Research-based learning in biology courses to train students critical thinking skills: Student's perception

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ARTICLE INFO	ABSTRACT
	Critical thinking is an ability that has a specific purpose for empowering thinking activities in science education and other disciplines. This study aims to determine student perceptions of applying the Research Based Learning in training student's critical thinking skills. This research is quantitative descriptive. This type of research is used to analyze data by describe or describe the data that has been collected as it is. The population in this study were all students of biology education, Riau University, while the sample in this study were biology education students in semester 3 of class A who took Biology Learning Media courses. The sampling technique is through purposive sampling. The instrument used is a student response questionnaire and observation sheets that emphasizes the description of the achievement of critical thinking indicators according to Marzano and interview sheets. The questionnaire data were analyzed by calculating the percentage of student responses and the interview data were analyzed qualitatively. The result showed that students gave a positive response to the Research Based Learning in training students' critical thinking skills by 94% and were in the very good category. The indicators of "open thinking" and "able to provide ideas" are critical thinking indicators that get responses reaching 100%. In line with the observation results that the indicator "able to provide ideas" obtained the highest percentage, namely 88% in the very good category. Each stage in the Research Based Learning in this study provides opportunities for students to develop their critical thinking skills. The results of this study can be used as a reference for developing research-based learning strategies in other subjects.

INTRODUCTION

Critical thinking is an ability that has a specific purpose for empowering thinking activities in science education and other disciplines. Problem-solving and critical thinking skills as two of the ten core life skills strategies and techniques. Since time immemorial, Sacrotes taught by subjecting the ideas of his students to rigorous and critical questioning, while the aim of the process was to show students that they needed to force their thinking out of what they thought they didn't know when they could find their ideas (Changwong et al., 2018; Setiawati & Corebima, 2017). Critical thinking is one of the dimensions of Habits of mind or smart thinking habits which is a fundamental thing to be mastered and considered as a way of thinking in dealing with all problems. According to Firdaus et al., (2015) and Saputri et al., (2020), critical thinking skills will encourage someone to be independent, and someone who has critical skills is the most sought after person in the world of work because it can help find solutions to problems that occur and can minimize failure. Furthermore, critical thinking skills are an effort to consider many points of view and choose the most appropriate thing carefully, logically, and systematically which is an intellectual process in making scientific concepts so as to enable students to use them to analyze their own thinking and draw conclusions (Kurnianto et al., 2019; Setiawati & Corebima, 2017).

Critical Thinking is a bridge to help individuals find answers to the problems they face. Critical thinking is also one of the important skills in facing the 21st Century, so it is important that this skill is trained and developed (Changwong et al., 2018). Critical thinking is an activity of analyzing ideas in a more specific direction, intelligently, sharply and developing things in a more perfect direction. Critical thinking ability is closely related to the problem solving process, where students' ability to be able to explore, investigate, and analyze processes in finding answers to a given problem to produce new knowledge that encourages students to use all efforts in connecting the concepts that are in mind them (Firdaus et al., 2015). But in fact, based on observations made by lecturers towards students in biology lectures, it is still difficult to understand and complete assignments given by lecturers such as in making biology learning media. There are still a few students who are able to synthesize their knowledge in the form of scientific concepts to be applied in solving cases given by lecturers. When students were given biology questions at cognitive levels C4-C6, it was found that 24 out of a total of 36 students scored below 60. This shows that students' critical thinking skills are still low. Such as research from Fakhriyah (2014) and Kirana & Kusairi (2019) that critical thinking skills can be seen from how students solve problems when given a case. When students cannot solve a given case, it shows that students' critical thinking skills are still low. Kirana & Kusairi (2019) added that when students are unable to solve questions at the level of analysis, evaluation, and creation, students' critical thinking skills are low. Wiyoko (2019) says that critical thinking skills are high-level thinking skills, students who have good critical thinking skills are able to process concepts and can use them in dealing with conflict situations, when students are not able to process information properly in terms of dealing with a given problem or case and cannot answer questions that require students to be able to analyze, interpret, evaluate, make inferences, so these students do not yet have high critical thinking skills. Therefore, it is necessary to apply learning that trains students to think accurately and clearly in accordance with the facts. According to Setiawati & Corebima (2017), critical thinking skills are not an automatic inheritance from every student but can be trained through guided practice. One learning strategy that can develop analytical power and train students in constructing their thinking to train students' critical thinking skills is a research-based learning strategy.

