RESEARCH ARTICLE

# Improving critical thinking skills through discovery learning models assisted animation video on digestive system material

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Abstract: This research is quantitative research to determine the effect of using the Discovery Learning model to assist animation video on the critical thinking skills of students grade XI on the digestive system. The research method used is Quasi Experiment with a Non-equivalent Control Group Design and used purposive sampling. The research instruments used were multiple choice (pretest and post-test). Observation sheets, and students' questionnaire responses. Data on critical thinking skills outcomes were analysed using an independent sample t-test in the SPSS version 26.0 program. The result showed that the use of Discovery Learning models assisted animation video increased student critical thinking skills with a gain value of 41.43 and n gain of 0.64 in the medium category. The result of the hypothesis test shows the value of Sig. (2-tailed) 0.000 < 0.05 which means H0 is rejected and Ha is accepted. This shows that the Discovery Learning models to assist animation videos have a significant effect on student critical thinking skills of class XI of SHS 1 Lahat in the human digestive system. The implementation of learning has an excellent category, while student responses have an excellent and good category.

**Keywords**: animated video; critical thinking; digestive system; discovery learning

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***Article history:***
**Received:** 8 September 2023
**Revised:** 16 October 2023
**Accepted:** 22 October 2023
**Published:** 16 November 2023

10.22219/jpbi.v9i3.29042



p-ISSN: 2442-3750
e-ISSN: 2537-6204

**How to cite:** Anwar, Y., Slamet, A., & Daniaty, U. (2023) Improving critical thinking skills through discovery learning models assisted animation video on digestive system material. *JPBI (Jurnal Pendidikan Biologi Indonesia), 9*(3), 433-444. https://doi.org/10.22219/jpbi.v9i3.29042

## Introduction

Learning in the 21st century in the era of the Industrial Revolution 4.0 requires the birth of a superior generation capable of critical and creative thinking (Anwar et al., 2020). In addition, the 21st century also demands learning that provides 4C skills to students including communication, collaboration, critical thinking and problem-solving, and creativity and innovation (Ferazona, 2020). It can be seen that the ability to think critically is one of the abilities that must be possessed by students in the 21st century.

Critical thinking is the ability to think in deciding about things that must be believed and carried out reasonably and reflectively (Ennis, 2011). Critical thinking skills are very important to have and develop in learners. When learners can think critically, it means that they are able to make discoveries that are focused on certain goals. For the learning process to develop critical thinking skills, a learning model is needed in the 2013 curriculum that can improve critical thinking skills. Critical thinking skills are part of higher-order thinking skills (Rohmawati, 2020). A learning model that focuses more on high thinking skills to find out various concepts or theoretical issues through the process of beginning to end at a conclusion is the Discovery Learning model (Djepy et al., 2022).

Students' critical thinking skills vary and are measured based on several indicators. There are several indicators of critical thinking, including according to Ennis (2011) consisting of providing simple explanations, building basic skills, concluding, providing further explanations, and developing strategies and tactics. Then, Inch states that critical thinking has eight interrelated components, namely (1) the existence of a problem, (2) has a purpose, (3) the existence of data and facts, (4) theories, definitions,

axioms, postulates, (5) the beginning of the solution, (6) completion framework, (7) completion and conclusion, and (8) implications. This study uses critical thinking indicators according to Ennis (2011) because these critical thinking indicators are related to the syntax of Discovery Learning.

The Discovery Learning model is one of the appropriate learning models for improving students' critical thinking skills and focuses more on discovering concepts from previously unknown knowledge or information and student-centered learning (Wulandari, 2019). The stages of this model are stimulation, problem statement, data collecting, data processing, verification, and generalization (Syah, 2016 Kemendikbud, 2017). The discovery learning model is one of the learning models that supports the 2013 curriculum (Nababan, 2021). This model is one of the models in the 2013 curriculum that is effective in increasing the activeness and critical thinking skills needed in 21st-century learning. Critical thinking skills should also be developed by educators, especially in biology learning.

Biology learning contains material that emphasizes students to be actively involved in direct experience because it is related to the environment and nature (Ridho & Hasruddin, 2017). In Biology subjects, some material is still abstract, one of which is material about the human digestive system (Putri et al., 2022). The material about the digestive system is complicated, involving certain interconnected processes so it is very suitable to be packaged in a digital format it is not enough if the explanation is only in the form of text or ordinary pictures so it is better to use digital media in the form of animated videos (Jayawardana, 2017).

