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Development of Ludo Game Based Android as Learning Media on Reduction and Oxidation Reaction Material

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Abstract

The era revolution 4.0 is an era of digitalization especially in education. Exercise that was initially conventionally using paper does not always provide opportunities high interest students because students are bored using paper. One of innovations is developing a chemistry ludo game as an alternative exercise model. The goal is develop and determine the level validity, practicality, and effectiveness. This type is the Plomp model Educational Design Research with 3 stages, namely initial, prototype, and assessment stage. The research instruments are questionnaires and test instruments. Validity data were analyzed using Aiken`s V and all validation aspects were above 0.80 so the results of content, construction and media validation showed a valid category, practicality data were analyzed using percentage formula with a result of 90% in practical category, and effectiveness using N-Gain with the results experimental class of 0.79 high criteria, while the control class only 0.47 moderate criteria. Hypothesis namely the tcount 7.84527 and ttable of 0.05 obtained 1.668 so the learning outcomes of the experimental class higher. So, the ludo game is valid, practical, and effective. So that this media can be used for educators as an alternative to providing exercise using fun technology for students.

Keywords: education, validity, practicallity, effectiveness, game, ludo, android

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INTRODUCTION

Material for reduction and oxidation responses is one of the material that's studied in chemistry subject class X SMA/ MA. Reduction and oxidation response material contains factual and abstract knowledge (Husna et al., 2022). Factual knowledge on this material, for illustration the oxidation number of chlorine is-1, the oxidation number of free rudiments like tittles or motes of rudiments is zero. The abstract knowledge in this material, for illustration understanding reduction and oxidation responses and also understanding the oxidation figures. scholars' knowledge regarding mastery of the generalities, principles and procedures that have been studied can be increased by furnishing exercise. furnishing exercise to scholars serves to solidify scholars' generalities of the material that has been studied (Iman Sari & Harjono, 2016). Thus, repeated exercises are demanded to strengthen scholars' mastery of the generalities of reduction and oxidation responses (Dinanti, 2023). In this reduction and oxidation reaction material, students must be able to distinguish reduction and oxidation and determine the oxidation number of an element. To be able to determine this oxidation number, of course, students must do repeated exercises so that students understand the oxidation number of an element because there are rules that must be understood to determine the number. If

students are not used to doing exercises on this material, then students will find it difficult to understand the material. In addition, determining this oxidation number will also determine whether the reaction is a reduction and oxidation reaction.

Based on the distribution of the questionnaire that was carried out for each of the 2 chemistry teachers, the information was obtained that at SMAN 2 Batang Anai, SMAN 1 Batang Anai and SMAN 13 Padang that the exercise was given to scholars from handbooks, modules, and worksheets or questions made by the teacher themself (Aptriyani, 2021). The completion of practice questions was generally individual and did not show high student learning activity. In addition, according to the teachers, student learning outcomes were also classified as less than satisfactory due to the lack of student enthusiasm. The decrease in student motivation in working on questions was caused by several factors, including the questions given were not varied and the completion of the questions was individual, so that the motivation within students towards the exercises given was low (Nawawi, 2020). In conditioning learning, motivation is very much needed because someone who does not have motivation in learning will not be able to carry out learning activities. In addition, the characteristics of varied exercises can increase student learning motivation, the learning atmosphere becomes fun, relaxed, but still has a conducive learning atmosphere (Rahmatin & Khabibah, 2016).

One of the learning media that can increase students' motivation to be active in learning is game media (Mulia, 2016). The benefits of game media include being fun, entertaining, and can increase students' activeness in the teaching and learning process and increase students' motivation (Wicaksono, 2021). In addition, games can also reduce boredom even if used continuously. One of the games that can be used to strengthen students' understanding and increase students' motivation to learn is the Android-based Ludo game. The era of the 4.0 revolution is an era where digitalization occurs in various fields, especially in education (Anwas, 2013). The rapid development of technology can be an opportunity to develop literacy ideas and innovations. One of the learning innovations in this digitalization era is the creation of learning media in electronic form (Tekege, 2017). Thus, teachers are expected to be able to apply technology and communication in the teaching and learning process. In addition, students must have the ability to use technology in the field of learning. One way that can be used is to use Android. The use of android among students is very high, but it is not yet on target because most students use android only as a means of communication, social media, games or limited to other entertainment (Setyosari, 2014). This can be used to design learning media that can direct students' playing abilities towards more useful abilities such as doing exercises (Mardhiah et al., 2018).