According to Usmeldi et al. (2017), research-based learning is learning that integrates research experiences into the learning process. The development of research-based learning includes a research-based learning process, with instructions such as research being adopted into learning with the help of lecturers as supervising instructors in learning the steps for obtaining information and processing it. In the process, students are expected to always review all the ongoing processes, relate to the surrounding community and take part in discovering new knowledge through new experiences. According to Tungkasamit (2019), research-based learning is a learning that departs from existing phenomena, requiring students to carry out scientific activities in a structured manner through the investigation of new knowledge by finding, proving, collecting, analyzing, drawing conclusions appropriately in accordance with the data collected. ril. Research-based learning provides a wide space for students to discover new scientific knowledge so as to train their critical thinking skills. Research-based learning

has many positive sides, referring to various learning methods that cause student learning outcomes to come from simple research they do, for example through experiments and field studies.

Several studies that discuss research-based learning and critical thinking skills include research conducted by Usmeldi et al. (2017), namely the implementation of research-based learning is an effective approach in improving critical thinking skills and student learning outcomes. Research conducted by Mutakinati et al. (2018) which aims to determine students' thinking skills with a STEM approach through Project Based Learning. Furthermore, research by Narahaubun et al. (2020) which discusses improving the quality of learning through Research Based Learning combined with Think Pair Share which provides good learning outcomes for students. Liu & Li, (2011) combine research-based learning with a modern physics teaching approach that triggers students' academic development for the better. Haviz (2018) conduct research to develop research-based learning in biology learning that produces research-based learning designs. Research by Srikoon et al. (2014) regarding the analysis of research-based learning studies in Thailand, seen from the number of research-based learning studies that have been published and descriptions of the effects of research-based learning on various dependent variables. Amelia (2018) conducts research-based learning in biology seminar courses by teaching research concepts to students. From several previous studies, there is still little research discussing research-based learning in biology lectures and in the technical implementation of research-based learning conducted in previous research, no one has carried out research-based learning stages by training students to do research on developing simple media in biology learning (types of research and development) such as research-based learning stages in this study so that it becomes novelty in this research.

In the vision and mission of the Faculty of Teacher Training and Education, Riau University, Indonesia it is stated that the implementation of education and teaching must be research-oriented, so it is important to conduct research on student perceptions of Research Based Learning learning strategies so that they can be further developed more broadly by a lecturer in biology education at the Faculty of Teacher Training and Education Universitas of Riau because the critical thinking skills of biology education students are still low. This study aims to determine student perceptions of the implementation of Research Based Learning in training students' critical thinking skills. This study will provide alternative lecture strategies that support the University's Vision and Mission that are able to train critical thinking skills and provide information related to student responses after carrying out lectures with Research Based Learning strategies in training students' critical thinking skills.

METHODS
Research Design
This research is quantitative descriptive. This type of research is used to analyze data by describe or describe the data that has been collected as it is (Arikunto, 2014). This study aims to describe student perceptions after the implementation of research based learning. This research was conducted at the Faculty of Teacher Training and Education, Riau University. This research was conducted for 4 months.

Population and Samples
The population in this study were all students of Biology education at the Riau University. The sample in this study were Biology Education students in semester 3 (three) class A who took the Learning Media course totally 36 students and taught by lecturers using research-based learning strategies. Sampling technique is through purposive sampling, namely the sampling technique of data sources with certain considerations (Sugiyono, 2014).

Instrument
The instrument used in this study was a student response questionnaire after implementing the Research Based Learning lecture strategy. The data is also supported based on the results of observations. The questions in the questionnaire and observation sheets emphasize the description of indicators for achieving critical thinking skills developed by Marzano (1994), namely (1) accurate and seeking accuracy, (2) clearly seeking clarity, (3) being open, (4) able to provide ideas, (5) is sensitive and knows his friends' abilities.

In addition, interview sheets were also used. The questions on the interview sheet are related to the description of the achievement of students' critical thinking indicators after participating in research based learning. Attached is the student response questionnaire in Table 1.

Table 1
Student response questionnaire that emphasizes the description of critical thinking indicators through research based learning

No	Question	Yes	No
1.	Can investigation and information gathering activities to develop simple learning media train you to always *seek clarity* in these stages?		
2.	Does the need analysis activity and information gathering and product validation make you *always look for accuracy* in developing suitable learning media for an educational unit?		
3.	Does going through each stage of the Reseach Based Learning make you *challenged* in developing simple learning media?		
4.	Does the needs analysis activity enable you to *make the right decisions* to develop simple learning media?		
5.	Did the discussion and evaluation activities regarding the development of simple learning media make you *open-minded* in accepting your friends' opinions?		
6.	Can discussions and presentations about the developed products get you used to *being more sensitive to your friends and recognizing your friends' abilities*?		
7.	Does the group presentation make you *open-minded* in accepting criticism and suggestions from other groups?		
8.	Has the group presentation made *you recognize your friends' knowledge abilities*?		

