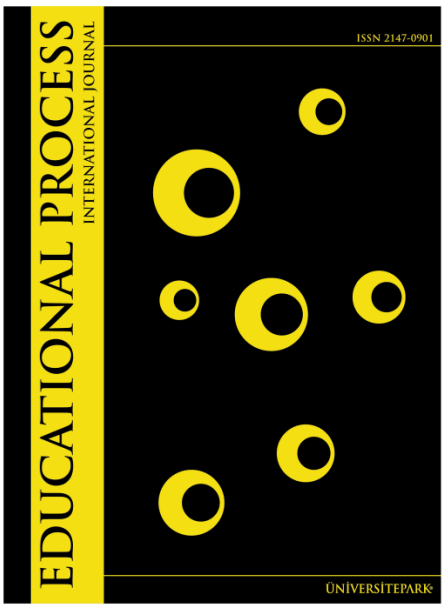

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CIRSA: Designing Instructional Kits to Empower 21st Century Skill

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Abstract

Research about scientific literacy and metacognitive in the learning process is one of the main aspects of education with a vision to strengthening 21st century skills. This study aimed to produce a learning design as a product of a scientific approach-based cooperative integrated reading and composition (CIRSA) media with a vision of empowering science literacy and metacognitive. The research method employed was a 4D research and development model (define, design, develop, disseminate). However, the research was limited up to the develop stage. The research result indicates that the product of CIRSA learning development in form of syllabus, lesson plan, learner worksheet, and evaluation instruments were within the category of very valid and feasible to be used as a learning media for Biology as a subject at the junior high school level. The research result is expected to contribute in the empowerment of scientific literacy and metacognitive.

Keywords: CIRSA, instructional kits, metacognitive, scientific approach, scientific literacy.

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Introduction

In the 21st century, research related to scientific literacy and metacognitive in learning are one of the main constituents of Biology education (Darmawan, Zubaidah, Susilo, Suwono, & Indrawati, 2017; Ristanto, Zubaidah, Amin, & Rohman, 2017). Scientific literacy and metacognitive are part of 21st century skills that should be empowered through science learning. Science has a significant influence on personal lives in global society as well as for the economy as a whole (Ristanto, Zubaidah, Amin, & Rohman, 2018). Thus, students are required to have a good level of scientific literacy (Glynn & Muth, 1994) and metacognitive skills (Zohar & Barzilai, 2013) in 21st century science learning. The implementation of metacognitive processes will create a meaningful learning process, as well as involve students in active roles in learning sciences and direct them towards being an independent person (Kipnis & Hofstein, 2007).

Biology learning should not be merely centered on teachers as the learning source (Ichsan, Rusdi, & Sartono, 2017), but should involve students playing an active role to improve the achievement of biology learning by improving their science literacy skills (Ristanto et al., 2017, 2018) and empowering their metacognitive skills (Darmawan, 2017). Students need to have a good level of literacy skill in order to train their reading understanding domain, as well as for reading as an activity for learning (Kuhlthau, 2010). Literacy skill is referred to as a fundamental capital for students to develop their self-potential (Susanti, 2014). In addition, scientific literacy is important for individuals to maximize their opportunity to be able to adjust to the dynamics of life and aid the development of a country (Genc, 2015; Jurecki & Wander, 2012; Turgut, 2007). Scientific literacy is mentioned as related to metacognitive skill (Riyadi, Sunyono, & Efkar, 2018; Sukowati, Rusilowati, & Sugianto, 2017).

Students are expected to have metacognitive skill in order to better understand the strengths and weaknesses of their knowledge development process, thus they will be able to identify the needs to fulfill demand (Winne & Perry, 2000). Based on their knowledge and skill, students are able to manage their attitude and behavior in optimizing their learning process, and thereby, their academic results. Metacognitive skill refers to activities of control, monitoring, and self-regulation that occurs whilst studying (Darmawan et al., 2017).

Scientific literacy improvement and metacognitive empowerment need to be conducted so that students are more independent in the learning process. Effort in the improvement of scientific literacy and the habituation of metacognitive is conducted through learning activity (Darmawan et al., 2017). According to Bunce, Gabel, and Samuel (1991), Biology is a part of science that requires the teacher to help their students to think about organisms. It can be interpreted as an effort in learning process to equip students with various skills on how to find out and understand the concept or fact of organism. Also, Biology should be able to accommodate a student's intellectual enjoyment and satisfaction in their effort to expose various concepts on organisms. It is believed that it can help in the achievement of effective Biology learning (Darmawan, Brasilita, Zubaidah, & Saptasari, 2018). According to Bustami (2017), Darmawan (2017), and Ristanto (2011, 2017), for the achievement of effective Biology learning, a learning model is needed that enables the teaching of the concepts of Biology by empowering students' scientific literacy and metacognitive abilities, and in turn the achievement of the formulated goals of Biology learning.

