



The Validity and Reliability of Electronic Students' Worksheet Based on Discovery Learning on Thermochemical Topic

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Abstract

This study aims to evaluate an electronic student worksheets product based on discovery learning that valid and reliable on thermochemical topic. The development of electronic student worksheets-based on discovery learning follows the steps of the 4D development model, namely define, design, develop, disseminate. The feasibility test of the developed learning device was analyzed using a validation sheet. The assessment of the feasibility of the learning tools developed was carried out by three expert validators who are competent in the field of education at the University of Mataram. Criticisms and suggestions given by the validator are used as improvements to the developed electronic student worksheets. Data analysis was carried out using descriptive percentage techniques, Aiken's V index, and percentage of agreement. The validation results show that the developed electronic student worksheets component is included in the valid category with an average validity value of 0.79. The results of the agreement between validators showed that the developed electronic student worksheets had a percentage of more than 75% which was included in the reliable category. Based on the results of the validation and reliability tests, the electronic student worksheets based on discovery learning developed can be concluded to be valid and reliable. A more complete and detailed explanation of the development of electronic student worksheets based on discovery learning and validation results is presented in this article.

Keywords: Electronic Student Worksheets, Discovery Learning, Validity, Reliability

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INTRODUCTION

One of the countries affected by Corona Virus Disease or Covid-19 is Indonesia which affects various sectors of life in the economic, social, tourism and education sectors (Wulandari et al., 2020). The application of the term social distancing has an impact on interactions carried out by the community, this is done in order to break the chain of virus spread (Mustakim, 2020). Based on the policy regarding education during the emergency period of the spread of Covid-19, namely using the term distance learning or online. (Gunawan, et al 2021).

Online learning is learning that is done not face to face, but using information and communication technology systems that can help the learning process that is carried out even though it is far away (Handarini & Wulandari, 2020). Information and communication technology systems currently play an important role in the field of education (Indrayana and Sadikin, 2020; Ramdani et al., 2020).

The existence of learning innovations as outlined in teaching materials can provide better learning outcomes and increase the effectiveness of learning for students (Korniawati et al., 2016). The presentation of teaching materials developed is not only limited to print media, but can be in the form of digital media (Mascita, 2021). Student worksheets developed

electronically is one of them. electronic student worksheets is a student activity sheet that is done digitally and is carried out systematically and continuously for a certain period of time (Yelianti et al., 2018).

One thing that needs to be adapted in the learning process is the existence of electronic student worksheets which is developed in an online form that is easily accessible and attractive to students (Yustiqvar, et al., 2019b; Hidayah et al., 2020). The Electronic student worksheets developed using Flip PDF Professional has the characteristics of being presented as attractively as possible, making it easier for students to learn. There are learning videos that can help clarify material that cannot be conveyed through writing, and there are interactive quizzes that are able to hone students' skills directly so that it generates student interest (Sriwahyuni et al., 2019).

Chemistry is seen as a process and product carried out by scientists to obtain knowledge by using scientific methods or methods (Hadisaputra, et al., 2019; Hemayanti et al., 2020). Students who learn about chemistry do not just memorize information, but also use a scientific attitude to make a decision (Soenarko et al., 2018). Discovery learning involves formulating and testing hypotheses, not just reading and listening to the teacher. Learners move from studying specific examples to formulating rules, concepts, and general principles (Munandar et al., 2016). This learning requires the activeness of students to be able to interact in developing and exploring teaching materials, namely student worksheets with various activities including stimulus, problem identification, data collection, data processing, proof, and conclusions that are adapted to a scientific approach (Erdi et al., 2017).

Based on the results of observations on chemistry subjects at SMAN 6 Mataram, information was obtained that the teaching materials used by students were in the form of modules and student worksheets provided by the teacher. The student worksheets used has not been adapted to the assessment of skills, especially decision-making skills and attitude assessment, especially scientific attitudes. The average value of the mid-semester assessment (PTS) of chemistry class XI MIPA at SMAN 6 Mataram is 66.8 which is still below the Minimum Work Completeness (KKM) which is 75. This is because many students are only able to memorize well the subject matter they receive, but in fact have not been able to understand it. Most students also have not been able to connect what they learn with how that knowledge will be used or utilized. Decision-making skills in students have not been trained properly. It has been confirmed by the chemistry teacher at the school that there has never been an attempt to see and assess students' decision-making skills. In addition, the thing that affects is the lack of student discipline in doing assignments, causing students' decision-making abilities and scientific attitudes to be not optimal. Decision-making skills and scientific attitudes affect student learning outcomes (Tanglang & Ibrahim, 2016; Maretasari & Subali, 2012).