(Marzano's Modification)

The student perception questionnaire instrument has been tested to determine the level of validity and reliability of the instrument. The following results of the research instrument trials are presented in Table 2.

Tabel 2
Questionnaire validity and reliability

Questionnaire Statement	Reability	Correlation	Significant Correlation	Description
1	0,756	0,068	Very Significant	Used
2		0,774	Very Significant	Used
3		0,602	Very Significant	Used
4		0,635	Very Significant	Used
5		0,548	Very Significant	Used
6		0,695	Very Significant	Used
7		0,386	Significant	Used
8		0,664	Very Significant	Used

Some of the questions on the interview sheet are as follows: (1) How do you find solutions to problems in developing your simple learning media?, (2) How can you complete each stage in the development of simple learning media?, (3) Where did you get the information to complete the development of simple learning media?, (4) How do you evaluate the results of your performance in relation to the comparison with the performance of your friends?, (5) What obstacles did you face when carrying out the stages of Research Based Learning?, (6) What is your impression after participating in Research Based Learning? follow-up questions adjusted during direct interviews with students.

Procedure

This research was conducted through three stages, namely the stage of making instruments, data collection and data analysis. The instrument was made referring to the framework of Marzano (1994). The data in this study were obtained through student response questionnaires after implementing the Research Based Learning lecture strategy and observation. After students carry out each stage of research based learning, student response questionnaires are distributed to students to determine

student responses to research based learning learning in practicing critical thinking skills. Questionnaires were made and distributed via google form. As long as students carry out research-based learning, students are observed by paying attention to their critical thinking abilities. After that, in-depth interviews were also conducted with students to obtain additional information and direct, more detailed explanations of student answers.

Table 3
Student observation sheets during lectures using research-based learning strategies

No	Statement
1.	Accurate and seeking accuracy:
	a. Check any doubtful and confusing things related to the answers to the assignments given
	b. read reference sources or books so that the data obtained more accurate
2.	Clearly seeking clarity:
	a. Try to get a clear and unambiguous understanding by asking the lecturer or other group members
3.	Being open:
	a. Willing to listen and consider the opinions of other friends when discussing the problems given
4.	Able to provide ideas:
	a. Every student can develop their ideas in designing simple learning media
	b. students can provide input ideas for the design of their friends' learning media
5.	Is sensitive and knows his friends' abilities
	a. Each member of the group seems to understand the knowledge and abilities of their group mates

(Sriyati's Modification)

Data Analysis Techniques

Student response questionnaires in the form of direct and closed questionnaires in the form of yes and no answer choices. For the answer "yes" is given a value of 1 while for the answer "no" is given a value of 0. Questionnaire data on student responses to the application of Research Based Learning lecture strategies in training students' critical thinking skills were analyzed by calculating the percentage of student responses. The data were analyzed by the following formula.

$$\% \text{ student responses} = \frac{the\ number\ of\ students\ who\ answered\ yes/no}{total\ number\ of\ students} \times 100\%$$

Class observation data listed on the observation sheet during lectures with research-based learning strategies were analyzed by calculating percentages. Based on these data it is known that the achievement of students' critical thinking which is trained every time is learning by using research-based learning strategies. Table 4 below presents the criteria for the percentage of questionnaire scores and observation sheets obtained.

Table 4
Categorization of student response questionnaire percentage results

| Percentage	Category
86 – 100%	Very well
76 – 85%	Well
60 – 75%	Enough
55-59 %	Not enough
≤ 54%	Less once

(Purwanto, 2009)

The results of interviews with students were analyzed qualitatively by Miles and Hubarman Models means of:
a. Data collection, at this stage the data is collected through interview answers from students.
b. Data reduction, at this stage the data is reduced or simplified to suit the needs and is easy to understand in obtaining information.
c. Data presentation, at this stage the data is presented after reduction and simplification have been carried out.

d. Drawing conclusions, at this stage obtained data that has been concluded and in accordance with the needs

