5E Learning Cycle Model on Students' Learning Outcomes

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ABSTRACT

Indonesian education currently being developed is a constructivist paradigm. It is a learning theory that emphasizes students' activeness to construct their knowledge. This is a challenge for educators to find a learning model that helps students actively acquire knowledge by learning independently. This study aims to review whether the 5E learning cycle model improves the students' learning outcomes and can be considered feasible in the teaching and learning process. The method of this study in collecting the data is a literature study by collecting the relevant data from various articles of research results related to this present study. The results of this study indicate that 5E Learning Cycle helps the students to think critically, analytically, creatively, and to improve the students' learning outcomes.

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1. INTRODUCTION

The success of the teaching and learning process is the main point that is expected in carrying out education in schools. Students and teachers are the essential components in teaching and learning activities. In this situation, students become the subject of learning rather than the object of learning. As a result, the paradigm of teacher-centered learning should be replaced with students-centered learning (BNSP, 2006). Following the current development of Education in Indonesia, a constructivist paradigm, namely a learning theory that emphasizes students' activeness to construct their knowledge. Constructivism allows students to actively participate in the learning process by gaining knowledge by learning independently and evaluating themselves (Ningsih et al., 2018). Thus, students must be active and independent so that schools' teaching and the learning process become more optimal.

In addition, the role of the teacher is significant in educational work (Murati, 2015). The teachers must contribute to creating a safe and comfortable atmosphere so that the students can explore their knowledge without feeling forced. This condition requires teachers to innovate in various aspects of education, such as the learning method, the learning media, and information technology development, to minimize problems by creating effective learning (Fauziddin et al., 2021). The teaching and learning process can be achieved if a teacher can apply the approach and prepare the best possible learning model to achieve learning objectives. Teachers are expected to master various learning methods and

apply them in the classroom. Students become passive listeners if the teacher's learning model does not allow students to participate in the learning process (Jaya & Indrayani, 2021). Therefore, the success of students' learning is determined mainly by the ability and accuracy of the teacher in choosing and using learning models.

One of the learning models that involve students to participate actively and involve potential cognitive processes in stimulating the intellectual development of students in the learning process is with the 5E learning cycle model (Sani et al., 2020). Initially, Learning Cycle consisted of three stages, namely exploration, explanation, and elaboration, known as the 3E learning cycle. However, in the next process, the three stages developed into five stages: engagement, exploration, explanation, elaboration, and evaluation, known as the 5E learning cycle. The 5E learning cycle model has a constructivist approach that consists of five stages, namely engagement, exploration, explanation, elaboration/extension, and evaluation (Rodriguez et al., 2019). Students can construct knowledge and experiences by actively, meaningfully learning content by working and thinking independently or in groups during the stages of the 5E learning model, allowing them to master the skills that must be acquired in learning (Sani et al., 2020). The 5E learning cycle model also has the advantage of stimulating students to remember previous material to relate to the material to be studied and convey concepts orally (Nur & Noviardila, 2021). Consequently, the learning activities in the 5E learning cycle model help students become active and independent individuals in mastering learning.

Furthermore, the learning process is closely related to learning outcomes. Learning outcomes can indicate the level of success in the learning process. By knowing learning outcomes, students will assist educators in designing learning models that affect the students in accepting and mastering lessons. The selection of the suitable learning model will impact the level of mastery or students' achievement. In this study, the 5E learning cycle was used. The researcher wants to review the 5E learning cycle model to improve students' abilities and learning outcomes. In the result of this study, it is expected that with the 5E learning cycle, students become active and independent in acquiring their knowledge, with the purpose that the learning process will be student-centered.

2.   METHODS

The technique used in collecting data was secondary data, namely collecting data indirectly by examining the object in question. This research was library research in such a way that the method used is a literature study. The literature study is an initial step taken by researchers in preparing a research plan that will be used to explore theories or opinions of experts related to the topic to be studied. The special characteristics used as the basis for developing research knowledge include: this research is faced directly with the data or text that is presented, not with field data or through eyewitnesses in the form of events, researchers only deal directly with sources that already exist on the internet, such as articles, e-books, and dictionaries. Sources of data for literature studies can be informed of official sources in the form of seminar reports/conclusions, notes/records of scientific discussions, official writings published by the government and other institutions, both in the form of printed and digital books such as optical discs, computers or data computer (Melfianora, 2019).