Animation media is one of the simple media that can eliminate the abstractness of the material, and channel learning messages by utilizing the senses of hearing and vision so that they can be seen and heard with a moving image that can attract students' attention. Students are expected to find information through animations displayed by educators so that they are not only fixated on books but are able to foster student activeness in the teaching process (Km et al., 2020).

Based on the results of interviews with Biology teachers at SMA Negeri 1 Lahat related to ongoing learning, shows that the school is still implementing the 2013 curriculum and still using expository and direct instruction methods and the learning media used are books and PowerPoint media. Some of the problems encountered in learning at school, especially in learning Biology, are that students tend to be passive, lack expressing their opinions, and critical thinking skills are still low because, in classroom learning, students do not follow the learning well, they tend not to pay attention to the explanation of the teacher so that students cannot answer questions given by the teacher.

To train and improve students' critical thinking skills, especially in the post-pandemic period like today, which invites students to return to active learning face-to-face, a learning model is needed that creates an atmosphere where students participate actively in learning in accordance with the 2013 curriculum. So, the right solution is to apply the Discovery Learning model. The material taught is in the basic competency 3.7 Analyze the relationship between the structure of the tissues that make up the organs in the digestive system nutrition, bioprocesses, and functional disorders that can occur in the human digestive system. The basic competency of this material is following the indicators of critical thinking. In addition, based on the results of interviews with Biology teachers, digestive system material is one of the materials that is difficult to understand because it is still abstract so appropriate media is needed, one of which is by using animation media.

Based on previous research on the discovery learning model that has been carried out by Aryani and Wasitohadi (2020), shows that the application of the discovery learning model has a significant effect on critical thinking skills. Similar research conducted by (Potu & Poluakan, 2020) showed that the discovery learning model assisted by interactive multimedia can improve students' critical thinking skills. Likewise, the results of research from Putri et al. (2022) show that the discovery learning model assisted by animated videos can improve the learning outcomes of VII grade junior high school students on digestive system material.

Based on the description of the background of the problem above, and considering that no research shows the effect of the Discovery Learning model assisted by animated video on the critical thinking skills of class XI high school students on the material of the digestive system, the researcher is interested in conducting a study entitled "The Effect of Discovery Learning model assisted by Animated Video on Critical Thinking Skills of Class XI Students on Digestive System Material."

## Method

The type of research used in this study is quantitative research with the Quasi Experimental Design method or pseudo experiment. Two research subjects are using this method, the experimental class received learning treatment using the discovery learning model assisted by animated videos and the control class received learning treatment using only the discovery learning method.

The design used in this research is a Nonequivalent Control-Group Design. In this design, the experimental group and control group were not randomly selected (Sugiyono, 2016). This research was conducted at SMA Negeri 1 Lahat in November-December of the 2022/2023 school year for 3 meetings.

The research design can be seen in Figure 1.

O1 X1 O2
---
Q3 X2 O4

Figure 1. Research Design

In this study, the population was all students of class XI IPA SMA Negeri 1 Lahat. The technique used in sampling used purposive sampling technique so that the XI MIPA 4 class was obtained as an experimental class totaling 37 students and the XI MIPA 1 class as a control class totaling 35 students. The data collection instrument was a multiple-choice critical thinking skills test using 20 multiple-choice questions with five answer choices. The questions used modified critical thinking questions (Tiara et al., 2020) which consisted of five indicators according to (Ennis, 2015).
The research procedure to be carried out is divided into three stages, namely the preparation stage, the implementation stage, and the completion stage. In the preparation stage, researchers first observed the school and then determined the class that was used as a sample using purposive sampling. Furthermore, preparing the Learning Implementation Plan (RPP), multiple choice questions for critical thinking skills, observation sheets, and student questionnaires. Then, students were introduced to the Discovery Learning model through classroom learning of human digestive system material. In the implementation stage, researchers gave pre-test and post-test questions. The learning process was then carried out by applying the Discovery Learning model assisted by animated videos for three meetings, the initial test was given at the beginning of the first meeting, the student response questionnaire, and the final test was given at the end of the last meeting. At the completion stage, researchers analyzed the results of critical thinking skills test data and drew conclusions. Data analysis was carried out to test the effect of the Discovery Learning model assisted by animated video on critical thinking skills. The data analysis technique used SPSS 26. Analysis of critical thinking skills test data is by paying attention to the value of the pre-test and post-test results. To calculate the overall results of students' critical thinking skills, the following Formula (1).

$$\text{Value} = \frac{\text{The raw score obtained by the learner}}{\text{Ideal maximum score}} \text{x100} \quad (1)$$

Furthermore, the test scores are converted in Table 1 of the following learning outcome categories.