The data from the interviews were used to support the results of the student response questionnaires.
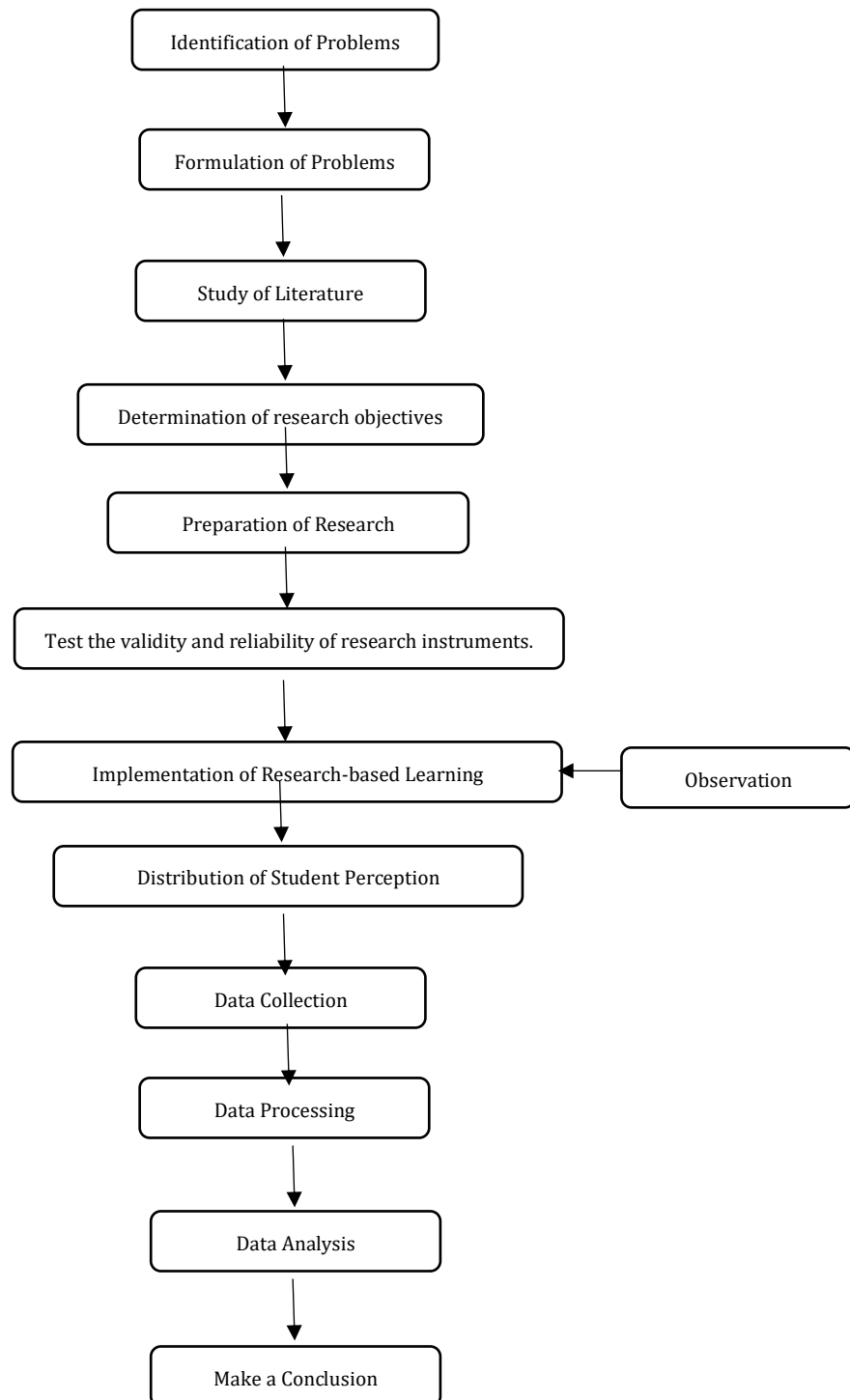