After collecting several journals related to the feasibility of the 5E learning cycle model, then analyzing the data using descriptive qualitative analysis through the literature study, the result of the analysis is descriptive data such as written sentences and behavioral results observed from the results of previous studies.

3.   FINDINGS AND DISCUSSION

The sources used in this study refer to the data obtained from the analysis of books or accredited journals worthy of being used as references. In this research, the researcher discussed the result of research that has been carried out by previous researchers related to the Learning Cycle model on students' learning outcomes. The researcher refers to the articles that have been displayed. The data

display contains seven relevant articles for this study based on previous research results and published in national journals in 2015-2021. Furthermore, the data in the form of sentences that will result in conclusions will be explained and presented in literary analysis. The following are some studies related to the 5E learning cycle model.

Table 1. Secondary source analysis table

No	Researchers	Title	Core Discussions	Conclusions
1	Farida hanum, Sukarmin, Cari (2019)	Pengembangan Modul Fisika Berbasis Learning Cycle 5E untuk Meningkatkan Kemampuan Berpikir Analitis Siswa	The main point of this research is that this research aims to do a learning module for Senior High Schools students to think critically by developing a physics module based on the 5E learning cycle. The research confirms that the type of this research carried out is a type of development research with a 4D model. In its implementation, the researcher chose Fluida Statis for XI-IPA science high school students. The module designed by the researcher was validated first by material experts, linguists, media experts, reviewers, and peer reviewers. The criteria for the module include the following: 1. The physics module's characteristics that were developed in the form of a print module based on the 5E learning cycle were considered very good. 2. The responses from material experts, media experts, linguists, physics teachers, and colleagues regarding the module content were considered very good. 3. The physical appearance of the physics module based	In this case, the researcher concludes in this study as follows: First, in its development of 5E learning cycle-based physics module, it is divided into several stages, including the stage of analyzing the needs of students, teachers, and learning materials; Making the physical appearance of the module, validating it to experts in their fields, and finally making revisions if there are still deficiencies in the module. Second, the responses from experts regarding the physics module based on the 5E learning cycle, the data obtained are as follows: 1. The physical appearance of the physics module based on the 5E learning cycle includes aspects of module skin layout, module skin typography, module skin illustration, module content layout, module typography, and module content illustration, which was considered very

on the 5E learning cycle was considered very good.

4. The design aspects of the 5E learning cycle model were considered very good.

With the physics module based on the 5e learning cycle, students find it helpful to find concepts from phenomena/events around which they often find to form their concepts from research results.

good with a score of 3.78.

2. Aspects of language assessment in the physics module based on the 5E learning cycle include the suitability of the language used with the level of student development, communicative, straightforward, according to Indonesian language rules, and by the rules for using terms and symbols getting perfect marks and evidenced by scores an average of 3.35.

3. Aspects of assessing the feasibility of the module by reviewers and peer reviewers include the feasibility of content, presentation, language and legibility, graphics, and the suitability of the module content with the 5E learning cycle-based which were considered very good with an average score of 3.50 from reviewers while the score obtained from peer reviewers of 3.51.

In general, the result of the module score of 88.74. Then, it can be concluded that the physics module based on the 5E learning cycle that was developed is feasible for physics learning.

