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Development of Gamification-Based Wordwall Game Platform on Reaction Rate Materials

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The purpose of this study was (1) to determine the development of a wordwall game platform on the reaction rate material, (2) to determine the feasibility of a gamification-based wordwall game platform from the results of validator and respondent data. wordwall is an application that can be used as a learning media, learning resource or online-based assessment tool that is attractive to students. The advantage of this application is that it has many templates that teachers can create to develop in the form of games. Wordwall is rarely used in learning media because there has not been socialization and application in the teaching and learning process for teachers. In this study, media development was carried out using wordwall applications on chemicals, namely the reaction rate that will be studied by students. This material contains the concept of reaction rate, factors that affect reaction rate, collision theory and reaction rate equations. The novelty of this study compared to existing research is that this research develops a wordwall medium that focuses on increasing students' interest in learning materials, especially chemistry in the online-based teaching and learning process. The wordwall media validators were 2 lecturers from Nusa Cendana University and the question validators were validated by 2 teachers at SMAN 3 Sidoarjo. The trial subjects were 37 students of high school class XI at SMAN 3 Sidoarjo. The research method used is R&D from the Alessi and Trollip model. Data collection using a google form-based questionnaire filled out online and test results. The data were analyzed by qualitative descriptive and percentage calculation. The results obtained: (1) the value of the validity of the material questions is 90%, (2) the value of media validity is 94%, and (3) the student implementation test score is 81.75%.

Graphical abstract



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1. Introduction

The COVID-19 pandemic that has occurred for almost 3 years has resulted in significant changes in various fields,

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one of which is education [14]. The previously full educational process was carried out offline, due to the sudden COVID-19 pandemic, teaching and learning activities were carried out completely offline and now it has been mixed (offline and online) [4], this makes teachers and students have to adapt to this learning [6]. In the process of teaching and learning during online learning, teachers are required to design a learning system that increases student enthusiasm. This is a challenge for teachers, because the change in learning implementation that occurs so quickly [26]. Learning in school can be said to be effective if the interaction between teachers and students is active. Teachers must strive optimally to foster learning motivation in students because learning motivation is one of the keys to success in achieving learning objectives [21]. This sudden adaptation period is fortunately supported by the industrial era 4.0 [2], where communication systems and technology are increasingly sophisticated so that researchers can use the advantages of technology in the application of current learning [3]. However, during the online learning process, students feel bored and bored while carrying out learning [1]. This is because learning resources and media made by educators are less attractive [8]. Therefore, researchers as educators must be able to design and develop learning media so that the information on the material being taught can be well received by students [7].

One example of the media developed was in practice questions or evaluation questions [5]. Practice questions are developed to be more interesting so that students are motivated to work. Applications that can be used are wordwall [9]. Wordwall is an application that is used to create learning media such as quizzes and can make it like a game with a gamification base that is designed like playing a game [13], where users will do quizzes while playing [12]. The advantage of wordwall is that it looks simple, so it is easy to use for educators and students [18], besides that the features provided are also complete with various templates that can be accessed for free and students can immediately take quizzes without having to create an account first. In the past [23], teachers can make educational games to overcome student boredom during learning [11], so that students become more active in receiving learning materials and can help teachers measure the level of understanding of students [15]. The use of games in Chemistry teaching is a methodology that has been used because it enables students to have pleasure and fun while learning [22].

The application of this media can be used on chemical materials, namely the rate of reaction [16]. Reaction rate material is a material that is quite complicated to be understood by students because it contains three levels of chemical representation (microscopic, submicroscopic, and macroscopic) that require interesting visualizations in studying it optimally [10], so media that attracts students must be used to learn more about the rate of reaction [25]. Therefore, the researchers developed a gamification-based wordwall game platform on the reaction rate material.

2. Material and Methods

The research method applied in this development research is Research and Development (R&D) [24]. Research and Development (R&D) is a research method used to produce products that are developed and test the effectiveness of these products. The design of this research development was adopted from the borg and gall model [17].