Table 1. Category of Critical Thinking of Learner

| Assessment Percentage | Category |
|---|---|
| 81 < X ≤ 100 | Very High |
| 71 < X ≤ 80 | High |
| 61 < X ≤ 70 | Medium |
| 41 < X ≤ 60 | Low |
| 0 < X ≤ 40 | Very Low |

(Karim & Cheng, 2018)

Furthermore, to find the gain value of critical thinking skills using the following Formula (2).

Gain = Final test score - Initial test score (2)

To determine the category of concept mastery level using the gain index (n-gain) with the following formula.

## Results and Discussion

Through a written test in the form of multiple choice, as many as 20 questions with 5 answer choices, data on the result of student's critical thinking skills were obtained the average scores of the initial test, final test, and gain and n gain can be seen in the Table 2.

Table 2. Average of Initial, Final, Gain, and N-Gain Test Scores of Experimental and Control Classes

| No. | Critical Thinking Skill Indicator | Experiment Class | | | | | Control Class | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pre Test | Post Test | Gain | N-Gain | N-Gain Category | Pre Test | Post Test | Gain | N-Gain | N-Gain Category |
| 1. | Elementary Clarification | 37.14 | 98.57 | 61.43 | 0.98 | High | 32.43 | 76.35 | 43.92 | 0.65 | Med |
| 2. | Basic Support | 34.29 | 86.43 | 52.14 | 0.79 | High | 31.76 | 58.11 | 26.35 | 0.39 | Med |
| 3. | Inference | 48.57 | 84.29 | 35.72 | 0.69 | Med | 33.78 | 79.73 | 45.95 | 0.69 | Med |
| 4. | Advanced Clarification | 29.29 | 57.86 | 28.57 | 0.40 | Med | 27.03 | 55.41 | 28.38 | 0.39 | Med |
| 5. | Strategy and Tactics | 26.43 | 55.71 | 29.28 | 0.40 | Med | 25.68 | 59.46 | 33.78 | 0.45 | Med |
| | TPK Total | 35.14 | 76.57 | 41.43 | 0.64 | Med | 30.13 | 65.81 | 35.68 | 0.51 | Med |

***Description: 81-100 (Very high), 71-80 (High), 61-70 (Medium), 41-60 (Low), 0-40 (Very Low)***

Table 2 shows the results of the critical thinking skills test in the experimental and control classes. The average initial test scores in the experimental and control classes are still both in the very low category, namely 35.14 and 30.13, Meanwhile, the average value of the final test in the experimental class is 76.57 (high) and the control class is 65.81 (medium), the average n-gain value in the experimental class is 0.64 (medium) and the average n-gain value in the control class is 0.51 (medium). Based on these results, shows that there is an increase in critical thinking skills in both classes, but the increase in the experimental class is higher than in the control class.

In the experimental class, the lowest average final test score was the strategy and tactics indicator 25.68 (very low) and the highest average final test score was giving a simple explanation 98.57 (very high). The lowest gain value was the indicator of providing advanced explanations 28.57 (failing) and the highest gain value was the indicator of providing simple explanations 61.43 (sufficient).

In the control class, the lowest average final test score was the indicator of giving further explanation 55.41 (poor) and the highest average final test score was the indicator of concluding 79.73 (good). The lowest gain value was the indicator of building basic skills 26.35 (failed) and the highest gain value was the indicator of concluding 45.95 (not good).

Furthermore, to determine the improvement of critical thinking skills by using the Discovery Learning model assisted by animated videos, the percentage of the mastery category of critical thinking skills was analyzed.