No	Author	Title	Method	Results
				Third, the development of a physics module based on the 5E learning cycle by bringing up the characteristics of analytical thinking skills that are applied to the Static Fluid material is considered adequate and can meet the needs of students with the results of increased students analytical thinking skills and the achievement of mastery standards on students' learning outcomes.
2	A. Ramdani, A. W. Jufri, Gunawan, M. Fahrurrozi, M. Yustiqvar (2021)	Analysis of Students' Critical Thinking Skills in Terms of Gender Using Science Teaching Materials Based on the 5E Learning Cycle Integrated with Local Wisdom	In terms of gender, this study looks at the impact of science teaching materials based on the 5E learning cycle model combined with local wisdom on students' critical thinking skills. This study used a quasi-experimental design with a pre-test and post-test control group, and this research was carried out in Madrasah Tsanawiyah with a total of one hundred students. The instrument used by the researcher is a critical thinking ability test which is made based on the indicators developed by Ennis (2011). Previously, the instrument had been tested for validity, reliability, and level of difficulty using the Rasch Model application with the help of Ministep. The research data were analyzed using the N-gain test and t-test.	The findings revealed that using science teaching materials based on the 5E learning cycle model and incorporating local wisdom improved students' critical skills. The results can be seen from the experimental class's N-gain value, which is higher than the control class. The t-test showed a significant difference in the improvement of critical thinking skills between male and female students. Male students exhibit superior critical thinking skills than female students in both classes.
3	Suciati, A. Vincentrisia,	Application of Learning Cycle Model (5E)	This study aims to see how the different schools in Surakarta use the LC (5E)	The conclusions obtained by the researchers were:

	dan Ismiyatin (2015)	Learning with Chart Variation Toward Students' Creativity	model with variation approaches (interrelationship/ID and affinity diagram/AD) to boost students' creativity. The researcher asserts that this research is a qualitative descriptive study involving 64 students. The research data used is the result of the creativity test, which covers four aspects: fluency, flexibility, originality, and elaboration. Researchers also added supporting data in the form of non-tests, namely observation sheets, questionnaires, and documentation. This research was carried out in several cycles covering planning, implementation, observation, and reflection activities to increase each aspect of student creativity produced.	1. Applying the LC (5E) with various techniques in two schools can increase students' creativity. 2. The difference in the increase in creativity scores on the application of the LC model (5E) = ID Pre-cycle, cycle I, cycle II, cycle III at SMAN 3 Surakarta got an average of 67, 25/55.50 / 55.38, while the increase in creativity scores in the application model LC (5E) =ID pre-cycle, cycle I, cycle II, cycle III at SMAN 3 Boyolali got 5.58/66.58/54.72.
4	Mislan Sasono, Farida Huriawati, dan Andista Candra Yusro (2017)	Pengembangan Perangkat Pembelajaran Melalui Pendekatan Konstruktivistik Dengan Metode Five E (5E) Stages Learning Cycle untuk Meningkatkan Hasil Belajar Dan Keterampilan Proses Sains	This research aims to develop a form of learning tool intended for fifth-grade elementary school students to improve science process skills and student learning outcomes through a constructivist approach with the 5E learning cycle method on material objects and learning cycle. The research confirms that the type of research carried out is R&D with a 4D model. Each form of learning device developed was validated first by the researcher by triangulation. In this study, the task completed and their learning outcomes were collected as quantitative	After being carried out with four 4D stages, the results of this study can be described as follows: 1. The forms of learning tools that have been successfully developed using the 5E learning cycle method for science process skills with a constructivist approach to the subject matter of objects and their nature as science learning media includes lesson plans, worksheets, learning outcomes evaluation tests, and students' science process skills have increased in

			data and descriptively assessed.	each lesson by 70.79%, 73.97%, 78.10%.
2. The form of learning tools developed with the 5E model can improve the learning outcomes of fifth-grade students at SD Negeri Kanigoro.
The average score of students pre-and post-tests increased by 31 points.
5	Sri Mulyani Endang Susilowati, Kaherul Anam

