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Work Sheet Development of High School Students Biology Based on Critical Thinking Skills on the Motion Systems Concept

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Abstract

One of the demands in 21st-century education is critical thinking skills that are considered still lacking. The 2013 curriculum learning process includes three domains, namely affective (attitude), cognitive (knowledge), and psychomotor (skills). One of the learning tools that need to be improved to achieve the 2013 curriculum goals is LKPD. This study aims to develop a student worksheet that is valid, practical, and effective. The research method used is the Tessmer design includes expert review, one-to-one, and small group evaluation. The validation subjects were three experts, the individual test subjects were three students of class XI SMAN 6 Banjarmasin, and the smalls group test subjects were six students of class XI SMAN 6 Banjarmasin. The results showed that LKPD obtained an average score of 3.25 (valid), the practicality of the content has an average score of 3.82 (good), the practicality of expectations obtained an average score of 90.48% (very good), and the effectiveness of the expectations has a very good category and good category. The score of interpersonal skills 86.17% (very good), and scores of intrapersonal skills 84.33% (very good).

Abstrak

Salah satu tuntutan dalam pendidikan abad ke-21 ialah keterampilan berpikir kritis yang dianggap masih kurang. Proses pembelajaran kurikulum 2013 mencakup tiga ranah, yaitu afektif (sikap), kognitif (pengetahuan) dan psikomotorik (keterampilan). Salah satu perangkat pembelajaran yang perlu diperbaiki agar tercapai tujuan kurikulum 2013 ialah LKPD. Penelitian ini bertujuan untuk mengembangkan LKPD yang valid, praktis, dan efektif. Metode penelitian yang digunakan yaitu desain Tessmer meliputi *expert review, one-to-one*, dan *small group evaluation.* Subjek validasi adalah 3 orang ahli, subjek uji perorangan adalah 3 orang peserta didik kelas XI SMAN 6 Banjarmasin, dan subjek uji kelompok kecil adalah 6 orang peserta didik kelas XI SMAN 6 Banjarmasin. Hasil penelitian menunjukkan LKPD memperoleh skor rata-rata 3,25 (valid), kepraktisan isi memperoleh skor rata-rata 3,82 (baik), kepraktisan harapan memperoleh skor rata-rata 90,48% (sangat baik), dan keefektifan harapan memperoleh kategori sangat baik dan kategori baik. Skor keterampilan interpersonal 86,17% (sangat baik), dan skor keterampilan intrapersonal 84,33% (sangat baik).

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A. Introduction

Human life in the 21st century has faced various kinds of problems ranging from issues of education survival. The 21st-century education is an education in the digital era, also known as the era of the industrial revolution 4.0. Education's required to be able to create a generation that is skilled in using technology can survive using life skills in the form of hard skills and soft skills whose in this cased include the ability to think at a higher level. (Trilling & Fadel, 2009 in Utami, MS, *et al*, 2017).

Critical thinking skills are part of one of the cognitive's skills (Facione, 1990) in the context of learning based on constructivism learning theory, which means building learners' understanding of unknown knowledge based on prior knowledge. According to Facione (2015), experts agree in interpreting critical thinking and critical thinking ideas. They understand critical thinking as an impetus from self-regulation through interpretation, analysis, evaluation, inference such as explaining based on evidence-based methodological concepts, criteria, or contextual (real) considerations.

Critical thinking skills need to be improved because the future will have different challenges. One of the efforts carried out by the government is to issue the 2013 curriculum and be implemented gradually since 2014. Permendikbud No. 69 of 2013 explains that the 2013 curriculum shows the preparation of Indonesian people to have the ability to live as individuals and citizens who are faithful, productive, creative, innovative, and effective and can contribute to the life of the nation, state, and world civilization. The learning process in the 2013 curriculum includes three domains, namely affective (attitude), cognitive (knowledge), and psychomotor (skills).

LKPD is a sheet in the form of tasks following the indicators to be achieved. The problem that often occurs in LKPD is that it cannot maximize the learning process itself because it is to achieve learning objectives. The biology LKPD that is used generally does not meet the requirements, namely the appearance of the LKPD provided is not attractive, the tasks are only in the form of questions without any examples of how to complete (Kurniawan, 2015).

The problems that often occur in LKPD have not been able to maximize the learning process in achieving learning objectives. The LKPD that have used generally does not meet the requirements, the appearance of the LKPD that has given is not attractive, the tasks are only in the form of questions without any clear examples of completion (Kurniawan, 2015). LKPD has been creating to help students find a concept both through practicum and theory and to help students apply and integrate various concepts that have been found. Permatasari *et al*., (2018) reported that the LKPD that has been circulating only contains summaries or reviews of the subject matter, contains exercise questions.