Efforts to improve learning achievement can occur through improving learning quality (Sujana, 2014), which can be determined through the learning model used by the instructor (Muhlisin, Susilo, Amin, & Rohman, 2016). The 2013 curriculum expects teachers to teach through a scientific approach. Cooperative Integrated Reading and Composition (CIRC) is one of the learning models that has the potential to improve Biology learning achievement (Ristanto et al., 2018). The learning model has not yet accommodated the whole scientific approach; thus, the scientific approach-based CIRC learning model (CIRCSA) is expected to improve students' scientific literacy and metacognitive, as well as to assist teachers in preparing learning media that supports the improvement of both abilities in teaching Biology to students.

Scientific approach-based learning belongs in the modern world (Hilda, 2015; Susilo, 2016; Wieman & Gilbert, 2015), but it cannot function well without the support of good learning media. The aim of the current research is to develop a CIRCSA learning design. The learning design to be developed consists of three elements for junior high school students: a lesson plan (*rencana pelaksanaan pembelajaran-RPP*); and a syllabus and learner worksheet (*lembar kerja peserta didik/LKPD*) on the material of respiration and excretion systems in humans.

Methodology

In the study, the method employed was *Research and Development* from Thiagarajan, Semmel, and Semmel (1974), which is a 4D (*Define,* Design*, Develop, and Disseminate*) model. However, the current research was limited to finish at the Develop stage. Stages in the current research study therefore consisted of the following three stages:

Define Stage: This stage aims to determine and define the learning requirements. It is started with a goal analysis of the limitations of the materials for which media will be developed. The stage consists of the main analytical steps i.e., (a) front-end analysis, (b) student analysis, (c) assignment analysis, (d) material analysis, and (e) the formulation of learning goals.

Design Stage: This stage aims to design the learning activities and learning media needed. The aim is to produce a Prototype I. CIRSA learning media is to be developed in accordance with the learning goals and situation based on scientific approach-based CIRC learning model according to the 2013 curriculum. The initial design of the learning media produced consists of a syllabus, lesson plan, learner worksheet and learning evaluation tools in the form of a scientific literacy test and metacognitive test.

The scientific literacy test was developed by referring to PISA indicators. Questions are multiple-choice, each with a single correct answer. The metacognitive test is in the form of a question matrix, questions, an assessment rubric, and answer keys. It was developed based on test-essay integrated MAD indicators (Corebima, 2009), and consists of seven scales (0-7) as a reference to check students' answers for each test item.

Develop Stage: Thiagarajan et al. (1974) divided the develop stage into two distinct activities, namely, expert appraisal and developmental testing. The result of this stage is an instructional kits product in the form of Prototype II.

Expert validation: In this case, the educational expert has the qualifications of a Doctorate in Biology and a certified Biology teacher who teaches in junior high school. The media validated consisted of a syllabus, lesson plan, learner worksheet, and instruments of learning evaluation, which were scientific literacy and metacognitive instruments.

Developmental testing: Development testing was conducted on the validated media by students who had been studying the respiration and excretion systems of humans. The testing result was used as a basis to determine the empirical validity and reliability of the evaluation test. This stage consisted of validation (content, construct and empirical validities) and reliability tests.

Results

The research results shown in this section end at the Develop stage since the Disseminate stage was not conducted. The results obtained in the develop stage can be seen in Table 1.

Table 1. Syntax of Scientific Approach-based CIRC Learning

CIRC Syntax	*Learning Activities*	
	Teacher Activities	*Scientific Approach*
Stage 1. Group division	1. Explain the learning model, logistic and its implementation. 2. Present the learning goals. 3. Motivate the learners and relate the present materials to the previous material through pictures or learning videos. 4. Guide learners to form heterogeneous groups of 4-5 learners.	Observe
Stage 2. Reading, discussion and finding main concepts of the article	1. Guide the learners to prepare articles/ reading materials according to the topic being studied. 2. Give learners the opportunity to read, discuss and understand the articles. 3. Guide the learners to find important facts, the articles' main concept and re-write them on the LKPD.	Exploration Exploration Association, Ask
Stage 3. Group presentation	1. Ask some groups to present their assignment. 2. Facilitate learners to hold class discussion. 3. Direct the discussion.	Communicate

The Scientific Approach-based CIRC learning media consisted of syllabus, RPP, and LKPD was further validated by the experts. The result of the validation is presented in Table 2.

Table 2. Result of Validation Score of CIRSA Learning Media by Experts

Type of Instructional Kit	*Expert Validation*	*Score of Validation Result*	*Average Score*	*Category*
	User 1	3.38		
Syllabus	User 2	3.75	3.62	Very Valid
	User 3	3.75		
	User 1	3.30		
RPP	User 2	3.29	3.41	Very Valid
	User 3	3.65		
	User 1	3.00		
LKPD	User 2	3.83	3.52	Very Valid
	User 3	3.75		

Based on the result in Table 2, it can be interpreted that the instructional kits consisted of a syllabus, lesson plan and learner worksheet that were all within the category of "very valid." This means that it can be used to improve the scientific literacy and metacognitive. The next instructional kit item was the question or evaluation sheet, which was validated by the experts, and whose validation results can be seen in Table 3.