Figure 1. Research Procedure

RESULTS AND DISCUSSION

A. Results of questionnaires and interviews with students after participating in research-based learning

During lectures using the Research Based Learning, students conduct a research on the development of simple learning media in Biology lessons. The stages of the Research Based Learning in this study are, (1) students conduct a needs analysis of the development of simple learning media (Analysis stage), (2) students develop a simple learning media design that will be made (Design stage), (3) students develop simple learning media products (Development stage), (4) students implement simple learning media made through making learning videos and their application online (Implementation stage), (5) students evaluate the results of simple learning media products they have produced (Evaluation stage). After students carry out all stages of the Research Based Learning, it will be seen how students respond to the Research Based Learning in training students' critical thinking skills. The results of data analysis regarding student responses to Research Based Learning in training students' critical thinking skills by looking at the achievements of the indicators can be seen in the following figure.
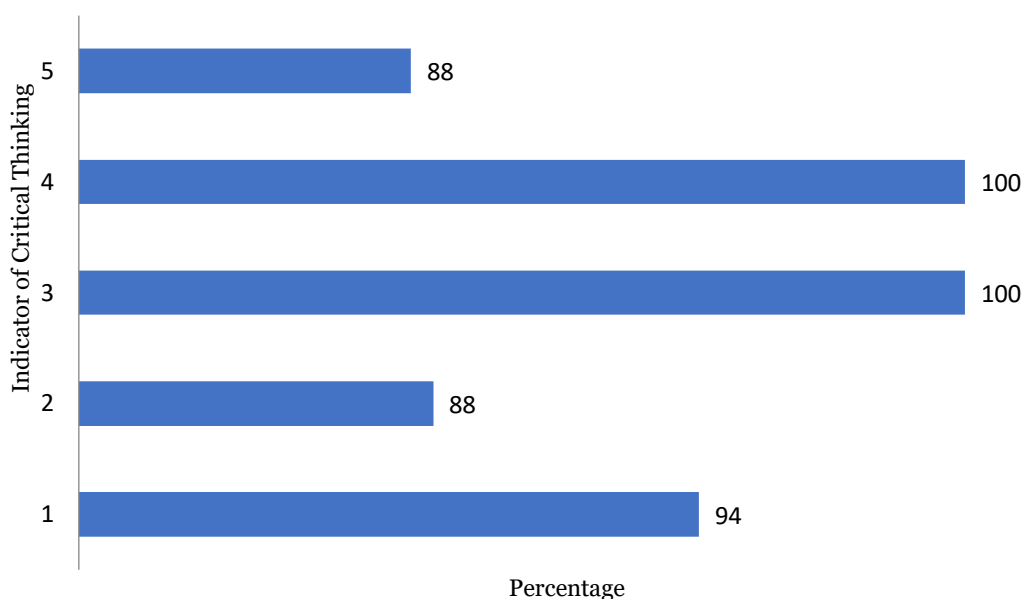
Figure 2. Student responses to the achievement of critical thinking indicators after participating in Research Based Learning. Information: (1) accurate and seeking accuracy, (2) clearly seeking clarity, (3) being open, (4) able to provide ideas, (5) being sensitive and aware of the abilities of his friends.

Details of the questions on the achievement of critical thinking indicators through the Research Based Learning are presented in the following Table 5. Based on the results of the student response questionnaire analysis in Figure 2. it can be seen that through the Research Based Learning can train students' critical thinking skills as seen from the results of the average positive response from students of 94% in the very good category. This is also supported by Brew & Saunders (2020) and Tohir et al. (2018) research that research-based learning strategies can open students' critical thinking because these learning strategies make students think scientifically. In the Research Based Learning, students will tend to think critically in carrying out the learning process. In this stage, students work and learn independently as well as learn and practice communication skills. Applying experiences during learning and research impressions to display the results of their products, presenting in writing and orally will train students' analytical and critical thinking skills (Mahardini et al., 2018).

In the Research Based Learning, students are given the opportunity to gain experience as researchers, find their own problems and solve these problems with the methods used by researchers in research. This strategy makes students get a different impression, they are more responsible in every stage of their learning, actively involved in thoughts, actions, solutions, ideas, creativity and their social experiences. Seen from the results of the data obtained by students giving a positive response of 100% on the indicator "able to provide ideas / ideas".

Table 5
The results of student responses to each question of achieving critical thinking indicators through Research Based Learning

No	Question	Yes		No	
		Total	(%)	Total	(%)
1.	Can investigation and information gathering activities to develop simple learning media train you to always *seek clarity* in these stages?	32	88	4	12
2.	Does the need analysis activity and information gathering and product validation make you *always look for accuracy* in developing suitable learning media for an educational unit?	34	94	2	6
3.	Does going through each stage of the Reseach Based Learning make you *challenged* in developing simple learning media?	36	100	0	0
4.	Does the needs analysis activity enable you to *make the right decisions* to develop simple learning media?	34	94	2	6
5.	Did the discussion and evaluation activities regarding the development of simple learning media make you *open-minded* in accepting your friends' opinions?	36	100	0	0
6.	Can discussions and presentations about the developed products get you used to *being more sensitive to your friends and recognizing your friends' abilities*?	33	92	3	8
7.	Does the group presentation make you *open-minded* in accepting criticism and suggestions from other groups?	36	100	0	0
8.	Has the group presentation made *you recognize your friends' knowledge abilities*?	30	83	6	17
	Total	**94%**		**6%**	

