, Ismail and Mohammad (2017) also said that Kahoot is a tool that should be used to make the learning process fun so that it motivates students to learn.

Jumila et al. (2018) concluded that the use of the Kahoot web in colloidal learning can foster students' digital literacy as indicated by the attainment of digital literacy dimensions consisting of information, communication, content-creation, safety and problem solving. Meanwhile, Ningrum (2018) concluded that implementing interactive quizzes as an educational game Kahoot affects increased student learning outcomes, because it can accelerate student understanding of the material provided by providing direct feedback. Ancient Research, et al. (2019) proved that the use of Kahoot online games increased students' motivation in learning chemistry in the high category with a value of 0.73.

From this problem, the authors conducted a study entitled "Development of Pisa-Based Buffer Solution Material Problems and Their Application Using the Kahoot Platform". As for the formulation of the problem in this research, namely developing interactive quiz

media based on Kahoot educational games on buffer solution material in class XI SMA Negeri 3 Banda Aceh, describing teacher responses to the use of Kahoot educational game-based interactive quiz media on buffer solution material in class XI SMA Negeri 3 Banda Aceh, and describes students' responses to the use of interactive quiz media based on Kahoot educational games on buffer solution material in class XI SMA Negeri 3 Banda Aceh.

Method

The method used is a quantitative approach. This type of Research and Development (R&D) research uses the ADDIE model. The location of the research was at SMA Negeri 3 Banda Aceh, which was held from May 2020 to June 2020. The research subjects were students in class XI MIPA 2 and XI MIPA 3 SMA Negeri 3 Banda Aceh. Subject taking was carried out by purposive sampling, namely determining the sample based on a consideration (Sugiyono, 2010). The selection of subjects is based on the lack of use of media in learning, especially when.

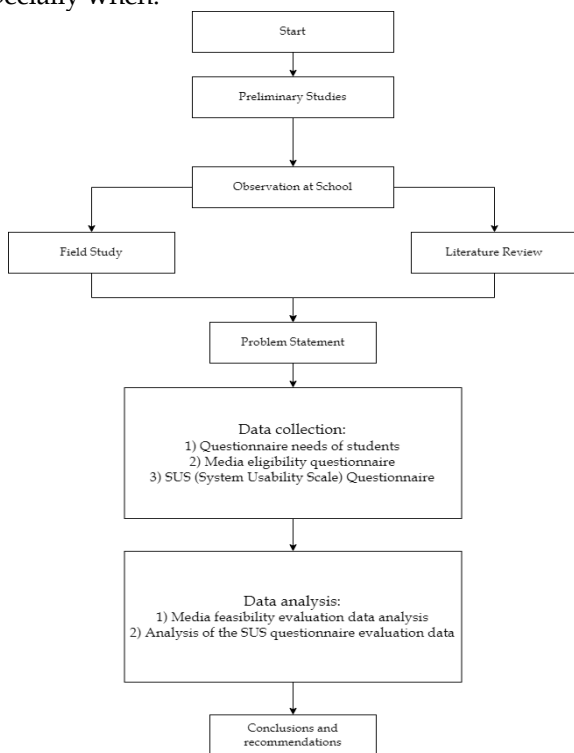


Figure 1. Research Flowchart

Research data collection was carried out using questionnaires or questionnaires, in the form of student needs questionnaires, media feasibility questionnaires, and the SUS (System Usability Scale) questionnaire. Analysis of the research data was divided into two parts, namely analysis of media feasibility evaluation data and analysis of SUS questionnaire evaluation data.

Result and Discussion

This study involved 68 respondents who were students in class XI MIPA 2 and XI MIPA 3 Public High School 3 Banda Aceh City. The distribution of questionnaires and research questions was carried out directly to the respondents. In the study, there were 2 tests and two questionnaires given, namely tests carried out by answering written questions, tests carried out by answering questions using the kahoot platform, kahoot platform feasibility sheets as interactive quiz media for buffer solution material and questionnaires for participants' needs. educate on interactive quiz media using the kahoot platform. The test given is in the form of multiple choice questions for students to work on. The results of distributing questionnaires to respondents were then analyzed. The following table 1 shows the descriptive characteristics of respondents based on gender.

Table 1. Respondent Characteristics Descriptive

Information	Frequency	Respondents (%)
Gender		
Man	25	36,76
Woman	43	63,24
Total	68	100

Based on the data in Table 1, it is known that of the 68 respondents who were examined based on gender, it was found that the majority were women, namely 43 respondents (63.24%) while men, namely 25 respondents (36.76%).