Before implementing electronic student worksheets in learning, the developed electronic student worksheets must first be tested for feasibility. Learning tools need to be tested for validity and reliability to ensure the quality of the developed learning tools (Zakaria et al., 2020). This article will describe the results of the validity and reliability test of developing discovery learning-based worksheets that are ready to use.

METODHS

This research is the part of research and development (R&D). The product developed is an electronic student worksheets based on discovery learning (Sugiyono, 2018) validity and reliability is evaluated in this study. The feasibility test of the developed learning device was analyzed using a validation sheet. The assessment of the feasibility of the learning tools developed was carried out by three expert validators who are competent in the field of education. The feasibility analysis of the developed learning device was analyzed using the Aiken's V equation (Aiken, 1997).

$$V = \frac{\sum(s)}{n(c-1)}$$

Keterangan :

- V = Expert agreement index on item validity
 s = $r - l_o$
 l_o = The lowest validity score
 c = The highest validity rating score
 r = The score given by the assessor
 n = Number of validators

The value obtained is confirmed with the eligibility criteria. The eligibility criteria can be seen in Table 1 (Arikunto, 2012).

Table 1. Instrument Eligibility Criteria

Value Range	Validation Level
0.00 - 0.20	Totally invalid
0.21 - 0.40	Not valid
0.41 - 0.60	Quite valid
0.61 - 0.80	Valid
0.81 - 1.00	Very valid

In addition to the validity test, a reliability test was also conducted on the learning tools developed using the percentage of agreement formula. Learning tools are said to be reliable, if the percentage of agreement value is 75% (Nasrah et al., 2017). The percentage of agreement (PA) formula is as follows.

$$PA = 1 - \frac{(A - B)}{(A + B)} \times 100\%$$

Keterangan:

- PA = *Percentage of agreement*
 A = The frequency with which an aspect of behavior is observed by an observer who provide high observations.
 B = The frequency with which an aspect of behavior is observed by an observer who give low observation

RESULTS AND DISCUSSION

The results obtained from this study are the result of developing an electronic student worksheets based on discovery learning. The first stage is the define stage. At this stage there are several steps that need to be carried out, namely preliminary final analysis, student analysis, curriculum analysis, concept analysis, task analysis, and analysis of learning objectives (Noprinda and Soleh, 2019). Based on the results of the analysis, it can be concluded that the teaching materials used by students are student worksheets which have not been adapted to the assessment of skills, especially decision-making skills and attitude assessment, especially scientific attitudes. Students are less than optimal in decision-making and scientific attitude during the learning process.

The second stage is the design stage. At this stage, media preparation, format selection, and initial design are carried out (Yusnelti & Asrial, 2019). The developed media are teaching materials in the form of discovery learning-based electronic student worksheets which are arranged according to the needs of students. Discovery learning-based electronic student worksheets is designed in the form of a flip book. Electronic student worksheets preparation using Corel Draw and Microsoft Word saved in PDF format with a size of 21 cm x 29.7 cm (A4). The file is then converted with the Flip PDF Professional application. The

content of the electronic student worksheets refers to the thermochemical material in K.D 3.4 which is equipped with pictures, videos, and exercises that can help students' skills and attitudes. The electronic student worksheets that has been compiled and the format chosen is then carried out the final process to be used by students in learning. Supporting learning tools, including syllabus, lesson plan design, decision-making skill questionnaires, scientific attitude questionnaires, and observation sheets were also prepared.

The third stage is the development stage. At this stage, validation of the learning devices that have been prepared is carried out. The validity of learning tools is assessed based on the results of the scores given by three validators in the field of education. This validation stage aims to obtain acknowledgment or validation of the suitability of the product developed with the needs so that the product developed can be said to be suitable for use in learning. A good product must meet two important requirements, namely validity and reliability (Laksmiwati et al., 2019). The results show that the Aiken's V index obtained is more than 0.6, which is 0.79, which means that the learning device developed has valid validity. Details of the data from the validation results are presented in Table 2.