The procedure in development research consists of 5 stages, namely: (1) preliminary study, (2) planning, (3) development of the initial product form, (4) initial field testing, and (5) revision or refinement of the main product [20]. In the preliminary stage, it was carried out through two stages, namely the literature study and field studies. In the literature study, researchers identified reaction rate questions according to KD which were adopted from the question bank of SMAN 3 Sidoarjo to be implemented in a wordwall and studied teaching materials and learning media in accordance with the high school curriculum. Meanwhile, in the field study stage, the researcher observed the chemistry learning media that had been used at SMAN 3 Sidoarjo in particular. SMA Negeri 3 Sidoarjo is located at Dr. Wahidin street No. 130, Sekardangan, Sidoarjo District, Sidoarjo Regency, East Java, Indonesia. Timur, Indonesia.



Fig. 1. SMAN 3 Sidoarjo.

In the second stage, namely the planning stage, the questions are sorted out that will be applied in planning the wordwall media concept to be developed. The third stage is the development of the initial product form, where at this stage the researcher begins to implement the questions in the form of games on the wordwall. After completing the manufacture and product development, an initial test is carried out in the form of validation, validation consists of two, namely material validation and media validation. The material validation was carried out by 2 teachers of SMAN 3 Sidoarjo and the media validator was carried out by 2 Nusa Cendana University lecturers. After the initial testing, the product will be evaluated and revised. Then, the revised product was implemented on 37 students of high school class XI at SMAN 3 Sidoarjo (field test) to find out the results of student responses to the use of wordwall media in working on reaction rate material questions. The age group of the 37 students who participated in the research is 15–16 years old. The material validation was carried out by 2 teachers of SMAN 3 Sidoarjo and the media validator was carried out by 2 Nusa Cendana University lecturers. After the initial testing, the product will be evaluated and revised. Then, the revised product was implemented on 37 students of high school class XI at SMAN 3 Sidoarjo (field test) to find out the results of student responses to the use of wordwall media in working on reaction rate material questions. The material validation was carried out by 2 teachers of SMAN 3 Sidoarjo and the media validator was carried out by 2 Nusa Cendana University lecturers. After the initial testing, the product will be evaluated and revised. Then, the revised product was implemented on 37 students at SMAN 3 Sidoarjo (field test) to find out the results of student responses to the use of

wordwall media in working on reaction rate material questions.

2.1 Data collection instruments

The data collection instrument in this study used a questionnaire to validate the material, media, and responses to media implementation conducted by students. The questionnaires used were material content validation sheets, wordwall game media content, and student response questionnaires, where the questionnaire consisted of questions with selected answers and questions with descriptive answers.

2.2 Data analysis techniques

The technical analysis of the data used in this research is the analysis of the percentage of the results of the answer choices on the questionnaire and descriptive qualitative analysis of the results of the descriptive answers on the questionnaire. The data from the wordwall game media validation questionnaire was analyzed using the following formula:

$$V = \frac{TSh}{TSe} \times 100\% \quad (1)$$

where V: Validity; TSh: Total max score; TSe: Total empirical score (validation result).

The level of feasibility of the validity of the developed product is obtained through the percentage analysis presented in Table 1.

The qualitative descriptive technique used to describe the wordwall game development product was developed by processing data from descriptive answer questions in the form of suggestions and comments from validators and student responses. The results of the qualitative descriptive

analysis are used by researchers to revise the wordwall game media that was developed to be even better so that it can be implemented on a wider scale.

Table 1. Percentage Analysis Eligibility Criteria [19].

Percentage (%)	Information
0-20	Not feasible
21-40	less worthy
41-60	Decent enough
61-80	Worthy
81-100	Very worth it

3. Results and Discussion

3.1 Development results

The development of the gamification-based Wordwall Game Platform uses the Research and development method of the Alessi and Trollip model. The first step is planning. In this stage the researcher plans the chemical materials that will be used in this development. According to the results of the team discussion, the reaction rate material was used. Next, the researcher made a question about the reaction rate which was included in the difficulty level C1-C5 which represented learning indicators according to the basic competence on reaction rates. The next stage is design. At this stage the researcher uses a wordwall application to create questions that are arranged in the form of a game so that it can attract users' interest in using the product. In the design here, the researcher chose a template on the wordwall that was suitable for the material and game form. Then enter the final stage, namely development. The results of the development are as shown in Fig. 2 below.