Feasibility of interactive quiz media based on educational games Kahoot on buffer solution material in class XI SMA Negeri 3 Banda Aceh

The feasibility of SUS qualitatively was carried out by an expert validator, namely a Lecturer in the Department of Chemistry Education, Mrs. Sri Winarni. The test questions used for this research amounted to 10 questions. The results of this validation are then used as a research instrument during the test.

The results of the feasibility test are shown in Table 2 which shows the generally achieved results are above 70%. This means that the use of kahoot is quite feasible to use for interactive quiz media based on educational games on buffer solution material in class XI SMA Negeri 3 Banda Aceh. The feasibility of this interactive quiz media is appropriate for use and according to Cahyani (2020) research, by testing the validity of the Kahoot-based acid-base evaluation instrument at Muhammadiyah 1 Pontianak High School, the results obtained for the validity tests were all with values of 81.73% and 80.47% respectively. the criteria are very valid.

Table 2. Results of the Kahoot Feasibility Test as an Interactive Quiz Media

Statement	Percentage of Eligibility Value (%)
The appearance of the quiz using the Kahoot application is interesting.	81.30
This game-based online quiz made me more enthusiastic about learning chemistry.	89.30
By using the Kahoot application, chemistry lessons are not boring.	81.60
In my opinion, the visual appearance (photos, images, etc.) of the Kahoot application is very interesting.	84.90
I feel that this quiz using the Kahoot application increases my learning motivation.	62.40
I am very interested in online quizzes using the Kahoot application.	85.80
I prefer to work on quiz questions using the Kahoot application.	78.70
The questions presented are in accordance with what I learned at school.	71.40
I feel that learning chemistry by using quizzes using the Kahoot application makes it very easy for me to work on and understand questions.	71.80
The material presented is easy to understand.	71.80
This quiz contains an evaluation test that can test how far I understand the material that has been taught at school.	77.40
The sentences used in the questions are clear and easy to understand.	80.30
In my opinion, the Kahoot application is easy to access.	79.60
The Kahoot app is easy to use.	79
In my opinion, the menus and facilities (buttons) in the Kahoot application are easy to understand.	80.40

This research is also supported by the results of Christiana's research (2022) which states that the Kahoot application is very suitable for use in the learning process, namely the ethics of carrying out evaluations or assessments of chemistry subjects during Limited Face-to-Face Learning. This is because the Kahoot application

can be used as a learning evaluation medium in the form of interactive quizzes which are very effective, fun, and make students more enthusiastic about learning. Evaluation of learning can be given to students as assignments, quizzes, daily assessments, midterm assessments, and end of semester assessments.

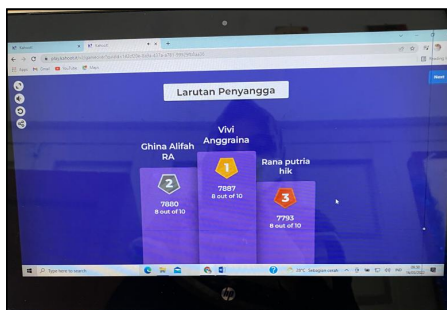


Figure 2. Display of the results of students taking interactive quizzes on the Kahoot application

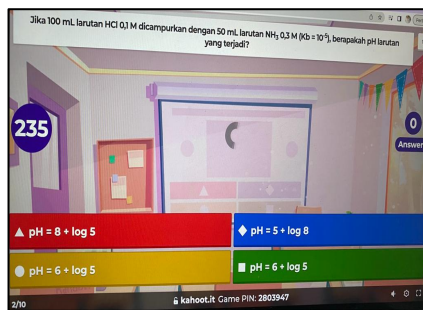


Figure 3. Display of one of the Kahoot application interactive quiz questions

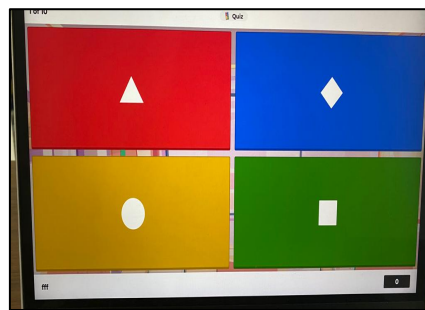


Figure 4. Display of interactive quiz answer choices for the Kahoot application

Teacher Responses to the Use of Kahoot Educational Game-Based Interactive Quiz Media

The teacher's response to the use of the kahoot platform as an interactive quiz medium is shown in Table 3. Based on the data in Table 3 it shows that the indicator for serving the kahoot platform as an interactive quiz medium on the buffer solution material received a score of 45 (100%) of the total score of 45. This means that the presentation of quizzes using the platform received positive responses from the teachers who taught so that the presentation of quizzes using the platform could be a reference for measuring students' understanding of the teaching material provided.

