
Development of E-Worksheets on Reaction Rate Topics

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Abstract

Students need ICT-based teaching to understand chemistry containing abstract and macroscopic concepts. The study aims to develop electronic worksheets using the Adobe Acrobat 11 Pro application. The Plomp model was used to calculate the total percentage of data collected from expert validation sheets and response questionnaires for educators and students. The results showed that the average percentage score obtained by material and media experts was 88.92% and 90.99%, respectively, in the very valid category. The results of the responses of educators and students in the small-scale test obtained an average percentage score of 88.42% and 85.35%, respectively, with very good and very interesting categories. Based on the result, the electronic worksheets developed for the reaction rate material are feasible for the learning process.

Keywords: Adobe Acrobat 11 pro, e-worksheet, information and communication technology (ICT), rate of reaction

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1. Introduction

Learning media is a tool that can help the teaching and learning process so that the meaning of the message conveyed becomes clearer and the educational or learning objectives can be achieved effectively and efficiently (Nurrita, 2018). The 21st century learning prepares generations to welcome advances in information and communication technology in social life. The 21st century learning is an implication of the development of society, which is characterized by the development of digitalization (Syahputra, 2018).

A good learning process is created using varied teaching materials. One of the components of teaching and learning activities that can support learning is the student worksheet which is a summary sheet of a material, directing students according to learning instructions and basic competencies to be achieved (Rahayu, 2020).

Chemistry is a branch of science related to studies of the structure, composition, and changes that occur in matter. The reaction rate is one of the high school 11th grade chemistry concept that requires a clear understanding. The character of the reaction rate concept is abstract, so it needs high reasoning ability to learn it (Tim Pengembang Ilmu Pendidikan FIP UPI, 2009).

The results of interviews with chemistry subject teachers at SMAN 6 and SMAN 2 Pekanbaru obtained information that when face-to-face learning is constrained by the Covid-19 pandemic, it still uses teaching materials in printed form, therefore it has not been able to facilitate the teaching and learning process optimally, so it requires innovative teaching materials and can be used independently. Field studies showed that students are allowed to bring notebook or gadget to school. This should be optimized by teachers to carry out ICT-based learning. Ideas or paths that can be taken to reduce the

impact of these problems are to present innovative teaching materials by utilizing electronic media in the form of electronic-student worksheets (e-worksheet) (Febriyanti et al., 2017).

According to this study, e-worksheet can be developed using Adobe Acrobat 11 pro extended application. Based on research, this application is not only in textual form but is able to present more complete information by integrating several media such as video, audio, images, animation, and flash. In addition, the Adobe Acrobat 11 pro extended application facilitates students to work directly on the given e-worksheet.

The design of interactive teaching materials based on Information and Communication Technology (ICT) aims to clarify the delivery of messages and information with the help of films, slides, videos, animations or images to overcome the limitations of senses, space, time, and objects (Trianto, 2011). ICT-based teaching materials can describe chemical concepts that include macroscopic and microscopic aspects with readings, illustrations, animated movements, musical sounds, and video shows so that students can have a complete mastery of the concept. The delivery of material to students can be simplified and concepts that are abstract can be visualized (Sadiman et al., 2011).

Astuti (2016) has conducted research on electronic books using Adobe Acrobat 11 pro extended application with product ratings in the excellent category. Based on the background, the development of e-worksheet using Adobe Acrobat 11 pro extended for reaction rate material was carried out.

2. Research Method

This research method was based on an R&D approach with a Plomp model (2013), to produce and test how the product affects (Sugiyono, 2011). The result of this study was in the form of e-worksheet using Adobe Acrobat 11 for reaction rate material as shown in Figure 1.