Therefore, the game that will be used in chemistry learning such as the chemical ludo game needs to be improved by training android in the form of arithmetic operations. The advantage of this media can be used anywhere and anytime because this product is effective compared to conventional chemical ludo which requires a place and friends in its work. In addition, this android-based chemical ludo game media is equipped with colors and sounds that attract students' attention. The questions on this media also vary. Another advantage is that this game media can be played by students online using an internet network or offline without an internet network. From several advantages and background descriptions, the researcher is interested in designing and describing android-based ludo games learning media for reduction and oxidation reactions. This research was conducted by referring to several problems that have been described, the problems in this study are limited to the development of android-based chemical ludo games as literacy media for reduction and oxidation response material for class X SMA/MA with the Plomp model which is limited to validity, practicality, and effectiveness on reduction and oxidation response material for class X SMA/MA.

METHOD

The type of research used is Educational Design Research by applying the Plomp model which has 3 stages of development carried out at FMIPA UNP, FT UNP and SMAN 2 Batang

Anai, SMAN 1 Batang Anai and SMAN 13 Padang in the 2021/2022 academic year and the next stage at SMA Negeri Binaan Khusus Kota Dumai in the 2022/2023 academic year (Sari & Iswendi, 2023). This research stage is the initial research, the prototype formation stage, and the assessment stage. This first research stage requires several steps such as needs and context analysis, literature review, and conceptual development. The goal is to be able to determine and define the requirements for developing an Android-based chemical ludo game. The steps at this stage are needs and context analysis. Needs analysis is a stage to see the picture of the conditions and needs required in the chemistry learning process, especially in the reduction and oxidation reaction material. So that what needs to be fixed or becomes a solution to the learning problems found is obtained.

The needs analysis was obtained from the results of filling out a questionnaire for each of 2 chemistry teachers in three different schools by focusing on the learning process carried out. The selection of schools was based on the use of the curriculum currently being implemented. Since this material is in the 2013 curriculum, schools that also use the curriculum were selected. And the teachers interviewed were teachers who taught the material. Context analysis is an analysis of the basic competencies of the reduction and oxidation reaction material used in developing an android-based chemical ludo game based on Permendikbud No. 37 of 2018. From these basic competencies, indicators of competency achievement and learning objectives can be derived that are to be achieved through the use of the android-based chemical ludo game as a learning medium.

The next step is a review of the literature which aims to find and understand sources related to the development activities carried out. A review of the literature is carried out by looking for sources and references related to research activities. After that, it is continued with the development of a conceptual framework which is the result of a needs and context analysis and the results of a literature review. The development of a conceptual framework is carried out by identifying, detailing, and compiling the main concepts needed for the development of an android-based chemical ludo game on the reduction and oxidation reaction material. After the initial research stage, it was continued with the prototype formation stage which was the design or design stage followed by realizing the intervention (product) in the form of an android-based chemical ludo game on the reduction and oxidation reaction material for class X SMA/MA.

In the prototyping stage, a formative evaluation was carried out which aimed to perfect the android-based chemical ludo game that was developed. The activities carried out in the prototype formation stage, namely prototype I, included the design stage aimed at designing learning media that were relevant to the data obtained. The learning media in the form of an android-based chemical ludo game on the reduction and oxidation reaction material. This android-based chemical ludo game media was designed using Microsoft Word 2007 and Adobe XD with Netbeans code writer/editor, Visual Studio Code and Android Studio using the Java programming language. The aspects assessed were related to the appearance of the media and its usage techniques. After prototype I was produced, a formative evaluation was carried out in the next stage. Prototype I produced in the design process was then subjected to self-evaluation. Self-evaluation is carried out using a checklist method that aims to see the completeness of the preparation of prototype I, important parts of prototype I, and real errors in prototype I.

If there are deficiencies in the prototype I produced, improvements are made related to things that need to be fixed to produce prototype II. The formation of prototype III is carried out by formative evaluation in the form of expert review and one-to-one evaluation to see the level of validity of the product developed with a description of the expert assessment, namely conducting a validation test using an instrument in the form of a questionnaire against the validation test questionnaire produced on prototype II. Validation was carried out by three chemistry lecturers from FMIPA UNP and two chemistry teachers for material expert validation and three informatics engineering lecturers from FT UNP as media expert validation. The results of the assessment at this stage were analyzed using the Aiken`s formula so that the

validity value of the android-based chemical ludo game was obtained. For the Effectiveness using N-gain formula with control and experiment class. If there are improvements, revisions are made according to the suggestions of the validator and questionnaire analysis in one-on-one testing to produce a valid prototype III.

