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Development of Constructivism-Base Student Work Sheets of Aldehydes and Ketone Materials for Organic Chemistry II Students

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Abstract. Teaching materials that were applied previously in the form of MFIs are not yet constructivism-based. During the time, the applied student worksheet (LKM) is monotonic so that students are less motivated in the learning process, as the solution, a constructivism-based LKM need to be developed. The research aims to develop constructivism-based Student Worksheets on aldehyde and ketone material. This type of research was Research and Development with a 4-D development model which includes Definition, Design, Development, and Disseminate. This research was only carried out until the development stage and was followed by limited trials. The research was conducted at the FKIP University of Riau. The object of the research was constructivism-based LKM. The data analysis technique used in the study was descriptive statistical analysis, which was calculating the percentage of validation values. The average score of the assessment of the five aspects of the LKM feasibility by the validator team, which was didactic, constructs of feasibility of presentation, construct of linguistic, technical feasibility, characteristics of constructivism successively have a score of 98%, 100%, 99%, 100% and 100%, respectively. The average score of overall validation of constructivism-based Aldehyde and Ketone LKM is 99.39% with a valid feasibility category, meaning that the developed LKM are feasible to use in the real teaching.

Keyword: *Aldehydes and Ketones, Constructivism, Development, Student Worksheets (LKM)*

1. Introduction

Education is a very important factor for human life. Through the education, human attitudes, characters, personalities and skills will be formed to face a better future. Education is a future asset that determines the progress of a nation. Improving the quality of education must be a top priority in development (Hendra et al., 2017).

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Learning is a change in individual behavior as a result of the learning process gained in acquiring and understanding knowledge. Bloom divided educational goals into three domains; cognitive, affective, and psychomotor domains. These domains are important to improve so that they can provide experience to students to develop the abilities and opportunities of students to interact with each other in building student knowledge. It is important for lecturers to understand that students must be actively involved in learning. Some lecturers think that students can efficiently and accurately provide what they have learned as long as the lecturer communicates knowledge to students, completing the tasks through building connections and arranging lessons into meaningful concepts by themselves (Astra et al., 2015).

This development is tailored to the KKNI that is applied in curriculum development to produce more effective and directed learning outcomes. This purpose is to be able to focus on the achievement of learning directly. The achieved learning achievement has been adjusted to the KKNI standard for University level learning. Achievement of learning leads to aspects of knowledge, skills and attitudes (Alidousti et al., 2009).

The KKNI-based undergraduate curriculum is a combination of deductive mindset (theory on campus) with an inductive mindset (practice in the field), the implementation of the KKNI-based undergraduate curriculum requires each lecturer not to impose teaching, but must be replaced with learning (Maba, 2016).

Learning that is expected to guide students to be active in learning, so that learning is centered on students, one of a constructivism-based approach. Constructivism approach is one view of the learning process which states that in the process of gaining knowledge begins with the occurrence of cognitive conflict, which can only be overcome through self-knowledge. At the end of the learning process, knowledge will be built by the students themselves through their experiences from interactive results with their environment (Saefudin, 2008).

One of the problems in the world of education in Indonesia is the limited teaching materials or learning tools that facilitate students in enriching experiences, building knowledge and activeness of students, and building their own knowledge. The limitations of these learning devices will certainly affect the quality of learning, especially learning organic chemistry II. One of the teaching materials or learning devices used in the teaching is the Student Work Activity Sheet (LKM).

The use of learning resources that are not in accordance with the needs of students can experience difficulties in learning, especially if the educator's explanation as a learning process and material that is difficult and too fast or

not in accordance with the speed of learning. This will certainly trigger students to become passive learning. In addition, in the learning process in class, students tend to only receive knowledge from educators without the process of discovering or forming knowledge by self-learning. There are several basic ingredients that can be understood by the process of building student knowledge to shape new knowledge (Sepriyanti et al., 2018).

The development of teaching materials is carried out by lecturers to solve learning problems by paying attention to the target or students and also adjusting to the competencies that must be achieved (Haryanto, 2016). It is also by creating the learning innovations. Teaching materials are materials, information, tools or media that is used by lecturers to carry out learning including creating an atmosphere that encourages students to learn. The form of teaching materials can be either printed or not printed. The printed teaching materials can be in the form of lecture, problem solving guides, and study guides, while non-printed teaching material can be in the form of audio, video, film, or other multimedia needed in the learning process (Hendripides, 2018).

Student Worksheets (LKM) are one form of learning guide used in learning that functions as a student learning guide to facilitate students and lecturers in conducting teaching and learning activities. The use of LKM in learning can provide full opportunities for students to express their abilities and skills in developing their thinking processes through searching, guessing, and even reasoning.