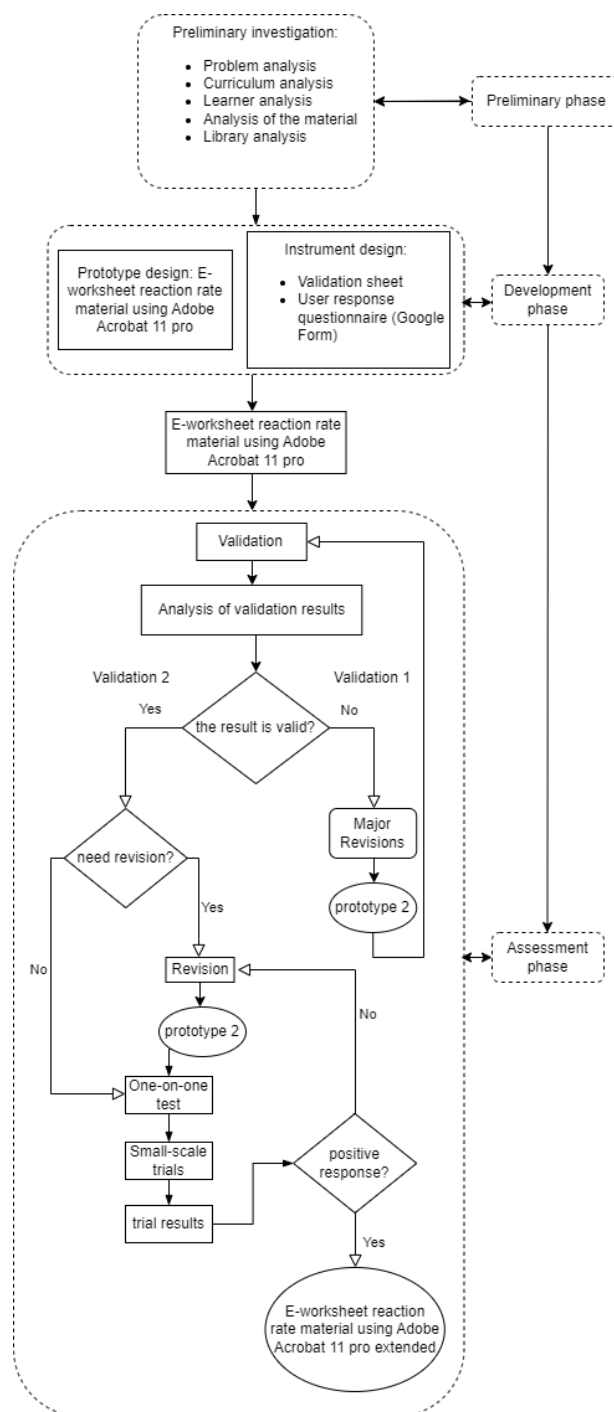


Figure 1. E-worksheet Development Flow Using Adobe Acrobat 11 Pro on the Reaction Rate Materials Based on Plomp Model

Data analysis techniques were obtained from the percentage score of validation assessment and user response. Determining the percentage of validator assessment using the following formula:

$$P = \frac{\sum X}{\sum xi} \times 100\%$$

Informations:

P : Percentage score (rounded up)

$\sum x$: Number of respondents' answer scores in one item

$\sum xi$: The ideal number of scores in one item

The Plomp model was chosen as a research method because from step by step it lists all development functions that are synchronized with the specificity and uniqueness of the research to be carried out, in addition, it is also explained in detail so that it is more flexible (Rochmad, 2012)

The criteria for the level of validity according to Riduwan (2012) on the percentage analysis of the products from development are presented in Table 1.

Table 1. Product Eligibility Criteria

Percentage	Criteria
80 -100	Very worthy/very valid/does not need to be revised
61-80	Eligible/valid/no revision needed
41-60	Less feasible/invalid/needs revision
21-40	Not feasible/invalid/needs revision
< 20	Very unfit/very invalid/needs revision

The criteria for the product attractiveness according to Akbar and Sriwiyana (2010) is shown in Table 2.

Table 2. Product Attractiveness Criteria

Percentage	Qualification
80%-100%	Pull
60%-79%	Quite interesting
50%-59%	Less attractive
< 49%	Unattractive

3. Result and Discussion

E-worksheet on chemistry learning using Adobe Acrobat 11 pro extended application for reaction rate material generated in this study has been declared valid. E-worksheet product was created and designed by

researchers themselves so as to produce interesting teaching materials for students to easily understand learning.

The research process for the development of e-worksheet began with an initial stage by analyzing problems, curriculum, materials, and libraries. From the results of field studies in two schools, SMAN 6 and SMAN 2 Pekanbaru, the following information was obtained: 1) students have difficulty in learning the reaction rate material due to limited face-to-face learning, 2) teachers only use teaching materials available at school in the form of printed books so that students are less interested in learning.

After obtaining information about material in chemistry that is considered difficult by students, it was continued with the analysis of the curriculum used, the 2017 revised K13 curriculum. This reaction rate material has a character that really requires a clear understanding of concepts, applicative, and is related to familiar phenomena or activities, so the reaction rate material is interesting for learners to learn even though the learning process is carried out independently.