LKPD with short answers did not provide clear examples of solutions, did not meet requirements, and designs were less attractive and innovative. Even though it is given in the form of a task, the nature of the task is only one problem-solving. LKPD should invite students to think systematically, this can be done if students are given complex tasks in one bill. This has been pioneered by previous researchers Nabila (2019), their research only uses one sub-skill from several sub-skills in each critical thinking skill. Ideally, each sub-skill critical thinking uses all sub-skills. If the above conditions are met, the instructed learning to fulfill 21st-century thinking skills in education can be achieved.

Research on the development of LKPD has often been carried out. Previous research was also conducted by Sari & Asrial, (2016) which stated that the LKPD circulating in schools only contained material summaries and contained question exercises compiled and designed by publishers only. Thus, the LKPD in the reference book has not been able to facilitate students to obtain meaningful learning (Anggraini & Madang, 2016). So, in essence, LKPD needs to be improved which can explore critical thinking skills. One way is to adopt the facione model. Not only that, the structure must be following the prevailing structure (Daryanto & Dwicahyono, 2014)

The subject matter of the human movement system is quite difficult. This is in line with Murdiyani (2012) in the subject matter of the motion system, many scientific terms are a scourge for students and become a burden for students to memorize and understand. Therefore, in its presentation, this material must be provided in audio and visual form, for example by observing the images in the LKPD so that students can easily understand and remember the material.

Based on the description above, it is necessary to develop a valid, practical, and effective LKPD with the title "Development of LKPD Biology in Senior High School Based on Critical Thinking Skills in the Concept of Motion Systems". So that this LKPD can later be used by students and makes it easier for teachers to deliver learning material on the concept of motion systems.

B. Materials and Method

The LKPD development research conducted is educational design research using the Tessmer formative evaluation design (1993) through the

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stages of self-evaluation, expert review, one-to-one evaluation, and small group testing (smalls group evaluation).

The research focuses on the effectiveness of LKPD expectations at the small group test stage. The subjects of the smalls group test consisted of 6 students of class XI MIA 1 SMAN 6 Banjarmasin. In the smalls group test stage, the effectiveness determines the LKPD expectations, which are viewed from the consistency between the design and experience and the results of learning by students. The selection of research subjects is base on the academic abilities of students. The expectations effectiveness data is base on the critical thinking skills assessment instrument following the existing tasks in the LKPD.

The data analysis of the expectations effectiveness is base on critical thinking skills from students' answers to LKPD. That data calculated by the formula for the number of scores obtained divided by the maximum number of scores then multiplied by 100%. Then the categorized of results has adapted from Akbar & Sriwiyana, (2010), namely a score of 75.01-100.00% (very good), 50.01-75.00% (good), 25.01-50.00 % (good enough), and 00.00-25.00% (not good).

C. Results and Discussions

The results of research on the effectiveness of LKPD expectations has shown in Table 1.

Table 1 Average Effectiveness of LKPD (Small Group Evaluation) Expectations

No.	Skills	Score Max	LKPD				Average	Score (%)	Category
			I	II	III	IV			
1.	Interpretation (1.1, 1.2, 1.3)	14	12,67	14	11,67	-	12,78	91,29	**Very good**
2.	Analysis (2.1, 2.2, 2.3)	10	5,25	6,67	10	9,5	7,86	78,60	**Very good**
3.	Inference (4.1, 4.2, 4.3)	24	24	19	-	17,8	20,27	84,46	**Very good**
4.	Eksplanation (5.1, 5.2, 5.3)	20	-	-	18	-	18	90,00	**Very good**

Information:
1. Category 75.01 - 100.00% (very good), 50.01 - 75.00% (good), 25.01 - 50.00% (good enough), 00.00 - 25.00% (not good) adapted from Akbar (2010).
2. LKPD I = Bone and Skeletal Structure in Humans, LKPD II = Joints in Humans, LKPD III = Human Skeletal Muscles, LKPD IV = Disorders and Technology in the Movement System.

Table 1 describes the effectiveness of LKPD expectations are determined based on critical thinking skills in the very good category (including interpretation, analysis, inference, and explanation) and the good category (including self-regulation). Furthermore, the research on interpersonal and intrapersonal skills of six students can continue along with the effectiveness of expectations by the observer.

The results of the research on Interpersonal and Intrapersonal skills of LKPD were developed in the small group test, while the summary has presented in Table 2.

Table 2 Results of Intrapersonal and Interpersonal Skills LKPD (Small Group Evaluation)

No	Name	Recapitulation of Interpersonal Skills (%)	Category	Recapitulation of Intrapersonal Skills (%)	Category
1.	PD1	88	Very good	88	Very good
2.	PD2	88	Very good	88	Very good
3.	PD3	88	Very good	77	Very good
4.	PD4	88	Very good	77	Very good
5.	PD5	77	Very good	88	Very good
6.	PD6	88	Very good	88	Very good
Average		**86,17**	**Very good**	**84,33**	**Very good**

Information:
1. Category 75.01 - 100.00% (very good), 50.01 - 75.00% (good), 25.01 - 50.00% (good enough), 00.00 - 25.00% (not good) adapted from Akbar (2010).
2. LKPD I = Bone and Skeletal Structure in Humans, LKPD II = Joints in Humans, LKPD III = Human Skeletal Muscles, LKPD IV = Disorders and Technology in the Movement System.