Most of the LKM that are found today are informative, only contain summaries of material and practice exercises so students are still passive in learning activities. The material presentation of the LKM has not been able to involve students to find the concept of organic chemistry II independently and build its own knowledge so that it causes a lack of meaningful students in learning. Therefore, it is necessary to develop LKM that can guide students to be active in learning and prioritize student activities so that learning is centered on students. Based on the background described, the researcher conducted a research on constructivism-based Student Worksheets (LKM) on aldehyde and ketone material for students of organic chemistry II.

The theory of constructivism is defined as generative learning, which is creating something meaningful from what is learned. This causes a person to become knowledgeable and to become more dynamic. The constructivism approach has several general concepts:

1. Teachers actively increase knowledge based on existing experience.
2. In the context of learning, students must develop their own knowledge.

3. The importance of actively cultivating knowledge by self learners through the process of interaction between past learning and the latest learning.
4. The most important element in this theory is that someone develops himself to have active knowledge by comparing new information with existing understanding information.
5. Teaching materials must be related to students' experiences to attract the interest of learning (Suanto et al., 2017).

2. Methodology

The research was conducted at the Chemistry Education Study Program, Faculty of Teacher Training and Education, University of Riau. The research period was conducted from October 2017 to February 2018. The type of research was development research referring to the R & D (Research and Development) approach. In a research study conducted by Fitrayati et al (2016), researchers tried to develop constructivism-based Student Worksheets using a 4-D development model which was introduced by Thiagarajan and Semmel 1974. This 4-D stage consists of four stages, Define, Design, Develop, and Disseminate or adapted to 4-P, namely defining, designing, developing, and distributing (Trianto, 2012). In this study, it was carried out up to the third stages, namely Develop (development stage), while Disseminate (distribution stage) was not carried out.

The object of research is a learning device, namely constructivism-based Student Worksheets (LKM) on Aldehyde and Ketone material. The research instrument used in the assessment was the LKM validation sheet. The LKM validation sheet serves as a research instrument that aimed to determine the validity criteria of LKM that are being developed by researchers. The LKM validation sheet was assessed by 3 validators, which were 2 lecturers from the Chemistry Education, University of Riau and 1 lecturer from Faculty of Sciences, University of Riau. The assessment was to improve the development of constructivism-based LKM on Aldehyde and Ketone material.

The data collection technique in the research was the validation of the LKM by the validators. The LKM research data was collected by filling out the LKM validation sheet. These data became the raw data that was processed by researchers so that the results of data analysis can be obtained. The data analysis technique used in the study was descriptive statistical analysis, namely by calculating the percentage of validation values.

The level of product feasibility results of development research were identified with the percentage score. The greater the percentage of the

results of the data analysis is the better level of product. The criteria for the level of feasibility analysis of the percentage are presented in Table 1.

Table 1. Percentage criteria of feasibility analysis (Riduwan, 2012)

Percentage (%)	Remarks
80,00 – 100	Good/Valid/Reasonably
60,00 – 79,99	Fairly Good / Fairly Valid / Fairly Reasonably
50,00 – 59,99	Less Good / Less Valid / Less Reasonably
0 - 49,99	Not Good (Replaced)

3. Results and Discussion

The change of department images

The products that have been created from this development research are constructivism-based Student Worksheets (LKM) on aldehyde and ketone material. The research stages of developing LKM include defining (Define), design (Design) and development (Develop) stages. Analysis is a form of reasoning in understanding the relationship between the whole and its component parts and between cause and effect (Isra et al., 2018).

Define stage: It includes 3 main steps, namely "front end" analysis, student analysis, and task analysis. The results of the front end analysis are the limited number of Student Worksheets that can facilitate students in understanding the concepts of Aldehydes and Ketones and supporting problem solving abilities. While the student analysis shows that students or users of LKM Aldehyde and Ketone products are XI semester students who have an age range of 17-19 years. Task analysis produces several analyzes, including content structure analysis, concept analysis, procedural analysis, information processing analysis, and formulation of learning outcomes.

Content structure analysis is the analysis of the contents of the curriculum based on the material developed, namely aldehyde and ketone material. Development of aldehyde and ketone material is based on core competencies and basic competencies. Concept analysis produces a concept map. While the results of procedural analysis are the stages of completing the tasks used in the LKM, namely the constructivism stage which includes Exploration, Discussion and Explanation of concepts, Development and Application of concepts.

Information processing analysis produces an analysis of the need for LKM and LKM that will be developed for topics such as the Concept of Aldehydes and Ketones correctly. Explanation of the topic is still a macroscopic explanation of the concept (this explanation is usually already contained in organic chemistry books), but for an explanation of the concept

with a microscopic approach has not been seen. Microscopic explanation or explanation through pictures or illustrations (attached to the LKM) is to make it easier for students to understand the concept of aldehydes and ketones correctly. While the formulation of objectives produces learning outcomes that are formulated based on basic competencies and learning indicators that refer to the syllabus.