Next, the formation of prototype IV was carried out by a small group trial activity on the valid prototype III. The small group trial was carried out with 12 students with different levels of ability, namely low, medium and high. The instrument used in this small group test was a practicality questionnaire. The practicality test questionnaire was analyzed using a percentage formula to obtain the practicality value of prototype III. If revisions are needed, revisions are made according to the practitioner's suggestions. This revision aims to improve the quality of prototype IV. The assessment stage is carried out to conclude whether the android-based chemical ludo game that was developed can be used in the field. This stage is also used so that the quality of the final product intervention can be improved. At this stage, a field test is carried out on the prototype IV that has been produced. This stage also determines whether the media produced is in accordance with what is desired or needed in the field. Based on advice from experts (expert review) and with discussions with supervisors, revisions will be made to prototype IV that has been previously developed. The revision aims to make the resulting prototype better in terms of quality so that a final prototype is obtained that is valid, practical. Next is to test the effectiveness of the media with N-gain. We use experiment class and control class, so we compare them by learning resuts with this media. At this stage a field test is carried out of prototype IV that has been produced (Plomp & Nieveen, 2010).

RESULTS AND DISCUSSION

Development of an ludo game based android as a media learning on reduction and oxidation reaction material for class X SMA/MA with the Plomp development model consists of three stages in developing it with the results namely for needs analysis is carried out by collecting problems related to the learning process both teaching materials or providing exercises used in schools. This stage was carried out through an interview process with each of 2 teachers at SMAN 2 Batang Anai, SMAN 1 Batang Anai and SMAN 13 Padang. Based on the results of the interviews it was concluded that the teaching materials and exercise used by the teacher were in the form of printed books, modules, and LKPD or questions made by the teacher himself, the practice was generally individual in nature and did not show high student learning activity. The lack of student activity in doing the exercises is caused by several factors including the exercises given are not yet varied and the work on the exercises is individual, so that the motivation within the students towards the exercises given is low.

After those step completed, next the context analysis is a step to understand the content of the curriculum used in the learning process. Context analysis of the syllabus in the 2013 curriculum based on Permendikbud no 37 of 2018 has been carried out in the form of an analysis of basic competencies which are translated into indicators of competency achievement. The review of literature aims to find and understand the sources related to the development activities carried out. The sources and references used are journals, books or internet sources. One of the media that can be used by teachers in learning is a game. Management of learning media in the form of games is very much needed in the learning process. Games have the ability to involve students in the learning process actively. Student activity is influenced by one factor, namely motivation. If students already have motivation within themselves, student activity will increase. One way to motivate students to be active in their learning is by providing learning media that are appropriate to the characteristics of students. The use of android is very popular among children and adults alike.

At the conceptual framework development stage, identifying, detailing and compiling from needs analysis, context, and review of the literature are carried out. Based on the needs analysis, students need it as a learning evaluation for consolidating concepts. In doing the exercises, students must have motivation so that learning activities can increase. For this

reason, a variety of exercises is needed so that learning is not boring. One variation of the exercise is by using a game. So that a product was created in the form of an Android-based chemical ludo game as an option in working on questions to strengthen student concepts.

Prototype I was produced in the form of an ludo game on redox material. The ludo game was designed using Microsoft word 2007 and Adobe XD with Netbeans code writer/editor, Visual Studio Code and Android Studio. After prototype I was produced, a formative evaluation was carried out in the form of self-evaluation. Based on the self-evaluation questionnaire sheet, all components of the game that were formulated already exist in the Android-based chemical ludo game so no revision is needed. The results of this self-evaluation produced prototype II. After prototyping II was produced, a formative evaluation was then carried out in the form of expert judgment and one-on-one trials. The validation of the ludo game was carried out by eight validators, including five validators who were experts in chemistry including three chemistry lecturers and two chemistry teachers and three validators who were experts in the media field. Validation needs to be carried out by several experts or those who have experience to assess the feasibility of the product produced. Material validation is divided into two, namely content validation and construct validation. The results of content validation data processing using the Aiken`s V formula for all aspects are in the valid category. The data shows that the ludo game already has compatibility indicators of competence achievement in reduction and oxidation reaction materials with basic competencies based on Permendikbud no 37 of 2018. The questions presented in the form of ludo game are in accordance with the indicators of competency achievement and the characteristics of the reaction material reduction and oxidation. This shows that the designed media is able to help individuals achieve learning goals, where the questions in the ludo chemistry game contain factual and conceptual knowledge in accordance with GPA material in language that makes it easy to understand. The use of learning media must be relevant to the competence and content of the material itself. For the compliance of GPA with KD results is 0,9 (valid category), the accordance with the GPA is 0,9 (valid category), packaged in the form interactive instructional games is 0,9 (valid category), media contains images/ icons/ symbols to related to the material 0,9 (valid category), media displayed according to chemical science 0,8 (valid category), media that contains question than can strengthen the material 0,8 (valid category), media related to characyeristic questions 0,9 (valid category), aesthetics 0,8 (valid category), media that used for learning 0,8 (valid category), media that can make students active in learning 0,9 (valid category).