Students in grade 11 of SMAN 6 Pekanbaru are on average 16-17 years old. Therefore, the product was developed according to Piaget's learning theory that students are already able to think critically and are able to infer existing information (Siswoyo et al., 2013). As a supporter of the research process, data was collected from various references and literature such as journals, articles, books, and internet.

The procedure for developing e-worksheet on reaction rate material in this study was designed based on the need to improve the learning conditions of students. Therefore, any development design was carried out by describing indicators of competence achievement. Prototype product was designed to be easy to use as well as attractive to users. The sequence of development designs that has been implemented is: 1) e-worksheet front page design: e-worksheet title, subject, class, and

semester, identity of the author; 2) e-worksheet preliminary design: study instructions and competency achievement indeks; 3) e-worksheet content design: teaching materials; learning videos; sample questions; 4) design of closing parts: bibliography.

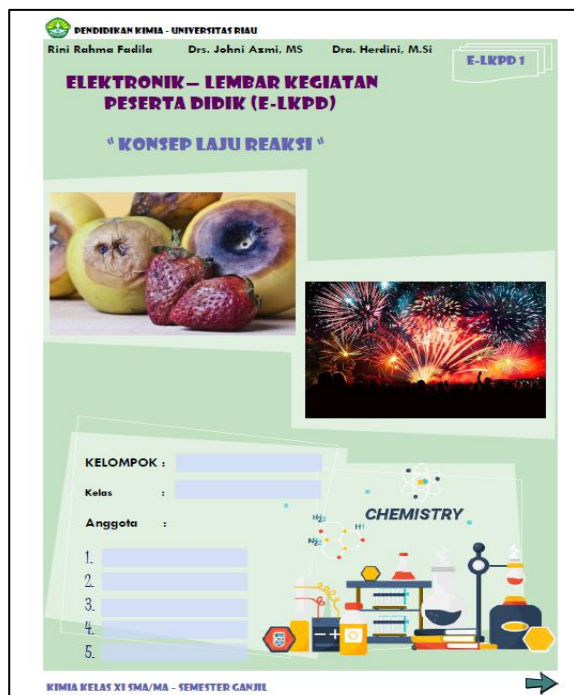


Figure 2. E-Worksheet Front Page Design

E-worksheet was also arranged according to the learning objectives on the reaction rate material so that the product was designed for five meetings. Each meeting was designed to be as attractive as possible so that the e-worksheet on reaction rate material using Adobe Acrobat 11 pro is easy to use and appropriate to support current distance learning activities. Thus, at the end of learning, students' understanding of the material learned can increase. A more detailed explanation of the results of the product design that has been made are shown in Figures 2 and 3.