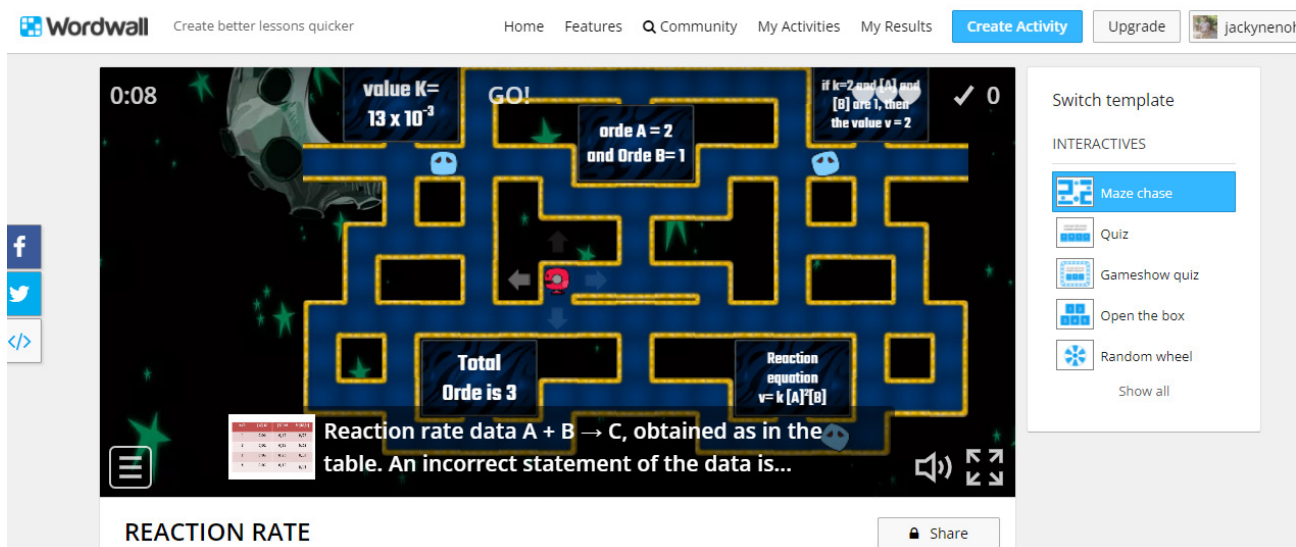


Fig. 2. The results of the development of questions that are applied in the wordwall.

In developing questions with the help of this wordwall application, it can attract students' interest in boredom in studying chemistry because the display in this problem is like a game. The display of student learning outcomes using wordwall games is also available directly in the wordwall application so that it can assist teachers in measuring the level of student understanding. The display of student results

can be seen in Fig. 3.

3.2 Validation (feasibility test)

Validation of Gamification-Based Game Wordwall Platform Development is carried out content validation (questions and media) and user validation (student responses).



Fig. 3. Display student results in the wordwall application.

1. Content validation (questions and media)

This validation consists of questions and media that are assessed by the validator in their respective fields.

a. Question validation

In the validation of this question assessed by 2 teachers

of SMAN 3 Sidoarjo. The validation of this question is assessed for researchers knowing the questions presented in this game already include indicators on the reaction rate material. Aspects assessed by the question validator using a Likert scale and its components in the assessment can be seen in Table 2 below.

Table 2. Question validator assessment components.