Based on interview results students said that each stage in the Research Based Learning made them trained in finding ideas. In the needs analysis stage (analysis), students are trained to express their ideas through making appropriate interview questions to be able to describe current conditions and what needs are appropriate to overcome real problems (real conditions) so that students get comprehensive information. According to Yulhendri et al., (2018) authentic research-based learning with the perspective of problem formulation, alternative solutions, and implementation of research results can provide benefits in the form and level of students' thinking.

At the stage of making research reports, students train students to express their thoughts in writing, writing skills are also trained at this stage. Not all students are able to write well, based on the results of the interviews they said that there were many ideas in their heads but it was difficult to write them down. In the end they read more writings, scientific papers, research articles to provide inspiration in writing their research reports, that's the way they did to finish their writing. According to Setiawan et al. (2018), Prahmana & Kusumah (2016), Prahmana et al. (2017), writing research reports is a learning process involved in producing valid research products, especially when students use real problems, they will read more, reflect, conduct data investigations, analyze data and communicate their work. which is included in the inquiry-based learning process that will train students' critical thinking skills.

In practice, students have logical reasons for developing their respective products, which can be seen from their ability to provide arguments for each question regarding their own design products during class discussions and with lecturers. The independence of students in conducting research on the development of learning media products makes them produce creative and innovative ideas and requires them to be open-minded to produce quality products. Students develop product ideas for simple biology learning media also based on needs analysis through interviews so that they develop products according to real problems and become extraordinary experiences for students, this is a new discovery in this research. Based on interviews, students are more flexible in developing the ideas that are in their minds because research-based lecture strategies provide great opportunities for students to play an active role as researchers who are responsible for their own design work. An interesting thing was stated by Rahim (2019), that students are able to make an active contribution to the research-based learning process by building their own knowledge by combining new information and experience with knowledge structures that already exist in their minds.

The implementation phase through the making of learning videos by applying the learning media products that have been made also provides its own challenges for students. Students said that in this stage they try new things and learn different aspects because this is related to a person's skill in creating a learning video creation that so far students have never made it. Students also realize that when they carry out research on product development, this learning media also has a lot of impact, not only being able to produce the right product in solving learning problems but also providing information widely through learning videos that are created and uploaded through their YouTube channel. Their thinking ideas and thinking insights are increasingly developing through their activities during learning using the Research Based Learning.

The stages of learning media product design (Design), also make students come up with creative ideas in developing an innovative product. Based on the results of interviews, students said that they worked hard in designing the suitability and reliability of a new product in the form of a simple learning media that could provide the maximum benefit with the smallest capital. This is supported by the research of Alvionita et al. (2020), Brew & Saunders (2020) and Durham et al. (2017), in the application of research-based learning models, teachers see students have the skills to develop ideas in finding solutions to problems. Situations that require students to demonstrate valid declarative and procedural skills in assessing their own work and those of others, will develop reflective and metacognitive skills, especially developing critical thinking skills when analyzing problems to creating innovative product ideas as solutions. In addition, each stage that is carried out will always be through discussion with the lecturer so that students are also facilitated to always seek accuracy in the stages of research carried out. According to Liu & Li (2011) guiding students to think independently, and seeking deeper information in exploration and discussion is very important. Students are directed to analyze and manage various processes in the survey and observation during actualization and exploration activities by exploring an existing problem, then the information obtained will become a tool to confirm the accuracy of the existing data. So it can be said that it is important for students to explore problems by going directly to real situations and by analyzing situations and needs.

Students also said that they always try to explore various information related to the type of design, to how to develop a learning media that is different from the existing one. They ask for advice from their classmates and also discuss directly with the lecturer. Students elaborate all design techniques on their respective learning media products and this shows an open attitude in developing product ideas. Based on the results of the questionnaire data analysis also showed that students gave a positive response of 100% on the open-thinking indicator after attending the Research Based Learning. Based on interviews, students also always look for information through YouTube, the internet, and scientific articles in developing creative learning media, this shows the achievement of the "open-minded" indicator. It can be seen based on the results of observations during lectures using the "Students as Researchers" strategy that students' critical thinking abilities have increased every meeting. This is in line with the opinion of Narahaubun et al. (2020), in research-based learning there is an independent information search stage that helps students practice as critical thinkers to find out and utilize information to form logical thinking. In addition, students are also free to convey and accept arguments. Students are trained to be open-minded by using learning resources from anywhere, not limited to teachers and books, but more than that flexibility of thinking can be obtained through the web and the internet, videos and pictures of information sources. Students synthesize independent learning resources and the results of their friends' readings so as to allow the exchange of information between each other.