Table 2 describes the interpersonal and intrapersonal skills of students when working on LKPD in the small group test stage. Base on that results, the category is very good from an average of six students.

The developed LKPD has formed as an effort to improve critical thinking skills and as a learning tool capable of training students in developing ICT-based interpersonal skills and collaborating as well as intrapersonal, namely being

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careful in 21st-century education. The developed LKPD of the Motion System concept fosters critical thinking skills with good categories (including self-regulation), and very good categories (including interpretation, analysis, inference, and explanation) have been represented by at least one sub-skill. LKPD based on critical thinking skills by Facione (1990), this is in line with previous studies (Sari *et al*., 2018 & Nuraini, 2017).

Based on the results of the research on critical thinking skills of students on the interpretation of 91.29% (very good), analysis of 78.60% (very good), inference of 84.46 (very good), explanation of 90.00% (very good)), and self-regulation of 70.83% (good). According to Yunita (2018) in Novitayani (2019), the level of students' critical thinking skills has divided into three, namely low (0% - 59%), medium (60% - 75%), and high (76% - 100%).

In addition to assessing student critical thinking skills, the assessment of interpersonal skills (cooperation) is also doing includes five aspects, namely division of labor, selflessness, problem-solving, tolerance, and motivation, while intrapersonal skills (conscientious) cover three aspects, namely doing each stage correctly, do all the stages right, and deliver on time. Based on the results, it is known that the interpersonal skills (cooperation) and intrapersonal skills (conscientious) of students have a very good category with a score of 86.17% interpersonal skills and 84.33% intrapersonal skills.

As it is known that in the 21st century, 3 skills need to be developed in learning, namely cognitive skills (critical thinking skills), interpersonal skills (work together), and intrapersonal skills (thorough). This is consistent with the results of the NRC workshop (2011) where there are three focus 21st century skills, namely 1) cognitive skills (non-routine problem solving, critical thinking, systems thinking); 2) interpersonal skills (complex communication, social skills, teamwork, cultural sensitivity, diversity); and 3) intrapersonal skills (self-management, time management, self-development, self-regulation, adaptability, and executive functioning).

These three skills are interconnected and very much needed by students. One way that doing to improve these three skills is by using LKPD in the learning system because students can play an active role and take control to solve the problems faced. This statement agrees with Astuti (2017) in Novitayani (2019) explains that so that students are actively involved in critical thinking, one alternative that can facilitate is the use of LKPD where students can express their ideas and opinions in criticizing a problem.

The results of this study are also supported by studies that have previously reported, the effectiveness of the expected category is at least good and able to train students in critical thinking. Zaini & Jumirah (2016) reported that critical thinking skills were categorized as good through the development of learning tools, which were categorized as effective for use by students from the value of the distribution of students' answers based on indicators of scientific literacy questions. Research conducted by Nurichah *et al*., (2012) in Faridah (2019) LKPD which they developed can help students understand the material and also be able to train critical thinking skills.

And it includes the objectives of learning curriculum 2013 in three cognitive domains (knowledge in the form of tasks in LKPD), affective domains (attitudes in the form of collaboration and also thoroughness), and psychomotor (skills in the form of observing, asking, trying, reasoning, presenting, and creating). All LKPDs developed in this study included Facione's five critical thinking skills, but they did not me*et al*l of the subcritical thinking skills. Even so, critical thinking skills have been represented by at least one sub-skill in each task in the LKPD. Also, researchers are aware of the lack of one critical thinking skill accord to Facione (1990), namely evaluation. That is due to the limited ability of researchers to develop questions in the form of invoices with evaluation skills. One way that can be done to improve critical thinking skills is by using LKPD.

D. Conclusion

Based on the results of research on four LKPDs through the Development of LKPD Biology SMA Based on Thinking Skills on the Concept of Motion Systems, it has concluded that the developed LKPD has a valid's category with an average score of 3.25. The developed LKPD has content practicality with a good category based on an average score of 3.82 and practicalities expectations with a very good category based on an average score of 90.48%. The LKPD that has developed had the effectiveness of expectations based on the assessment of students' critical thinking skills had a very good category (including interpretation, analysis, inference, and explanation) and a good category (including self-regulation). The interpersonal skills (cooperation) of students get scores of 86.17% (very good category), and the intrapersonal skills (conscientious) get scores of 84.33% (very good category).

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