The content quality indicator displayed by the kahoot platform as an interactive quiz medium on buffer solution material received a score of 29 (96.67%) of the

total score of 30. This means that the quality of the quiz questions given using the kahoot platform received good responses from the teachers teaching. It's just that there is the use of terms that are used inaccurately. There is a reduction in the score at that point.

The construction indicator given by the kahoot platform as an interactive quiz medium on the buffer solution material received a score of 13 (86.67%) of the total score of 15. This means that the construction given in the application of kahoot as a quiz medium received a good response from the teaching teacher. The teacher gives suggestions for the order of presentation of the questions should be made from the concept of a buffer solution first and then the calculations.

Table 3. Data on Teacher Responses to the Use of the Kahoot Platform

Indicator	Total Score	Answer	
		Total	Percentage (%)
Presentation of the kahoot platform as an interactive quiz medium on buffer solution material	45	45	100
The quality of content displayed on the kahoot platform	30	29	96.67
The construction given by the kahoot platform	15	13	86.67
Using the kahoot platform	10	10	100

The indicator for using the kahoot platform in the buffer solution material received a score of 10 (100%) of the total score, namely 10. This means that the use of the kahoot platform as a quiz medium received positive responses from the teaching teacher so that the presentation of quizzes using this platform can be proposed as a method used to measure students' understanding of the teaching material provided as attractive as possible.

The research is in accordance with Cahyani research (2020), by assessing the teacher's response to the Kahoot-based evaluation instrument, which is practical according to the teacher's response scores in the initial and main tests of 83.33 and 97.22%. This means that the interactive quiz media instrument based on the Kahoot educational game has been accepted by the teacher and has received a positive response. This research is also based on the opinion of Ismail and Mohammad (2017) who said that Kahoot is a tool that can be used in the

learning process to be fun so that it motivates students to learn.

Student Responses to the Use of Kahoot Educational Game-Based Interactive Quiz Media

The students' responses to the test questions are shown in Table 4. Based on the data in Table 4, it can be seen that the students' responses to the use of kahoot-based interactive quiz media. The average score given by students regarding the use of the kahoot platform as a quiz medium is 4.08 in the good category. This means that the use of kahoot received a positive response from students. Giving quizzes using kahoot can help students not feel monotonous over a learning system that only uses the writing paper method.

This research is in accordance with Cahyani (2020) research, which assessed teacher responses to Kahoot-based evaluation instruments, based on student responses in pre-testing each variable of 85.80% and 86.21%, the criteria being the most practical. This means that this interactive quiz media instrument can be accepted by students and is effective in increasing student learning interest and results. The research is also in accordance with Wang's research, which states that game-based student responses are able to involve, motivate student learning after being used repeatedly within 5 months. Not only that, using Kahoot makes students more concentrated, strong teamwork, comfortable while learning, and more motivating learning according to Nokham (2017). Furthermore Iwamoto et al. (2017) also stated that students like the Kahoot game because it helps them memorize core concepts in class, as well as increases the competitive aspect of students. Kahoot also has the potential to improve exam results at the college and university level.

Table 4. Student Responses to the Question Material

Statement	Alternative Answers					Average	Category
	1	2	3	4	5		
The appearance of the quiz using the kahoot application is interesting.	2	4	2	37	23	4.10	Good
This game-based online quiz made me more enthusiastic about learning chemistry.	2	4	0	41	21	4.10	Good
By using the kahoot application, chemistry lessons are not boring.	1	4	2	34	27	4.21	Good
In my opinion, the visual appearance (photos, drawings, etc.) of the kahoot application is very interesting.	2	3	5	41	17	4	Good
I feel that this quiz using the kahoot application has increased my learning motivation.	1	3	7	33	24	4.12	Good
I am very interested in online quizzes using this kahoot application.	0	5	2	37	24	4.18	Good
I prefer to do quiz questions using the kahoot application.	0	5	10	33	20	4	Good