According to responses from students, the product development stage provides students' experience in producing simple learning media prototypes by involving their ideas, besides that students also prepare validation sheets and ask for expert judgment in validating their products. This step makes students trained in open-mindedness to accept suggestions and input from experts. During lectures, lecturers also provide opportunities for students to present their designs, discussions carried out on this strategy are not only discussions limited to answering the assigned questions but also discuss a draft of each student's work. High-level thinking skills are needed in discussions, other friends participate in expressing their ideas for improving their friends' products. This activity makes students interact with each other and are open-minded, students understand the need for sharing sessions in learning. This is also supported research by Wessels et al. (2021) and Daryanes (2020) that research-based learning can improve students' cognitive, affective-motivated to social abilities.

The Research Based Learning provides opportunities for students to interact both with school teachers, lecturers, friends, and the outside community. Students said that they gained a lot of knowledge and experience as well as updating information from every collaboration they did. The ability to think deeply will always be applied by students during research-based learning that trains their habits (Suparini et al., 2020). The evaluation stage is the stage where students improve their learning media products according to suggestions and input from friends, lecturers and the validator team. Open thinking is one of the keys to making products developed to always have innovation. According to Liu & Li, (2011), research-based learning will foster students' innovative spirit and practical ability. This learning is related to actuality and problem solving through exploration to reform the basic concepts of quality and research-based innovation by focusing on students' scientific thinking and growing students' ability to analyze and solve problems and innovate.

Aspects of critical thinking presented in the research include interpretation, analysis, evaluation, inference, explanation, and argumentation (Daryanes, 2021; Susiani et al., 2018; Usmeldi, 2018). Students acquire data entry skills, data analysis, data interpretation, planning, discovery, development of a work, communication, mastery of technology to self-regulation (self-regulation) while participating in research-based learning (Daryanes & Fauza, 2020; Elgin et al., 2016; Noguez & Neri, 2019). Research-based learning has a very significant impact on improving students' critical thinking skills when compared to traditional one-way learning. With this learning, students become more active and dare to try new things, so that learning occurs in two directions between students and teachers. This research-based learning is proven to be able to improve higher-order thinking skills such as critical thinking and creative thinking skills (Ridlo et al., 2021).

B. Result of student observations during research-based learning
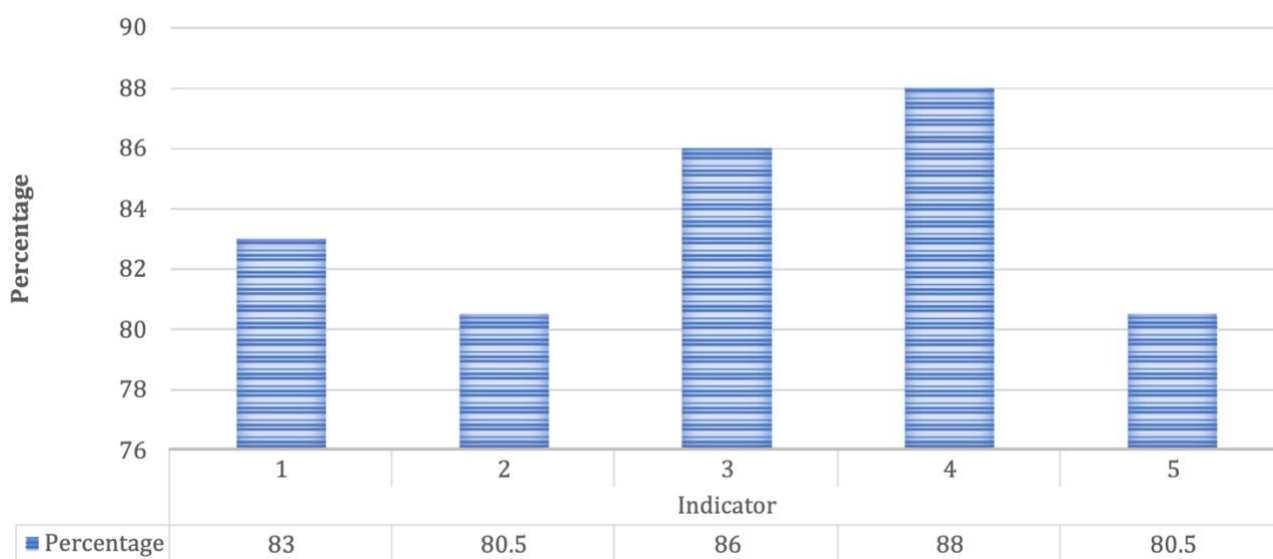
Figure 3. The results of student observations during research-based learning. Information: (1) accurate and seeking accuracy, (2) clearly seeking clarity, (3) being open, (4) able to provide ideas, (5) being sensitive and aware of the abilities of his friends.