(2017) | Improving Students' Scientific Reasoning and Problem-Solving Skills by the 5E Learning Model | This paper aims to see the effectiveness of the 5E learning cycle model in improving students' scientific knowledge of their problem-solving abilities
The researcher used a pre-experimental type of research with one group pre-test and post-test. The population of this study was 208 students from five classes in the second semester at MA Khas Kempek, and as many as sixty students were selected as samples. Students' learning outcomes were collected through reasoning and problem-solving tests. Researchers in this study confirmed the following hypotheses;
1. Learning biology with the 5E model effectively improves scientific reasoning and problem-solving.
2. The ability to think and solve problems have a good link. | This study shows that using the %e learning cycle model in biology to teach students about the human reproductive system improves their scientific reasoning and problem-solving abilities. This can be proven by the increased in students' scientific reasoning as much as 69,77% and 66,27% and are included in the medium category. This study confirms that reasoning skills are necessary for problem-solving. |
| 6 | Muh. Nasir, Wahab Jufri Muhlis | Pengembangan Perangkat Model 5E untuk Meningkatkan | The essence of this research is to develop a 5E model of learning tools and analyze the effect of its | The results of this study indicate that the 5E model of learning tools consisting of the syllabus, |

No	Author	Title	Aim/Method	Results
	(2015)	Kemampuan Berpikir Kritis Siswa	implementation on differences in critical thinking abilities. The researcher asserts that the researcher used the type of research and development by following the Dick and Carey model steps. The expert first validates the device that will be developed by the researcher.	lesson plan (RPP), student work instructions (PKS), Student work results sheets (LHKS), and instruments in this study was considered very feasible. This is based on responses from experts by the aspects included in it. Students who studied using the 5E model had significantly different scores in the t-test of critical thinking skills than those with the EEK model.
7	Muhamad Zikrullah, Wildan, Yayuk Andayani (2016)	Pengembangan Lembar Kegiatan Siswa (LKS) Model *Learning Cycle* 5E	This research aims to create a 5E learning cycle model students' worksheet that can be used to teach the subject of reduce-oxidations in class X. The method employed was the R&D with a 4D model.	The results of the limited test by six students and two chemistry teachers from MAN 1 Mataram, as well as the expert validation by three validators, revealed that the 5E learning cycle model students' worksheet was deemed very suitable for use, with scores 3.36, 3.37, and 3.33 on scale 1-4.

In the light of the results of the table analysis above, it can be inferred that the 5E learning cycle model has advantages in improving the learning process. Furthermore, the presentation data on the implementation of the 5E learning cycle in learning is based on the literature study results, which will be explained as follows.

The results of earlier investigations revealed that evaluations by experts related to instruments to test the suitability of the content, language, and presentation received positive responses to the development of student activity sheets (LKS) integrated with the 5E learning cycle model (Zikrullah et al., 2016). The 5E expert validation test results can be seen in Table 2 as the following.

Table 2. Expert validation test results

No	Aspects	Average
1.	Content Suitability	3.33
2.	Language Use	3.33
3.	Presentation	3.33
	Average	3.33
	Category	Very Feasible

From the table above, it can be assumed that the aspects in the development of worksheets that experts assets can be categorized into very feasible levels. Based on the results, the development of the

5E learning cycle model worksheet is very feasible to be applied to chemistry learning with the subject matter of oxidation-reduction reactions.

Students and teachers carried out the limited test results to respond to language/readability and presentation of content/interesting. The response by the teacher can be seen in the following table.

Table 3. Limited test results by the teacher

No	Aspects	Average
1.	Content Suitability	3.62
2.	Language Use	3.00
3.	Presentation	3.50
	Average	3.37
	Category	Very Feasible

Based on the average results, the teacher responded that the aspects assessed in developing students' worksheets were included in the very feasible category. Similarly, students' responses can be shown in the following table.

Table 4. Limited test results by students

No	Aspects	Average
1.	Presentation	3.36
2.	Language	3.36
	Average	3.36
	Category	Very Feasible

From the data above, it can be concluded that students gave a positive response to the aspects contained in developing worksheets that were integrated with the learning activities of the 5E learning cycle model with a very feasible category and can be proven with an average score of 3.36. This aligns with previous researchers who developed learning tools through a constructivist approach with the 5E learning cycle model in improving learning outcomes and the science process (Sasono et al., 2017). The tools that have been successfully developed are lesson plans (RPP), student activity sheets (LKS), and product evaluation sheets (LEP). Based on the results of descriptive analysis of skill observation data, students experienced an increase in each lesson I, II, and III as seen from the results of the instrument reliability coefficients, respectively 62,50%,71,93%, and 85,71%, as well as the student process skills that appear in the learning of lesson I, II, III are 70,79%, 73,97%, 78,10%. From this explanation, it can be concluded that the student's process skills have increased at every meeting.