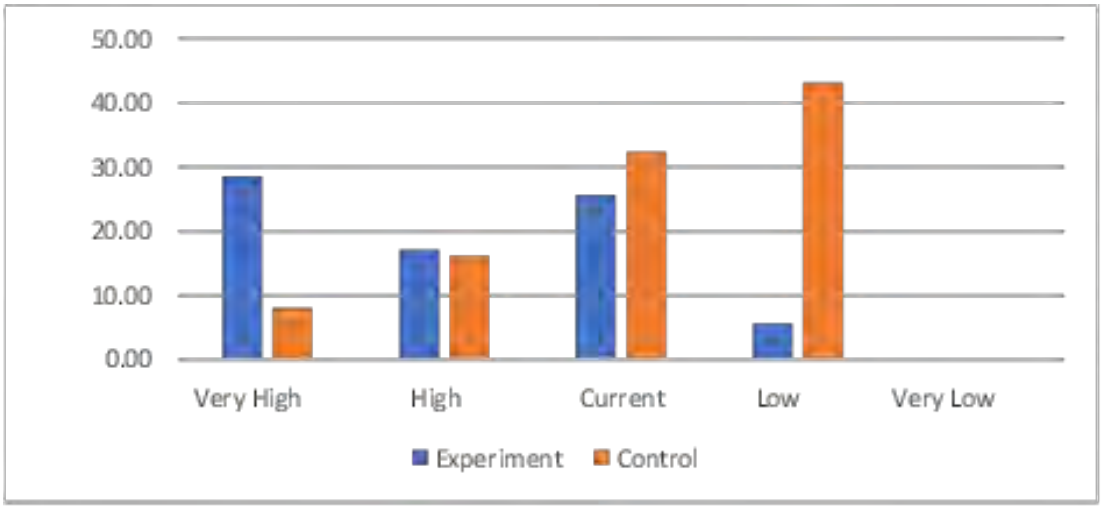


Figure 2. Percentage of Critical Thinking Skill Mastery Categories

Based on Figure 2 shows the percentage results of mastery of critical thinking skills of students based on the final test results obtained by the results of the very high category in the experimental class, namely 28.57% while in the control class 8.11%, in the high category of the experimental class, namely 17.14% while in the control class, namely 16.22%, in the medium category, namely 25.71% in the experimental class while 32.43% in the control class, in the low category, namely 5.71% in the experimental class

while 43.24% in the low category, and the very low category in the experimental class and control class 0%.

The data on student's critical thinking skills that have been obtained are analyzed for normality using SPSS software version 26.0 with the Kolmogorov-Smirnov and Shapiro-Wilk tests. The normality test has the aim of knowing whether the research data is normally distributed or not. The results of the normality test can be seen in Tabel 3 below

Table 3. Normality Test Results of Critical Thinking Skill

| Tests of Normality | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Kolmogorov-Smirnova | | | Shapiro-Wilk | | |
| | Class | Stat | df | Sig. | Stat | df | Sig. |
| Critical Thinking Skill Results Pre-Test Experiment | Pre Test | .136 | 35 | .101 | .941 | 35 | .058 |
| | Post Test | .140 | 35 | .079 | .945 | 35 | .078 |
| | Pre Test Control | .142 | 37 | .057 | .956 | 37 | .154 |
| | Post Test Control | .105 | 37 | .200* | .971 | 37 | .424 |

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Based on Table 3, the results of the significance value (Sig.) in the Kolmogorov-Smirnov and Shapiro-Wilk tests of all data are (Sig.) > 0.05. This means that the research data in the experimental class and control class are normally distributed.
Furthermore, the homogeneity test was carried out using the Levene Statistic test through the SPSS version 26.0 application which aims to determine whether there is an equal variance between the two class groups studied: experimental and control classes. The results are shown in Table 4 below.

Table 4. Homogeneity Test Results Using SPSS version 26.0

| Data | Levene statistic | df1 | df2 | Sig. | Description |
|---|---|---|---|---|---|
| Pretest | 1.378 | 1 | 70 | 0.244 | Homogeneous |
| Posttest | 1.728 | 1 | 70 | 0.193 | Homogeneous |

Table 4 shows the results of the SPSS homogeneity test, which indicates that the significance results based on the pre-test and post-test mean for the experimental and control classes exceed 0.05. After that, it can be concluded that the data is homogeneous. Since the data is homogeneous and normally distributed, the T-test can be conducted.
The T-test was conducted using the Independent Sample T-test, which compares the critical thinking skill scores of students in the experimental and control classes. The T-test results are shown in Table 5.