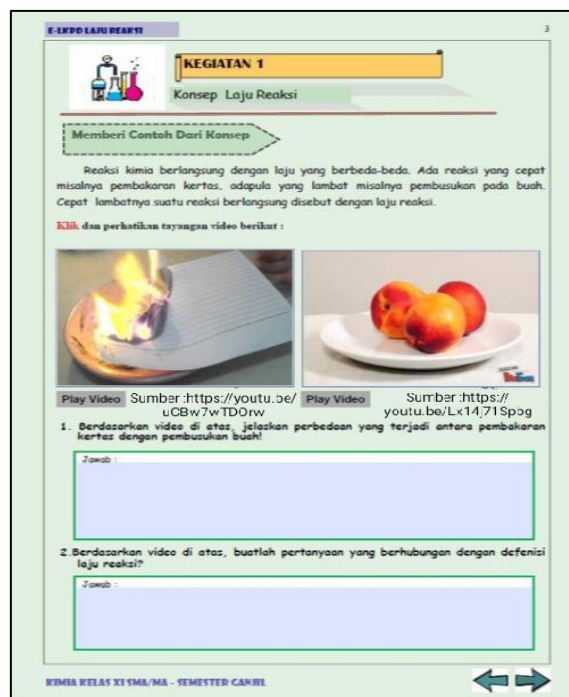


Figure 3. E-Worksheet Content Page Design

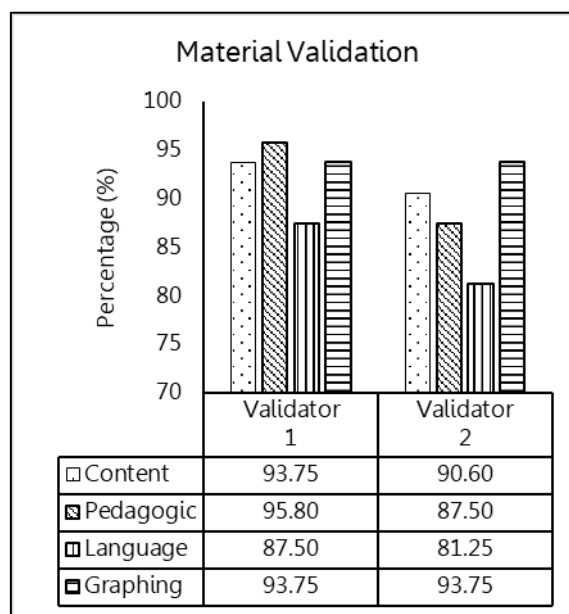


Figure 4. Material Validation Percentage Graph

After the product has been finished manufacturing, the next stage was the assessment of the product. Assessment in the form of validation sheets related to reaction rate material was carried out by two expert lecturers as validators. The data obtained from the assessment of validation sheets was in the form of a scale of 1-4. The results obtained were in the very valid category

with a percentage of 88.92%. This shows that validators assessed that the material presented in the e-worksheet can improve students' understanding of the reaction rate material. The validation results is shown in Figure 4. The validation stage was carried out in order to obtain a product that is in accordance with the assessment based on the national standards that have been set.

The assessment of media validation sheets was carried out by two expert lecturers as validators. The aspects assessed were aspects of e-worksheet page size or orientation, cover design, and content presentation, with a percentage of 90.99%. This means that the e-worksheet media design is attractive to students in the learning process. The results of validation by the two validators are shown in Figure 5.

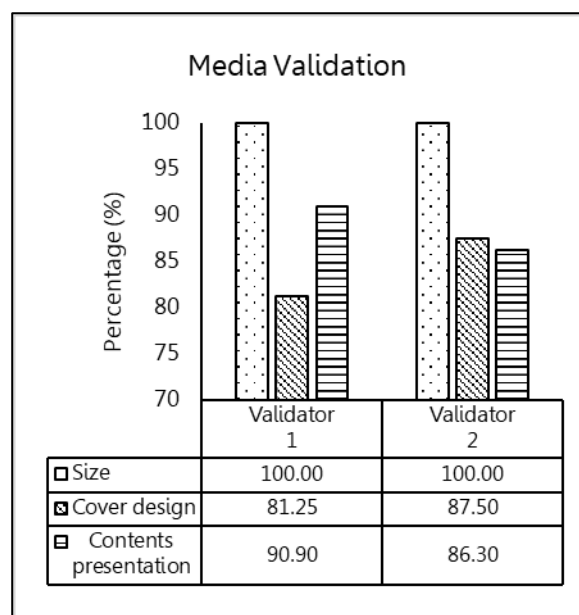


Figure 5. Media Validation Percentage Graph

If the validation of e-worksheet material is in the valid category with a percentage of 93.82% (Haqsari, 2014), then this shows that validators assess the material presented in e-worksheet can make it easier for students to understand the reaction rate and has been adjusted to national education standards or curriculum. In addition, in the media aspect, results were also obtained in the very valid category with a percentage of 90.99%. This is in accordance with (Astuti,

2016) that the validation of teaching material media using the Adobe Acrobat 11 pro extended application is in the very valid category with a percentage of 89%, meaning that the design of teaching material media is attractive and easy to use in the learning process.

The learning process using ICT-based media that can contain flash animations will ease or make it easier for students to understand the lesson and follow the learning process well (Tüysüz, 2010).

The media validation process lasted for approximately one month. The material was validated in two stages. In the first validation from media experts, suggestions and input were obtained that the media still needs revisions and additions that are in accordance with the level of ease of use by students. This indicates that the results obtained at the first stage of media validation belong to the category of invalid. This means that in the first stage of validation, the media is not yet suitable for use, so further revisions were carried out until the media with valid material is obtained and suitable for use in the learning process.