The application of the 5E learning cycle model that involves students in the media implementation process and its application to teaching and learning is also found in previous research (Nasir et al., 2015). By involving 131 students from four classes at SMA Negeri 1 Woha Bima, this research is about the 5E learning model of learning tools which developed by following the 2001 Dick and Carey model to produce a prototype of learning tools that can improve students' learning activities and improve students' critical thinking skills. There is an evaluation that experts' response to learning tools was considered very good using the 5E model. The criteria included in the analysis can be seen in Table 5 below.

Table 5. Recapitulation of learning device validation results

No	Device type	Average scores	Qualification
1.	Syllabus	3.30	Very Feasible
2.	Lesson Plan	3.37	Very Feasible
3.	Student Work Instruction	3.30	Very Feasible
4.	Student Worksheet	3.50	Very Feasible
5.	Critical Thinking Ability Test	3.42	Very Feasible
6.	Arguing Ability Test	3.33	Very Feasible
	Average	**3.37**	**Very Feasible**

The results from the table above showed that the average value of the learning developed was 3.37. It can be categorized into very feasible to be applied in the learning process. In addition, there are also significant differences in the improvement of critical thinking skills between male and female students. Previous research has shown that boys have a faster response time and higher self-confidence than female students in problem-solving (Ramdani et al., 2021). According to the findings of this study, the use of science teaching material with 5E integrated with local wisdom has a positive impact on students' thinking skills. The effectiveness of the 5E learning cycle model in improving critical thinking skills can be proven by looking at reasoning abilities which are directly proportional to increasing problem-solving abilities (Susilowati & Anam, 2017).

Additionally, in previous studies that have been carried out, it is explained that the physics module based on the 5E learning cycle was also able to improve students' analytical thinking skills (Hannum et al., 2019). It can be proven from the results of the researcher's data analysis obtained from the average pre-test and post-test scores of students.

Table 5. Result of assessment of analytical thinking ability of each indicator

No.	Indikator	Ketercapaian		N-Gain
		Pre-test	Post-test	
1	Interpretasi	0.43	0.66	0.41
2	Menggunakan Konsep	0.52	0.77	0,52
3	Membuat Evaluasi	0.44	0.61	0.31
4	Memberikan Alasan	0.47	0.70	0.43
	Rata-Rata	0.46	0.69	
	N-Gain		0.41	

Table 5 above shows the students' analytical thinking ability scores on each indicator. The most significant improvement was in the indicator on using concepts in problem-solving with a score of 0,52. On the whole, students' analytical thinking skills increased by 0,41 in the "medium" category. Then, the adoption of s physics module based on the 5E learning cycle model can be inferred to boost students' critical thinking skills effectively.

In the implementation, the 5E learning cycle-based physics learning module is practical if it reaches the minimum criteria of mastery learning (KKM) of 75 with a percentage of completeness of 75%. From the results of the analysis of questions referring to Bloom's taxonomy, it was found that the average score of students' learning outcomes in the cognitive domain 78,28, which means that the implementation of the physics module based on the 5E learning cycle model helps students to achieve the minimum criteria (KKM) scores with a completeness percentage of 87,50%. Hence, it can be assumed that implementing the physics module based on the 5E learning cycle module effectively