No.	Component	Alternative options				
		SB	B	C	K	SK
1	Problems in accordance with competency with indicators					
2	The cheater works/homogeneous options					
3	The question has one of the correct test answers					
4	The subject matter is clearly and firmly formulated					
5	Main formulation of the problem (stem) and logical option					
6	The subject matter does not give instructions towards the correct answer					
7	The subject matter does not contain a double interpretation					
8	The length of the option formula is relatively the same					
9	Options numbers are arranged from small to large or vice versa					
10	Options does not contain a statement of all right/wrong					
11	Picture. Graphs, tables and the like are clear and functional					
12	The question item does not depend on the answer to the previous question					
13	Using raw Indonesian					
14	Use communicative language so that it is easy to understand					

The results of the percentage of validation questions as a whole from the 2 validators are 90% and are categorized as suitable for use. There are also comments/suggestions given in the assessment of this question which can be seen

in Table 3 below.

Table 3. Comments/suggestions from question validators.

No.	Comments/suggestions
1	Good, because the game provides a challenge and a thought process, the suggestion is that at the end of the question there will also be a discussion.
2	Time may be adjusted according to the difficulty of the question.

Based on the suggestions given, the developer edits the game time per question to change according to the level of difficulty of the questions so that students as users can solve the questions at the right time. Suggestions to add discussion are not applied because the wordwall application can only create questions in the form of games, cannot add discussion questions. It is better if the discussion of the problem is directly explained by the teacher so that the interaction between the teacher and students in this product can be well established.

b. Media validation

This media validation was assessed by 2 lecturers from Nusa Cendana University who have expertise in the media field. This media assessment aims to check the ease of developing questions in the form of games from the wordwall application. Aspects assessed by the media validator using a Likert scale and its components in the assessment can be seen in Table 4.

Table 4. Media Validator Assessment Components.

No.	Component	Alternative options				
		SB	B	C	K	SK
1	Accuracy of typeface selection					
2	Accuracy of letter size selection					
3	Accuracy of text color selection					
4	The size of the writing is clear to read					
5	The color composition of the writing is clear read against the background color					
6	Clarity of image shapes, tables or graphs					
7	Ease of use of media					
8	Work on it becomes more interesting and fun					
9	The contents of the problem are easy to understand					
10	Make it easier for teachers to provide evaluation questions to students					

The results of the overall media validation percentage of the 2 validators are 94% and are categorized as suitable for

use. There are also comments/suggestions given in the assessment of this question which can be seen in Table 5.

Table 5. Comments/suggestions from media validators.

No	Comments/suggestions
1	The presentation of the questions is interesting. Maybe it can be improved again with a video presentation.
2	Media is very good to use in conducting evaluations. If possible, there is an additional correct answer key.

Based on the advice given, the developer can't apply it because the wordwall application can only add text and images in making questions, it can't be in the form of videos, while the suggestion regarding adding the correct answer key is not applied also because the development of this question is in the form of games so students have to look for answer correctly by themselves so that they can understand the material of the reaction rate well too.

2. User Validation (student response)

User validation of the development of questions using the wordwall application in the form of a game was assessed by 37 students of high school class XI at SMAN 3 Sidoarjo. Response or testing to students aims for developers to find out directly the interests and interests of students in using this product. Aspects assessed by students using the Gutmann scale and their statements on the assessment can be seen in Table 6 below.

Table 6. Student assessment statement.

No.	Statement	Alternative Options	
		Yes	No
1	What is the design interesting?		
2	What is the text or writing on this subject easy to read?		
3	Can the background color be distinguished from the color of writing and images?		
4	Are the images, tables or graphs presented on this subject clear and not blurry?		
5	Can you easily understand the given problem?		
6	Does the sentence used in the problem, not make a double interpretation?		
7	Can you operate this?		
8	Are you very interested in using this?		
9	Are you more excited about this?		
10	Is it that by using this problem, you are more interested in learning chemistry in terms of chemistry?		
11	Do you feel motivated to learn?		
12	Do you want a model like this to always be used?		

The results of the overall percentage of student

responses from 37 students amounted to 81.75% and were categorized as suitable for use. There are also comments/suggestions given in the assessment of this question which can be seen in Table 7 below.

Table 7. Comments/Suggestions from Media Validators.