Table 3. Result of Validation Score of Science Literacy and Metacognitive Questions by Experts

Type of Instrument	*Score of Validation Result*	*Category*
Scientific Literacy	3.75	Very Valid
Metacognitive	3.50	Very Valid

The validity test result of question items and empirical reliability in scientific literacy and metacognitive shows that each question item was valid and reliable. Based on the result, the largest average score was found in the type of syllabus instructional kit. The smallest score was obtained in the type of lesson plan. Overall, the three instructional kits were found to be within the valid category, which means that they could be used in Biology learning at junior high school.

Discussion and Conclusion

The research developed CIRSA instructional kits for the material of respiratory and excretion systems in humans. The research aimed to develop a scientific approach-based CIRC learning design. The results of the development were learning media in the form of a syllabus, lesson plan, learner worksheet and evaluation instruments in the form of scientific literacy and metacognitive. Thus, a CIRSA learning product was produced that is in line with the 2013 curriculum and feasible to be used and is expected to improve scientific literacy and metacognitive. The research result of Holliday, Yore, and Alvermann (1994) and Ristanto et al. (2018) indicated that academic activities in learning stressed on reading and writing through article analysis could train students to link their own knowledge and experience to the new knowledge. The opinion is relevant to the learning activity process designed in

CIRSA learning, which is Biology learning and considered to be more meaningful when compared to memorization, especially for students at the junior high school level.

Biology learning is a type of learning that requires a scientific approach. It is relevant to CISRA learning design developed for Biology. This is the main reason for the good validation score of CIRCSA learning thus it is feasible to be used in school learning. Actually, learning media can be developed continuously to bring about new innovations in learning (Sandberg & Ohman, 2011).

CIRSA learning design in the concept of respiration and excretion systems in humans is believed to have the potential to improve scientific literacy and metacognitive. Designed in accordance with CIRC principles stressing on the reading process, the reading activity is a process that is often missed in learning, especially in conventional learning. Conventional learning at the junior high school level often rules out reading activity. This causes scientific illiteracy among students at the junior high school level, whereas high scientific literacy could positively impact on student learning at class (Ait, Rannikmäe, Soobard, Reiska, & Holbrook, 2015). CIRSA can be used for all materials in Biology learning at the junior high school level.

The importance of reading activity in the learning process has also been stated by Gupta and Ahuja (2014a) and Muhlisin et al. (2016), in that reading could significantly improve planned study results. One of the factors influencing scientific literacy is reading and writing abilities (Ristanto et al., 2017). The abilities can be used by students to develop skill to analyze, interpret and communicate scientific ideas (Holliday et al., 1994). Those skills are the components needed for a scientifically literacy person (Ristanto, 2017).

The designed CIRSA learning accommodates learning aspects that not only stress reading and writing processes, but also scientific activities such as observing, asking, trying, reasoning and communicating. Reading activity is a metacognitive skill (Darmawan, 2017). In reading process, procedural skill will occur and will improve learning motivation since what is to be learned is already known (Muhlisin, 2018). The skills refer to knowledge on student activities. Knowledge is built as a heuristic by studying information of materials and books through reading, and then summarizing by determining the main thoughts. Alexander and Jetton (2000) and Cubukcu (2008) stated that the implementation of strategy that develops metacognitive skill will train students in improving their understanding on new vocabularies and improve reading understanding skill. Further, supported by the research result of Hayati (2016), CIRC learning could improve metacognitive skill.

The development of CIRCSA learning design is recommended for implementation in Biology learning, as the 2013 curriculum learning is expected to use a scientific approach. CIRSA learning design has various important aspects, of which, among others, students have a reading process and discussion, and it is both a student-centered and scientific approach. Cooperative learning process is already proven to improve metacognitive and scientific literacy learning outcomes (Darmawan et al., 2017). Metacognitive and scientific literacy form part of the focus in 21st century skills development.

In the 21st century, one of the abilities needed to compete in a global world is communication. Good interpersonal intelligence contributes to a students' communication ability improvement, and is in line with the 21st century demand for good communication and collaborative abilities. CIRSA learning design is believed to be relevant since it stresses

group cooperation in learning, which creates a more effective learning (Navarro-Pablo & Gallardo-Saborido, 2015).

CIRSA learning design can be used as an option in school Biology learning, especially at schools that apply conventional learning design such as lecturing; a method often used in Biology learning. Biology learning at the junior high school level is expected to stress the ability of students in scientific literacy. Science learning is related to the demand for students to have broad insight, and as such, teachers also play an essential role in science literacy improvement (Udompong, Traiwichitkhun, & Wongwanich, 2014).

Based on the research result, CIRSA instructional kits designed in the form of syllabus, lesson plan, and learner worksheet, plus evaluation instruments for Biology learning in the form of scientific literacy and metacognitive tests were stated as valid and reliable. In addition, the design was proven as feasible to be used as Biology instructional kits. The expectation is that CIRSA instructional kits can be further developed to achieve more effective Biology learning goals across various level of education.

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Notes

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