For construct validity using the Aiken`s V formula for all aspects both in terms of content components 0,8 (valid), presentation components 0,8 (valid), linguistic components 0,9 (valid) and graphical 0,8 (valid) components are in the valid category. Content component assessment is an assessment of products developed based on the relevant curriculum. Based on the results of data processing, it shows that the android-based chemical ludo game in terms of the eligibility of the content components is valid. This data reveals that the ludo game that has been developed is in accordance with the current curriculum, namely the 2013 revised 2018 curriculum which includes basic competency demands (KD) and competency achievement indicators. Learning media can be said to be valid if they are in accordance with the existing curriculum. In addition, the ludo game that has been developed has the correctness of the questions, the suitability of the practice questions with the material and the android-based chemical ludo game can solidify students' concepts of the material. All aspects of content validation, constructs and media show valid categories, but in practice there are several suggestions and criticisms from the validator on the appearance of the ludo game based android including writing inaccurate questions, choosing colors and game backgrounds, adjusting some button colors with game backgrounds and neatness of writing on GPA, learning objectives and game rules. All suggestions are welcome and the android based chemistry ludo game is revised. The purpose of the revision is to make improvements according to the suggestions from the validator.

Then a one-one trial phase was carried out with three students through a one-one trial interview sheet. Based on these results, it shows that prototype III which has been developed according to students, the cover appearance is very attractive, the game rules are easy for students to understand, the type of writing used is clear and the language is easy to understand, the color selection is good and attracts students' interest in playing it, the questions presented are easy to understand. and the opinions of students who stated that the ludo game was very helpful in strengthening the material concept of reduction and oxidation reactions. This expert assessment and one-on-one trial resulted in a valid prototype III.

The next step is the stage of forming prototype IV with small-scale trials (small group). The practicality of the ludo game was carried out with 2 chemistry teachers and 12 students. Based on the results of data analysis, the practicality of the Android-based chemical ludo game is assessed from 3 aspects, namely ease of use, efficiency of learning time and benefits. A media is said to be practical if it is easy to use in learning. The aspect of ease of use relates to the use of the Android-based chemical ludo game in the learning process. The aspect of time efficiency relates to the use of learning time to play the ludo game as exercise material. While the benefit aspect relates to the benefits obtained after learning to use the ludo game on reduction and oxidation reaction material. The results of ease of use component assessment by teachers is very practical for the rules of games 90%, the questions presented 90%, the contents 90%, the language used 90%, the writing style used is clear 90%, the material is easy to use 90%, the application of concept 90 %, the images, symbols, icons are clear 90%, and the material can be used repeatedly 90%. Based on the results of processing the practicality test questionnaire data, the percentage value for the ease of use aspect of the teacher's response and student responses was obtained in the very practical category. The practicality percentage is 86% - 100% it is said to be very practical. The assessment of the ease of use aspect of teacher and student responses has a very practical category. This proves that, the ludo game in terms of clarity of language, writing, clarity of questions and game rules is easy to understand and clear. So that overall, the ludo game is easy to use in learning and the instructions for use are easy to understand. Judging from the aspect of efficiency of learning time obtained from the responses of teachers and students are in the very practical category. This shows that using the Android-based chemical ludo game makes learning time more efficient and students can learn at their own pace.