Table 5. Critical Thinking Skill Hypothesis Test Results

| Category | Sig. (2-tailed) | Description |
|---|---|---|
| Critical Thinking Skill | 0.000 | Significant |

Based on Table 5 shows that the significance value obtained from the T-test results of critical thinking skills Asymp. Sig (2-tailed) is 0.000 whose probability is below 0.05. These results show that H0 is rejected and Ha is accepted, this means that the Discovery Learning model assisted by animated videos has a significant effect on the critical thinking skills of grade XI students on Digestive System Material at SMA Negeri 1 Lahat.
Furthermore, the analysis of learning implementation in the experimental class can be seen in Table 6 below.

Table 6. Learning Implementation of Experimental Class

| | Grade Meeting- | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Introduction | 100 | 100 | 75 |
| Core | 100 | 100 | 75 |
| Closing | 100 | 90 | 75 |
| Average | 100 | 96.67 | 75 |
| Categories | | 90.56% (Very Good) | |

Based on Table 6, shows that by using the Discovery Learning model assisted by animated videos in the learning process, the results of the implementation are obtained in the very good category and the average percentage value for the introduction, core, and closing activities is 90.56%. This shows that learning using Discovery Learning assisted by animated videos follows the plan contained in the lesson plan.

Furthermore, the analysis of the student's response questionnaire was used to determine the learning process using the Discovery Learning model with the help of animated videos on material related to the digestive system. The results of the student response analysis can be seen in Table 7.

Table 7. Student Response Analysis

| Statement | Presentation (%) | | | | |
|---|---|---|---|---|---|
| | SS | S | R | TS | STS |
| Discovery Learning Model assisted by an animated video | 31 | 94 | 19 | 20 | 11 |
| Student Motivation | 38 | 118 | 10 | 9 | 0 |
| Interest in the Material | 41 | 119 | 9 | 5 | 1 |
| Student Confidence | 31 | 123 | 11 | 9 | 1 |
| Average | 35.25 | 113.5 | 12.25 | 10.75 | 3.25 |

Table 7 shows that in general students gave a good response to the implementation of the Discovery Learning model assisted by animated videos and digestive system material. Analysis of learner responses and percentage of learner response categories can be seen in Table 8.

Table 8. Experiment Class Learners' Response Category (%)

| | Very Good | Good | Fair | Less | Very Poor |
|---|---|---|---|---|---|
| Average | 57.14 | 42.86 | - | - | - |

Table 8 shows the overall average category of students' responses to the learning process using the Discovery Learning model assisted by animated videos is included in the very good and good criteria, this means that students respond well to the Discovery Learning model assisted by animated videos that have been applied to the learning process on digestive system material to measure students' critical thinking skills.

This study was conducted to measure the effect of the Discovery Learning model assisted by an animated video on the critical thinking skill of class XI students on the material of the digestive system in SMA Negeri 1 Lahat. In this study, the samples of XI MIPA 1 were 37 students and XI MIPA 4 were 35 students. Critical thinking skills are measured using 20 multiple-choice questions that refer to critical thinking indicators. There are five indicators of critical thinking skills measured in this study, namely providing simple explanations, building basic skills, concluding, providing advanced explanations, and organizing strategies and tactics (Ennis, 2011).

Based on the results of research using class XI IPA 4 as the experimental class and class XI IPA 1 as the control class, shows that there is a difference in the average value of the level of critical thinking skills of students in both classes (Tabel 2). Before the learning was carried out, the experimental and control classes had critical thinking skills that were still both classified as failing categories. This is shown in the total average value of the initial test in the experimental class is 35.14 and in Table 3 the total average value of the initial test in the control class is 30.13. This shows that both classes have scores that have not reached the KKM so both still have low critical thinking skills.

After the learning was carried out, there was an increase in the critical thinking skills of students in both classes. This is shown in Table 2 showing the results of the calculation of the average final test score of the experimental class of 76.57 (good) has reached the KKM and the n gain value of 0.64 (medium) while the average final test score of the control class of 65.81 (sufficient) has not reached the KKM and the n gain value of 0.51 (medium). Based on the average value of the final test and the n gain value in both classes, it shows that there is an increase in students' critical thinking skills, but the experimental class has an average value of the final test and a n gain value that is greater than the control class, namely (76.57> 65.81) and (0.64> 0.51). This shows that critical thinking skills have increased higher in

the experimental class than in the control class.