Statement	Alternative Answers					Average	Category
	1	2	3	4	5		
The questions presented are in accordance with what I learned at school.	0	3	14	30	21	4.01	Good
I feel that learning chemistry by using quizzes using the kahoot application makes it very easy for me to work on and understand questions.	2	2	20	27	17	3.81	Good
The material presented is easy to understand.	0	9	10	32	17	3.84	Good
This quiz contains an evaluation test that can test how far I understand the material that has been taught at school.	1	3	7	37	20	4.06	Good
The sentences used in the questions are clear and easy to understand.	1	1	12	33	21	4.06	Good
I think this kahoot app is easy to access.	1	3	5	32	27	4.19	Good
This kahoot app is easy to use	1	3	2	29	33	4.32	Very Good
In my opinion, the menus and facilities (buttons) in the kahoot application are easy to understand.	1	2	5	32	28	4.24	Good
Average Student Responses						4.08	Good

Furthermore, the results of student quizzes were carried out with 2 different treatments. The first treatment was given questions and students and answered with answer paper. The second treatment, students were asked to open the kahoot website and fill in the code provided on the platform then answer the questions displayed on the kahoot.

Based on the data in Table 5, it shows the average gain obtained by students for the two treatments. Giving quizzes using kahoot has a higher average score of 51.03 than giving quizzes using answer paper, which is 19.85. This means that giving quizzes using kahoot makes students more interested so that there is a difference in the average score in the two treatments.

This research is in accordance with Cahyani's research (2020), that the reliability of the questions according to the calculated results shows r_1 in the initial field tests worth 0.89 and 0.82, which are very reliable criteria. This research is also in line with Ningrum's research (2018) which states that applying this quiz media affects the level of student learning, because it can accelerate student understanding of the teaching materials provided because it provides direct feedback. Ancient Research, et al. (2019) also proved that the use of Kahoot online games increased students' motivation in learning chemistry in the high category with a value of 0.73. Based on this, the authors can conclude that giving quizzes using kahoot is very efficient in interactive quiz media on buffer solution material in class XI SMA Negeri 3 Banda Aceh because learning can interest students and increase student learning outcomes.

Table 5. Test result scores answer students' questions

Code	Value	
	Manuals	Platform Kahoot
S01	0	30
S02	20	50
S03	0	50
S04	20	50
S05	20	70
S06	0	30
S07	40	70
S08	20	50
S09	0	20
S10	20	50
S11	20	50
S12	20	60
S13	0	30
S14	0	30
S15	10	30
S16	0	40
S17	0	30
S18	0	40
S19	0	40
S20	0	30
S21	10	40
S22	20	60
S23	20	50
S24	10	50
S25	30	40
S26	30	70
S27	30	60
S28	50	80
S29	40	70
S30	20	50
S31	30	60
S32	0	40

Code	Value	
	Manuals	Platform Kahoot
S33	0	30
S34	20	50
S35	40	70
S36	20	60
S37	20	50
S38	60	60
S39	80	90
S40	0	40
S41	50	80
S42	10	50
S43	0	20
S44	0	30
S45	20	40
S46	20	20
S47	0	30
S48	0	30
S49	10	60
S50	10	40
S51	10	50
S52	70	90
S53	0	30
S54	60	80
S55	50	90
S56	10	30
S57	0	40
S58	0	30
S59	40	60
S60	40	70
S61	50	70
S62	0	40
S63	50	80
S64	20	70
S65	30	70
S66	20	70
S67	40	70
S68	20	60
Average Value	19.85	51.03

Conclusion

From the research, the authors conclude that the interactive quiz media based on the Kahoot educational game is suitable for use, having passed the test by an expert validator so that this quiz media can be used as a research instrument. Kahoot's educational game-based interactive quiz media on buffer solution material for the four indicators received a positive response from the teacher. The use of kahoot received positive responses from students, and giving quizzes using kahoot can improve student learning outcomes and make students not feel monotonous with a learning system that only uses the writing paper method. Students' responses to the use of Kahoot educational game-based interactive quiz media on buffer solution material in class XI SMA Negeri 3 Banda Aceh obtained an average score given by students which was 4.08, the assessment given by students could be said to be in a good category. Then look at the results of student quizzes conducted with 2

different treatments, namely the treatment of students being asked to open the kahoot website and fill in the code given on the platform then students answer the questions displayed on kahoot having a higher average value compared to the treatment given questions and students answer questions using answer paper. The author's suggestion is that, with the results of this research, it is hoped that other schools will apply Kahoot-based learning techniques.