After the product has been declared valid, it proceeded to the one-on-one product test stage by means of students who have actually learned the reaction rate material were asked to work directly on the e-worksheet that has been developed. One-on-one tests were carried out on three students who were around the researcher's neighborhood due to the constraints of the Covid-19 pandemic. Two students of SMAN 1 Lubuk Sikaping and one student of SMAN 3 West Sumatra. The percentage result obtained from the one-on-one test was 80.35%. Students took approximately 50 minutes out of the 45 minutes provided to work on e-worksheet because they asked a lot about the use of the product. This is considered reasonable because students use teaching materials for the first time in the form of an e-worksheet. This stage is expected to be able to improve the e-worksheet product after obtaining

suggestions and input from each student by revising it again. One of the suggestions or inputs from students regarding the content of e-worksheet is the addition of chemical animation to the reaction rate material.

One of the advantages of the e-worksheet product that has been developed is that it can contain chemical animations that attract students to learn chemistry and work on the e-worksheet given by the teacher.

The learning process constrained by the Covid-19 pandemic resulted in small-scale trials at SMAN 6 and SMAN 2 Pekanbaru being carried out online. The data obtained was in the form of teacher response sheet questionnaires and student response sheet questionnaires using google forms.

The small-scale trial stage that has been carried out was taking response questionnaires from three chemistry teachers at SMAN 2 and SMAN 6 in Pekanbaru. This response aims to see the user's response to the attractiveness of the e-worksheet product in the reaction rate material that has been developed. The teacher's response to e-worksheet as a whole was excellent. The result of the average teacher response questionnaire obtained was 88.42% with good categories. The material presented in the e-worksheet is able to support the achievement of learning objectives in the reaction rate material. The design and appearance presented can trigger the interest of students so that it is easy to learn and understand the material being studied. The success of student learning is influenced by teaching materials used by teachers equipped with innovative media, so as to increase enthusiasm and learning outcomes, as well as student motivation during learning activities (Handhika, 2012).

The ease of e-worksheet for teachers is not only in the aspect of use but also in the design of teaching materials for teaching and learning activities with simple and easy steps. Adobe Acrobat 11 pro is a learning support software both in terms of creation and use that is good and interesting.

From the research data, this e-worksheet can support a learning atmosphere that is different from before. Today's learning relies heavily on technology and networks, e-worksheet can be attractively packaged by combining images, text, and video, but it is still easy to use in the learning process. During the evaluation process, teachers can also easily collect and assess the e-worksheet that students have done through various supporting media such as classroom, email, whatsapp, and others.

The results obtained on e-worksheet in the form of questionnaire data on the response of students at SMAN 6 and SMAN 2 Pekanbaru as many as 20 people through the use of google forms resulted in a percentage of 85.35% with a very interesting category. The percentage of student response results obtained was 85.35%. Based on the assessment criteria according to Akbar and Sriwiyana (2010), the percentage was categorized as very interesting. The material presented was in accordance with national educational standards. This means that the e-worksheet developed on the reaction rate material is interesting for students and can also be used to overcome the obstacles of the face-to-face learning process. This finding is also in line with Anggraina (2019), the results of the research conducted obtained a student response of 85.96%, the products developed were considered attractive and suitable for use in learning. The design of e-worksheet that is not monotonous and attractive makes students feel enthusiastic when they see it. Meanwhile, the advice from students after working on e-worksheet was that the language contained in e-worksheet should be simplified and added animations and other graphic designs so that e-worksheet becomes more attractive.

E-worksheet developed using the Adobe Acrobat 11 pro application is very interesting to use in the learning process independently but requires other supporting applications such as Adobe Acrobat Reader 11 pro or Adobe Acrobat Reader pro DC. E-worksheet which was developed using Adobe Acrobat 11 pro application, so that it is not easily changed by students, an additional application, Adobe Acrobat Reader 11 pro, was used because the

software can only facilitate students to read and do e-worksheet. In addition, the capacity of the resulting product is large enough so that it is easy to operate, and it is recommended to use a computer or notebook.

4. Conclusion

E-worksheet was developed based on the Plomp model, with three stages, consisting of the preliminary phase, product development, and assessment stage. E-worksheet can be designed using Adobe Acrobat 11 pro extended application. The application can combine other media such as videos, animations, flashes, and images interestingly, and students can also type directly the answers on the e-worksheet. The product has been declared very valid and can be used in schools as an independent learning material for grade 11 high school students/ equivalent, with a percentage of material validation of 88.92% and media validation of 90.99%. E-worksheet based on Adobe Acrobat 11 pro on this reaction rate material also received a positive response for use by teachers and students with a percentage of 88.42% and 85.35% in the very good and very interesting category.

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