Comments/suggestions
1. I find it difficult to answer questions like that model, I can't focus on counting because I'm being chased. my suggestion is more interesting if no one is chasing.
2. There are no comments because I think the question in the form of this game is very exciting, it doesn't make you bored.
3. Because given the correct answer it is very good and interesting. His advice, if given material related to the questions asked, it will be even better so that students who forget or still don't understand in applying the material to questions can understand well in this fun way.
4. Good.
5. I think the animation is too long.
6. Germs that like to chase it makes me rush. Suggestion: The questions are placed at the top of the animation to make it easier to read.
7. Easy-to-understand questions, including reasoning questions.
8. It's better to use this learning method every now and then so you don't get too bored.
9. It's really cool, sir, I like chemistry even more if you teach Deni, I hope that in the future, Mr. Deni will be more successful in this world and the hereafter, amen.
10. the questions given are not clear enough to read.
11. The graphics are better and the questions are too small so they are hard to read. At the beginning there is a homepage for the "play" button. Before starting the game, give a few minutes to read the questions, and the control part of the game is easier and simpler.
12. It's very interesting, but because the game has like life, it's confusing because it's the first time I've played it.
13. it's good so there is innovation to learn but for less visible questions.
14. For the maze model, it's fun to do, but it's a bit difficult if you have to do calculations because not all answers appear at the same time, and when you panic, it's better to use theoretical questions for the maze model.
15. it's good.
16. It's good, unique, and very interesting, it doesn't make you bored, but it would be better to have background music to make it more fun and enjoyable.
17. Very interesting, and very motivated to learn.
18. no, it's good thank you.
19. Nothing because I like it and it's good, unfortunately I'm not good at chemistry.

Based on the advice given, the developer changed the appearance of the game from the template maze chase to the gameshow quiz because the table display on the

template maze chase was too small so it was difficult for students to read the reaction rate data. After editing, the table display can be read properly, it can be seen in Fig. 4.



Fig. 4. Maze chase game display changed to gameshow quiz.

Based on the results of the responses from students, the developer must adjust the form of the questions with the

type of game template so that the questions given can be understood and students can be comfortable in using them, especially in the reaction rate material.

4. Conclusions

The results of the validation of the gamification-based reaction rate material that have been developed in this research and development show very valid results, both from the content criteria for the reaction rate material, especially the questions implemented in the media, as well as from the eligibility criteria for the wordwall game media. In addition, the response from students as users of this media gave a very positive response to help them learn the reaction rate material in a fun way with an attractive and game-based display.

Author Contributions

Jacky Anggara Nenohai and Deni Ainur Rokhim contributed with conceptualization, formal analysis, investigation, methodology and writing – original draft. Nur Indah Agustina contributed with investigation, visualization, writing – original draft and writing – review & editing. Munzil contributed with writing – review & editing.