Based on the observation results obtained (Figure 3) it can be seen that the critical thinking skills of each indicator are in the good and very good categories. This data supports the results of student response questionnaires after participating in research-based learning. Students' critical thinking skills increase through research-based learning activities based on observation results. Student activities during research-based learning include analyzing, designing, creating, communicating and sharing as well as mutual introspection and evaluating a simple learning media product. According to Usmeldi (2018), through step by step activities in research-based learning will train students to solve problems independently and in groups. During the observation, it was seen that students found ideas in developing simple learning media products and provided input to their friends when their friends presented the results of developing simple biology learning media products. This habit will train critical thinking skills on the indicators "can give ideas/ideas" and "sensitive to the ability of friends" because

at the stage of reporting and presenting the results of the development of simple learning media products can also train their organizational skills by discussing and sharing them with each other. This is also in accordance with the opinion of Yulhendri et al. (2018) that research-based learning not only develops the ability to find and communicate knowledge but is also able to integrate ethical and moral decisions both individually and collectively for private and public. Research-based learning has a "social learning" component to develop self-confidence, empathy and social solidarity among friends.

The observation results show that the indicator "able to give ideas" has an achievement level of 88% in the very good category. The results of observations were seen in the stages of class discussions and presentations in research-based learning, all students played an active role in conveying ideas for improving the design of their friends' simple biology learning media products. Lecturers always provide time and opportunities in research-based learning for each student to contribute to their friends' products so that the resulting product development is better. In research-based learning, students independently find problems through the stages of needs analysis. Students solve and find solutions to their problems through the stages of the scientific method which provide research experience so that students are pure in creating simple biology learning media products that are appropriate to the problem and come from their own ideas. Lecturers do not carry out conventional learning which limits and forces students to develop products according to the lecturer's directions, but students utilize their critical thinking skills to generate ideas for the developed simple biology learning media products.

Based on the results of observations, it was found that the "open-minded" indicator reached 86% with the second highest percentage after the "able to convey ideas" indicator with a very good category (Figure 2). Based on observations, students always collect various information related to the development of simple biology learning media products. Students analyze, modify and create innovative product designs. In addition, students also follow up on input from their friends so that the products developed are more innovative, including students including quiz elements in the simple learning media they develop.

Students present their research results and explain research topics thoroughly and discuss so that the material is used as a basis for students to report their work. The presentation serves as a springboard for further and in-depth discussion. In practice, researchers communicate their values, ideas, and experiences through the discussion process. You can see the analysis and ideas of each researcher in finding solutions to problems, which include relevant strategies and analytical reasoning, critical thinking skills and persuasive communication (LaBeouf, 2016).

CONCLUSION

Based on the results of the research that has been done, it can be concluded that students gave positive responses reaching 94% and were in the very good category of lectures with the Research Based Learning in training critical thinking skills. In general, students agree that the Research Based Learning can train all critical thinking indicators. The indicators of "open thinking" and "able to provide ideas/ideas" are critical thinking indicators that get responses reaching 100%. Each stage in the Research Based Learning in this study provides opportunities for students to develop their critical thinking skills. The ability to think deeply will always be applied by students during research-based learning that trains their habits. This learning is related to actuality and problem solving through exploration to reform the basic concepts of quality and research-based innovation by focusing on students' scientific thinking and growing students' ability to analyze and solve problems and innovate. Based on the results of this study, it can be used as a reference for developing Research Based Learning strategies in other subjects. Other research can also explore and design different stages of a research model from the stages in this research that students use in their learning according to the characteristics of the course. In this study, the number of respondents is still limited, so that researchers who want to conduct research with the same theme can maximize the number of respondents in order to obtain more information.

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