Then to test the effectiveness in SMA Negeri Binaan Khusus Kota Dumai for the 2022/2023 academic year, seen from the results of the pretest (pretest) and posttest (posttest) then analyzed to get the average N-Gain of the experimental class and the control class. To do this, before the learning process on the reduction and oxidation reaction material is carried out, each sample class, namely the experimental class and the control class, is first given an initial test (pretest) which aims to determine the initial abilities of students related to the material to be studied. With the average pretest value, it shows that the two sample classes have initial abilities that are not much different. The next activity after the pretest is carried out in the experimental class and the control class is continued with learning on the reduction and oxidation reaction material. In the learning process, each sample class is given the same treatment. Learning materials, learning resource books, time allocation, teaching teachers, and practice questions in each sample class are the same. Different treatments are given when giving exercises, in the experimental class using android-based chemical ludo game media on the reduction and oxidation reaction material, while in the control class the exercise is done conventionally, such as using paper. The exercise using android-based chemical ludo game media for reduction and oxidation reaction material produces a greater total range of correct answers compared to the exercise using only paper. The total range of correct answers that can be answered by students by doing the exercise using android-based chemical ludo game media in the experimental class, namely in the blue series, the least total correct answers obtained by students are 15 answers and the most are 21 answers out of 34 questions, in the green series, the least total correct answers obtained by students are 14 answers and the most are 21 answers

out of 34 questions, in the yellow series, the least total correct answers obtained by students are 13 answers and the most are 22 answers out of 34 questions, and in the red series, the least total correct answers obtained by students are 14 answers and the most are 30 answers out of 34 questions. Meanwhile, in the control class that worked on the exercises conventionally by using the printout of the questions, the total correct answers in the blue series were at least 11 correct answers and at most 15 correct answers out of 34 questions, in the green series the total correct answers were at least 12 answers obtained by students and at most 16 answers out of 34 questions, in the yellow series the number of correct answers was at least 8 and at most 17 answers out of 34 questions, and in the red series the number of correct answers was at least 10 and at most 19 answers out of 34 questions.

Based on the results of the exercises for the two sample classes, it can be seen that more correct answers were obtained in the experimental class compared to the control class. This is because students are enthusiastic about the presence of the chemical ludo game media as an alternative to working on exercises in the experimental class, so that students are more enthusiastic in working on the exercises. After being given different treatments when giving exercises to students, then the two sample classes were given a final test or posttest. The final test (posttest) aims to determine the learning outcomes achieved by students after being given treatment. The posttest scores in the experimental class and the control class with an average posttest score for the experimental class of 86 and the control class of 65. From the average posttest score, it can be seen that the posttest score for the experimental class is higher than the posttest score for the control class. The average score of the total difference in the pretest and posttest scores for the experimental class is 51.06 and the control class is 31.65, which means that there is a significant difference. This indicates that there is an influence in giving different treatments to the sample class on student learning outcomes.

Then, we calculate the average N-Gain result for the experimental class is 0.79 in the high category and the control class is 0.47 in the medium category. This shows that there is an increase in students' cognitive learning outcomes which are better in the experimental class using the android-based chemical ludo game media material for reduction and oxidation reactions compared to the control class which only uses paper (Mursiti & Binadja, 2009). In accordance with the statement of Santana Purba et al (2021: 64) that the game is said to be effective if there are differences in the N-Gain of the experimental class and the control class, and the N-Gain value of the experimental class is higher (Santana Purba et al., 2021). The results of the normality and homogeneity tests for the two sample classes show that the two sample classes, namely the experimental class and the control class, are normally distributed with the results the value of experiment class and control class, that is 0,11859 and 0,195624 with Dtable 0,22743 and have a homogeneous variance with Ftable 1,7878 and Fcount 1,2531. Furthermore, testing the hypothesis with the t test because the sample class is normally distributed and has a homogeneous variance. The results of the hypothesis test show that tcount > ttable that is 7,84527 > 1,668, so that H0 is rejected and H1 is accepted. So it can be concluded that the use of android-based chemical ludo game media material for reduction and oxidation reactions is effective in increasing student learning outcomes significantly in the cognitive domain in class X SMA/MA.

CONCLUSION

A ludo game based android has been developed as a learning media on redox material for class X using the Plomp development model which has been developed is valid, practical, and effective and can be used in the learning process. This is supported by the posttest scores in the experimental class and the control class with an average posttest score for the experimental class of 86 and the control class of 65. From the average posttest score, it can be seen that the posttest score for the experimental class is higher than the posttest score for the control class, which means that there is a significant difference. This indicates that there is an influence in giving different treatments to the sample class on student learning outcomes.

Hopefully this android-based chemistry ludo learning media can be used by teacher and be an inspiration for teachers of other subjects to continue to develop innovative and technology-based media.

RECOMMENDATION

The development of a valid, practical and effective android-based ludo game on redox material is expected to be useful for further research and can be used as an alternative for providing exercises to students in chemistry lessons to increase student enthusiasm for learning.

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