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References

- Bicen, H., & Kocakoyun, S. (2017). Determination of University Students' Most Preferred Mobile Application for Gamification. *World Journal on Educational Technology: Current Issues*, 9(1), 18-23. <https://doi.org/10.18844/wjet.v9i1.641>
- Budiman, H. (2017). Peran Teknologi Informasi dan Komunikasi dalam Pendidikan. *Al-Tadzkiyyah: Jurnal Pendidikan Islam*, 8(1), 31-43. <https://doi.org/10.24042/atjpi.v8i1.2095>
- Cahyani, D.R. (2020). *Instrumen Evaluasi Berbasis Kahoot! Pada Materi Asam Basa*. Doctoral dissertation, Universitas Muhammadiyah Pontianak.
- Christiana, L. (2022). Pemanfaatan Kahoot Sebagai Media Evaluasi Kimia di Masa Pembelajaran Tatap Muka Terbatas. *Teacher: Jurnal Inovasi Karya Ilmiah Guru*, 2(1), 73-83. <https://doi.org/10.51878/teacher.v2i1.1112>
- Fauzan, R. (2019). Pemanfaatan *Gamification Kahoot.it* sebagai *Enrichment* Kemampuan Berpikir Historis Mahasiswa pada Mata Kuliah Sejarah Kolonialisme Indonesia. *Prosiding Seminar Nasional Pendidikan FKIP*, 2(1), 254-262. Retrieved from <https://jurnal.untirta.ac.id/index.php/psnp/article/view/5764>
- Ismail, M.A. dan Mohammad, J.A. (2017). Kahoot: A Promising Tool for Formative Assessment in Medical Education. *Education in Medicine Journal*, 9(2), 19-26. <https://doi.org/10.21315/eimj2017.9.2.2>
- Iwamoto, D. H., Hargis, J., Taitano, E. J., & Vuong, K. (2017). Analyzing the efficacy of the testing effect using KahootTM on student performance. *Turkish Online Journal of Distance Education*, 18(2), 80-93. <https://doi.org/10.17718/tojde.306561>
- Jumila, J., Paristiowati, M., Zulhipri, Z., & Allanas, E. (2018). Analisis literasi digital (ict) peserta didik

- melalui pemanfaatan web kahoot dalam pembelajaran koloid. *Jurnal Riset Pendidikan Kimia (JRPK)*, 8(2), 95-100.
<https://doi.org/10.21009/JRPK.082.04>
- Ningrum, G.D.K. (2018). Studi Penerapan Media Kuis Interaktif berbasis *Game* Edukasi *Kahoot!* terhadap Hasil Belajar Mahasiswa. *Vox Edukasi: Jurnal Ilmiah Ilmu Pendidikan*. 9(1), 22-28.
<https://doi.org/10.31932/ve.v9i1.32>
- Nokham, Y.C.R. (2017). The effect of Kahoot, Quizizz and Google Forms on the student's perception in the classrooms response system. *International Conference on Digital Arts, Media and Technology (ICDAMT)*, 178-182.
<https://doi.org/10.1109/icdamt.2017.7904957>
- Purba, L. S. L., Sormin, E., Harefa, N., & Sumiyati, S. (2019). Effectiveness of use of online games kahoot! chemical to improve student learning motivation. *Jurnal Pendidikan Kimia*, 11(2), 57-66.
<https://doi.org/10.24114/jpkim.v11i2.14463>
- Rosyida, S., Munzil dan Joharmawan R. (2017). Pengaruh Penggunaan Media Audio-Visual dalam Pembelajaran *Problem Posing* terhadap Motivasi dan Hasil Belajar Larutan Penyangga. *J-PEK: Jurnal Pembelajaran Kimia*. 2(1), 41-52.
<http://dx.doi.org/10.17977/um026v2i12017p041>
- Sugiyono. (2010). *Metode Penelitian Kuantitatif, Kualitatif, dan R & D*. Bandung: Alfabeta.
- Wang, A.I. (2015). The wear out effect of a game-based student response system. *Computer Education*, 82, 217-227.
<https://doi.org/10.1016/j.compedu.2014.11.004>