Based on the results of the data analysis that has been done, the normality test data obtained is normally distributed (Table 3). The homogeneity test obtained homogeneous data (Table 4). In the hypothesis test using the independent sample t-test in Table 5, it shows that the significance value or Asymp. Sig (2-tailed) is 0.000 whose probability is below 0.05 so that (0.000 <0.05) shows that Ho is rejected and H1 is accepted, meaning that the Discovery Learning model assisted by animated videos has a significant effect on the critical thinking skills of class XI students of SMA Negeri 1 Lahat on the material of the digestive system.

The increase in critical thinking skills occurred in both classes because they used the Discovery Learning model. This is in line with the research of Nurjanah et al., (2019) that critical thinking skills are strongly influenced by the Discovery Learning model. Furthermore, according to Meidinda et al. (2018); Suryanti et al (2020) stated that the Discovery Learning model affects critical thinking skills. In addition, the Discovery Learning model can improve students' critical thinking skills because there is a syntax that can empower students' critical thinking skills in its implementation. The syntax in the Discovery Learning model consists of stimulation, problem statement, data collection, data processing, verification, and generalization stages.

The first stage, namely stimulation, at this stage, begins by dividing students into several groups and distributing LKPDs that are in accordance with the discovery learning syntax about digestive system material to each group. In line with Elfina's (2020) research, the existence of LKPD is very meaningful in the implementation of the learning process because it can increase students' activities in the learning process. Furthermore, students are faced with something that confuses them so questions and activities arise to investigate themselves. Learners are given reading materials, videos/images, and questions that arouse the curiosity of students so that it makes it easier for students to explore. This is in line with research (Savitri & Wibawa, 2020) that the visual media used with its real nature accompanied by the Discovery Learning model makes visual media more realistic to show the subject matter, making it easier for students to explore and improve learning outcomes directly. Learners observe videos or images in focus in front of the class. In this case, the researcher has a challenge to stimulate interest, attract the attention of students and maintain it, and try to make students interested in learning the material that is the learning objective. Then, students are allowed to respond to videos or images by giving opinions. In line with Yusnia's (2017) research, explaining that at the stimulation stage, the ability of students is honed to analyze arguments. Educators put cognitive critical thinking in the first discovery of learning syntax, namely stimulation (Meriyana et al., 2020). Argumentation is a substitute for explanation in the definition of critical thinking (Felipe et al., 2023).

The second stage is problem statement, at this stage learners are allowed to identify various relevant problems based on videos or images shown at the stimulation stage. Learners identify problems by asking questions related to the video or image displayed, then other learners are asked to answer questions as a temporary conjecture, one is chosen and formulated in the form of a hypothesis. Learners discuss with their groupmates to write hypotheses on the student worksheet that has been distributed, some learners are confused because they do not understand how to write hypotheses but they try to ask researchers and their groupmates. In this second stage, the activities that arise are students discussing by asking or answering questions directly to their friends and the teacher and working on student worksheets according to the stages so that the critical thinking indicator that appears is to provide a simple explanation consisting of sub-indicators focusing on questions, analyzing arguments, asking and answering questions that require explanation or challenge. In line with research (Aryani et al., 2014), students can experience balance again by identifying problems that previously still experienced disequilibrium.

The third stage is data collection, at this stage students are allowed to collect relevant information to find out the proof of the hypothesis by reading books, observing videos conducting experiments, and working on student worksheets. This is in line with Snyder's (2008) statement, that a learning environment that involves students actively investigating information and applying their knowledge can improve critical thinking skills.

The fourth stage is data processing, at this stage students are required to be able to analyze the data or information that has been obtained from the previous stage in accordance with the activities that have been carried out. The data processing process in groups requires critical thinking skills (Nurrohmi et al., 2017). Learners get information from observations, then the information is processed through group discussion activities to be able to answer questions contained in student worksheets. Learners are trained to think long-term memory and active learning in this process to find the relationship between the problem and existing knowledge or information. In accordance with the advantages of the discovery learning model, namely providing opportunities for students to learn actively and train long-term memory (Agustia, 2019).