Table 2. Expert Validation Results

Evaluator	Syllabus	Lesson Plan	Design electronic student worksheets	Theory electronic student worksheets	Decision-making skills questionnaire	Scientific Attitude Questionnaire
Validator I	3.57	3.50	4.59	4.68	4.25	4.25
Validator II	2.93	2.69	3.81	3.96	3.63	3.88
Validator III	3.50	3.50	4.56	4.52	4.13	4.13
Average	3.33	3.23	4.32	4.39	4.00	4.08
Indeks Aiken's V	0.78	0.74	0.83	0.85	0.75	0.77
Validity Level	Valid	Valid	Very Valid	Very Valid	Valid	Valid

The calculation of agreement between validators obtained shows that the developed learning tool has a percentage of agreement of more than 75% which is included in the reliable category. If the resulting percentage value exceeds 75%, it means that there are similarities in perceptions between validators based on the instruments used so that the product is feasible to use (Kusumaningrum and Djukri, 2016). Details of the data reliability results are presented in Table 3.

Table 3. Expert Reliability Results

Learning Media	V 1.2 (%)	V 1.3 (%)	V 2.3 (%)	PA (%)	Category
Syllabus	90.41	98.98	91.43	93.61	Reliabel
Lesson Plan	86.73	100.00	86.73	91.15	Reliabel
Design Electronic Student Worksheets	89.86	98.65	91.18	93.23	Reliabel
Theory electronic student worksheets	91.89	98.22	93.65	94.59	Reliabel
Decision-making skills questionnaire	91.91	98.61	93.25	94.59	Reliabel
Scientific Attitude Questionnaire	95.44	98.61	96.83	96.96	Reliabel

The validator provides suggestions and input to researchers to be improved on the developed device. Inputs and suggestions for improving the developed electronic student worksheets are summarized in Table 4.

Table 4. Expert Advice and Repair Results electronic student worksheets

No.	Suggestion	Repair
1	Write the author's name on the cover.	The author's name is written on the cover of electronic student worksheets.
2	Replace the description of "Introduction" which	The description of the introduction was replaced

No.	Suggestion	Repair
	briefly explains the contents of the student worksheets.	by briefly explaining the contents of the electronic student worksheets.
3	Reduce the image on the cover so it's not too messy	The image on the cover is customized typical of thermochemistry in everyday life.
4	Cover student worksheets are made simpler with pictures that show typical thermochemistry (in everyday life).	The cover of electronic student worksheets is simplified and uses typical images of thermochemistry in everyday life.
5	In the 2nd video the writing is too small so it is difficult to read clearly.	The electronic student worksheets page can be enlarged so that it can overcome the writing that looks small on the display.
6	Sentences in questions are kept simple and clear.	Sentences in questions are presented briefly and clearly.
7	Student worksheets for each meeting are adjusted to the learning model and research variables.	Electronic student worksheets activities are adapted to the discovery learning model and indicators on research variables.

Based on the results of the study, it showed that the learning tools consisting of a syllabus, lesson plans, electronic student worksheets based on discovery learning, a decision-making skill questionnaire, and a scientific attitude questionnaire that were developed gave valid and reliable results so that they were suitable for use in learning chemistry on thermochemical material.

The electronic preparation of student worksheets is adjusted to the characteristics of the material and has been facilitated with indicators of decision making and scientific attitude. Electronic student worksheets are arranged with interesting media such as pictures and simulations. This is in accordance with previous research from (Yustiqvar et al, 2019b) learning using electronic media in the form of audio, video, and posters can make students more enthusiastic in learning. In addition, research from (Kurniawati et al., 2018) using visual-based media such as videos, pictures, and comics has proven to be effective for improving decision-making skills.

CONCLUSION

The conclusion of this study is that discovery learning-based electronic student worksheets is feasible to use in learning. The discovery learning-based electronic student worksheets that was developed showed valid and reliable results. Criticisms and suggestions given by the validator are used as improvements to the electronic student worksheets.

RECOMMENDATION

The electronic student worksheets which was developed further can be accessed on various devices without having to be connected to the internet. Further researchers can develop electronic student worksheets on chemistry learning materials other than thermochemistry K.D 3.4 material.

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