achieves the standard of mastery learning outcomes. At the same time, the learning outcomes of the affective domain can be shown in the following figure.
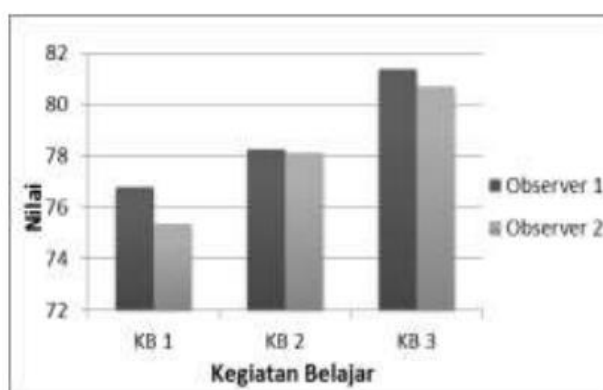

Figure 1. Student affective domain assessment result

The data shown in Figure 1 showed that the average score of students in KB 1to KB 3 continues to increase compared to the KKM score of 75 with a successive percentage of 77,78%; 81,24%; and 81,48% are above 75%. The instructions on the 5E learning cycle-based module that put forward concepts independently turned out to be effective in improving students' learning outcomes in the affective domain. It can be considered that from the results, the physics module based on the 5E learning cycle is effective in achieving the standard of mastery of affective learning outcomes. The assessment results for the psychomotor domain can be demonstrated from the following figure.
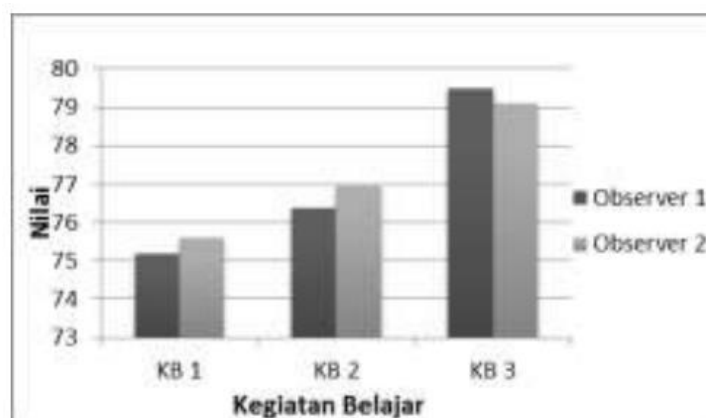

Figure 2. Psychomotor domain assessment results

It is clear from the figure above that the observation data carried out by the two observers and the score of students learning outcomes in the psychomotor domain consistently increased higher than the minimum standard of mastery learning (KKM) of 75. Besides, the percentage of completeness in psychomotor learning at each meeting was higher than the standard of completeness of 75%; the percentages were 76,56%, 79,49%, and 81,25%, respectively. Consequently, it can be argued that the use of the physics module based on the 5E learning cycle was effective in achieving the standard of completeness in psychomotor learning outcomes. Based on the description of the effectiveness of the use of the module being developed on learning outcomes in the cognitive, affective, and psychomotor domains, it can be inferred that the 5E learning cycle-based physics module is effective in gaining mastery of students' learning outcomes.

From the explanation of numerous studies that have been mentioned, the 5E learning cycle is regarded feasible to be applied in the learning process. After using the Learning Cycle 5E-based learning model, students feel able to think critically (Nasir et al., 2015; Ramdani et al., 2021; Susilowati

& Anam, 2017) able to think analytically (Darwis et al., 2020; Hannum et al., 2019), able to increase creativity (Suciati et al., 2015), and able to improve their learning outcomes (Sasono et al., 2017).

4. CONCLUSION

The conclusion of this present study stated that the type of learning involving the 5E learning cycle model is considered very useful because students feel that their scientific reasoning abilities and critical thinking skills have increased so that the students' learning outcomes increased. Learning media based on the 5E learning cycle is considered helpful because students can learn independently. This indicates that students can learn anytime and anywhere so that the learning process can take place continuously.

The application of the 5E learning cycle-based learning model has a positive impact on improving the quality of students' learning, as evidenced by various studies that have been described previously that learning media that applies the 5E learning cycle model can improve critical, analytical, creative thinking, as well as improve students' academic quality.

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