References and Notes

- [1] Ahmed, A. *Int. J. Creat. Res. Thoughts* **2020**, *8*, 243. [\[Link\]](#)
- [2] Atsani, L. G. M. Z. *Al-Hikmah: Journal of Islamic Studies* **2020**, *1*, 82. [\[Link\]](#)
- [3] Arizona, K.; Abidin, Z.; Rumansyah, R. *Jurnal Ilmiah Profesi Pendidikan* **2020**, *5*, 64. [\[Crossref\]](#)
- [4] Audihani, A. L.; Hidayah, F. F.; Ristanti, D. A. *Journal of the National Seminar on Edusaintek* **2019**, *3*, 149. [\[Link\]](#)
- [5] Baber, H. *Journal of Education and E-Learning Research* **2020**, *7*, 285. [\[Link\]](#)
- [6] Basar, A. M. *Scientific Journal of Education* **2021**, *2*, 208. [\[Link\]](#)
- [7] Birney, L. B.; Kong, J.; Evans, B. R.; Danker, M.; Grieser, K. *Journal of Curriculum and Teaching* **2017**, *6*, 1. [\[Link\]](#)
- [8] Cahyani, A.; Listiana, I. D.; Larasati, S. P. D. *Journal of Islamic Education* **2020**, *3*, 123. [\[Crossref\]](#)
- [9] Ceker, E.; Fezile, Ö. *European Journal of Contemporary Education* **2017**, *6*, 221. [\[Link\]](#)
- [10] Farida, Ida. Interkoneksi Multipel Level Representasi Mahasiswa Calon Guru pada Keseimbangan dalam Larutan melalui Pembelajaran Berbasis Web. [PhD Thesis]. Bandung, Indonesia: Universitas Pendidikan Indonesia, 2012. [\[Link\]](#)
- [11] Hanisah, Hanisah. Efektivitas Penggunaan Media Kartu Bergambar (*Flash Card*) terhadap Pengenalan Kosakata Bahasa Arab pada Peserta Didik Kelas VII SMP Muhammadiyah Parepare. [Master Thesis]. Makasar, Indonesia: Universitas Islam Negeri Alauddin Makassar, 2016. [\[Link\]](#)
- [12] Krisbiantoro, B. *International Conference on Education of Suryakencana (IConnects Proceedings)*. **2021**. [\[Crossref\]](#)
- [13] Maghfiroh, K. *Journal of the Teaching Profession* **2018**, *4*, 65. [\[Link\]](#)
- [14] Monero, Carles. The COVID Pandemic19 as a challenge and opportunity for learning. **2020**. [\[Link\]](#)
- [15] Morschheuser, B.; Hamari, J.; Werder, K.; Abe, J. Proceedings of the 50th Hawaii International Conference on System Sciences, Hawaii, United States of America, 2017. [\[Link\]](#)
- [16] Muchtar, Z.; Rosalia, A. V. A.; Silaban, S. *J. Phys.: Conf. Ser.* **2020**, *1462*, 012053. [\[Crossref\]](#)
- [17] Putra, N. Research & Development Research and Development: An Introduction. Jakarta: PT RAJAGRAFINDO PERSADA, 2012.
- [18] Putri, F. M. Efektivitas Penggunaan Aplikasi Wordwall dalam Pembelajaran Daring (Online) Matematika pada Materi Bilangan Cacah Kelas 1 di MIN 2 Kota Tangerang Selatan. [Undergraduate Thesis]. Jakarta, Indonesia: UIN Syarif Hidayatullah Jakarta, 2020. [\[Link\]](#)
- [19] Ridwan, M. B. A. Measurement Scale of Research Variables. Bandung: Alfabeta, 2010.
- [20] Rokhim, D. A.; Widarti, H. R.; Fajaroh, F. *Jurnal Teknologi Pendidikan* **2020**, *8*, 234. [\[Crossref\]](#)
- [21] Rokhim, D. A.; Kurniawan, C. S. A.; Ula, Q.; Al Siddiq, I. H. *EduHumaniora: Jurnal Pendidikan Dasar* **2020**, *14*, 8. [\[Link\]](#)
- [22] Santos, G. P.; Morais, D. R.; Souza, C. I. F. R.; Fonseca, N. A. R.; Miranda, M. L. D. *Orbital: Electron. J. Chem.* **2021**, *13*, 428. [\[Crossref\]](#)
- [23] Sari, P. M.; Yarza, H. N. *SELAPARANG Journal of Advanced Community Service* **2021**, *4*, 195. [\[Link\]](#)
- [24] Sugiyono. Educational Research Methods (Quantitative, Qualitative, and R & D Approaches). Bandung: Alfabeta, 2017.
- [25] Thamizhmanii, S.; Yuvaraj, C.; Senthilkumar, J. S.; Arun, I.; Sulaiman. *Procedia Manufacturing* **2019**, *30*, 216. [\[Crossref\]](#)
- [26] Widarti, H. R.; Rokhim, D. A.; Septiani, M. O.; Dzikrulloh, M. H. A. 2022. *Orbital: Electron. J. Chem.* **2022**, *14*, 63. [\[Crossref\]](#)

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