The Design Phase produces the initial design of the LKM and the LKM validation sheet. The design of the developed LKM contains the structure of the LKM in accordance with the Guidelines for the Development of Teaching Materials (Depdiknas, 2008) which includes the title of the LKM, LKM instructions, LKM material, and writing of the LKM answer key (lecturer guide LKM).

The Development Stage produces the design of the initial LKM, which is constructivism-based Aldehyde and Ketone Student Worksheets. The product of the LKM initial design was consulted with the supervisor so that it could get input for the development and improvement of the LKM before validation. The LKM validation aims to determine the feasibility of LKM that will be used in learning activities. The LKM validation is carried out by 3 validators, which are from 2 lecturers of Chemistry Education, University of Riau and 1 Lecturer at the Faculty of Mathematics and Natural Sciences, University of Riau. The LKM validation covers 4 aspects, namely the aspects of eligibility of content, language, presentation and graphics.

Didactic aspects

The didactic aspect has 7 components of assessment that aim to assess the accuracy of the concepts of organic chemistry II from aldehyde and ketone material in MFIs. The average score of didactic aspects validation is 98%. Based on the feasibility criteria of the learning device in Table 1, the percentage criteria for feasibility analysis of 98% are valid.

Constructing aspects of presentation

The feasibility aspect of presentation has 4 components that aim to assess the quality of the LKM. The average validation score in the presentation construct aspect is 100%. Based on the feasibility criteria of the learning device in Table 1, the feasibility criteria for percentage analysis of 100% are categorized as valid.

Language Development Aspect

The aspect of language feasibility has 5 components of assessment that aim to assess the level of readability or use of language in the LKM. The average score of validation in the language aspect is 98%. Based on the

feasibility criteria of the learning device in Table 1, the feasibility criteria for the 98% percentage analysis are valid.

Technical aspects

The technical aspect has 4 components that aim to assess the accuracy of the layout, writing, pictures or photographs and design of the LKM. The technical score validation score is 100%. Based on the feasibility criteria of the learning device in Table 1, the feasibility criteria for percentage analysis of 100% are categorized as valid.

Characteristic aspects of constructivism

The characteristic aspects of constructivism have 5 components that aim to assess the concept of organic chemistry II as outlined in constructivism steps on aldehyde and ketone material in LKM. The average score for the validation of the characteristics of constructivism is 100%. Based on the feasibility criteria of the learning device in Table 1, the feasibility criteria for percentage analysis of 100% are categorized as valid. The average score recapitulation of the five aspects of the LKM feasibility which is assessed by 3 validators can be seen in Table 2 below.

Table 2. Average assessment score of the fifth aspect of feasibility of LKM

No	Aspects	Average Score of Validator 1	Average Score of Validator 2	Average Score of Validator 3	Average Score of Validation	Grade
1	Didactic aspects	96%	100%	100%	98%	Valid
2	Contracting aspect (presentation feasibility)	100%	100%	100%	100%	Valid
3	Construct aspects (linguistic feasibility)	100%	95%	100%	98%	Valid
4	Technical aspects	100%	100%	100%	100%	Valid
5	Characteristic aspects	100%	100%	100%	100%	Valid
	Average score of all the validation				99,39%	Valid

Based on the recapitulation of the average score of the five feasibility aspects of LKM in Table 2, it can be seen the images of LKM that are valid based on the feasibility aspects, namely didactics, constructs of presentation, linguistic, technical constructs and characteristics of constructivism, as given in Figure 1.

Figure 1. LKM with Constructivism-Based

In the Figure 1, it can be seen that constructivism-based LKM are valid based on didactic aspects, presentation constructs, linguistic, technical constructs and constructivism characteristics. The average score of assessment of the four aspects of the LKM feasibility by the validator team, the didactic, constructs of presentation, language, technical constructs and characteristics of constructivism successively have a feasibility value of 98%, 100%, 98%, 100% and 100%, respectively. So, the overall average score of constructivism-based Aldehyde and Ketone LKM validation is 99.39%. Based on the feasibility criteria of learning devices in Table 1, the feasibility criteria for percentage analysis of 98.39% are valid. While the percentage of student responses to constructivism-based Aldehyde and Ketone LKM is 90.1% with very good criteria. This shows that Constructivism-based Aldehyde and Ketone LKM developed by researchers are valid and suitable for use in learning organic chemistry II.

4. Conclusion

Based on the analysis and interpretation of the data obtained from this research, it can be concluded that constructivism-based Student Worksheets (LKM) in the aldehyde and ketone material is fulfilling all the aspect of validation. The validation and limited trials process show that it fulfill didactic aspects, aspects of construct presentation, aspects of language constructs, aspects technical, and characteristics of constructivism with a positive category. Finally the LKM is ready to use in the real teaching.

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