The fifth stage is verification, at this stage students present the results of observations and group discussions that have been carried out to the front of the class, then responded to by other students and straightened out by the researcher to check the proof of the hypothesis set. In line with Trianto's (2010)

research, asking questions and defending opinions in discussion activities can help students gain more knowledge and become more confident. This can have an impact on improving students' thinking skills. The sixth stage is generalization, at this stage, the researcher provides an opportunity for students to express opinions regarding the conclusions of the teaching that has been done by reviewing the learning material that has been done. In line with Wulandari's (2019) research, students make conclusions according to the information that has been collected and then explained in front of the class. Learners are given the opportunity to convey conclusions. That way, students become motivated to convey their opinions (Dafira & Widodo, 2020).

Based on the results obtained, it can be seen that critical thinking skills have increased higher in the experimental class. In line with the research of Djepy, et al., (2022) that there is an effect of the Discovery Learning model assisted by learning videos on students' critical thinking skills. In addition, it is also in line with several researches (Dafrita, 2017; Mayarni & Nopiyanti, 2021; Putri et al., 2017) that the application of the Discovery Learning model assisted by animated videos on digestive system material can improve learning outcomes. Critical thinking skills in the learning process can train students to make decisions from various points of view carefully, thoroughly, and logically, therefore the development of critical thinking skills becomes a goal that must be achieved in the learning process, (Anwar et al, 2023) Indicators of critical thinking skills measured in the study are indicators used by Robert Ennis, including the ability to provide simple explanations by focusing questions by identifying criteria for considering answers and asking and answering questions; building basic skills by observing and making considerations to determine the results of observations, and making conclusions about information; giving a conclusion; and giving an answer to a question. further explanation by identifying necessary assumptions and terms; develop tactics and strategies through action by selecting criteria to create solutions.

The indicator of providing a simple explanation obtained an n gain of 0.98 (high) in the experimental class and an n gain of 0.65 (medium) in the control class. This means that students are able to focus on questions, analyze arguments, ask and answer questions. Achievement at this stage is influenced by the stimulation stage and the problem statement stage. This is in line with the research of Agustriana, et al., (2015) that the stimulation stage in the Discovery Learning model improves critical thinking skills on indicators of providing simple explanations. The indicator of giving a simple explanation is included in the high category in the experimental class because at the stimulation stage, the experimental class uses animated videos as stimuli that make students explore more and interact to analyze arguments and at the problem statement stage more ask and answer questions. In line with June's (2014) research, students are able to remember well using YouTube videos that can stimulate interaction and critical thinking between students.

The indicator of building basic skills obtained an n gain of 0.79 (high) in the experimental class and an n gain of 0.39 (medium). This means that students are able to observe and consider the results of observations. The achievement of this indicator is influenced by the data collection stage and the data processing stage. In line with the research of Laeni et al. (2022) stated that the aspect of building basic skills is trained in the data collection and processing steps. At the data collection stage, students are given the opportunity to observe videos and interact directly with the object of observation, the student worksheet has provided pictures and tables, and students are asked to organize their ideas by observing or observing pictures and tables related to the material, then at the data processing stage students discuss solving problems on the student worksheet provided. The experimental class has a gain which is in the high category because it uses video assistance at the data collection stage so that at the data processing stage, students are more varied in answering problems while in the control class only from books. Learning that is only based on books makes students' thinking patterns not varied and monotonous in answering a question (Purwanti, 2018). In addition, it is also in line with Putra's research (Putra et al., 2015), that video media is more effective in guiding thinking concepts than using printed media. Thus, to make it easier to improve the ability of the thinking process, video media is used.

The conclusion indicator obtained a gain of 0.69 (medium) in the experimental class and control class. This means that students are able to deduce and consider the results of deduction, induction, and consider the results of induction. Achievement in this indicator is influenced by the generalization stage, where students are guided to make decisions by linking concepts with each other according to their understanding of information based on existing facts. At this generalization stage, students actively participate in the process of making active decisions by linking ideas with each other with their understanding of information based on existing facts and considering the results of verification. In line with the research of Agustriana, et al., (2015) that the generalization stage in the Discovery Learning model improves critical thinking skills on the conclusion indicator.

The indicator providing further explanation obtained an n gain of 0.40 (medium) in the experimental class and an n gain of 0.39 (medium) in the control class. This means that students can define terms and consider a definition. Achievement of these indicators is influenced by the verification stage. This is in line with Laeni's et al (2022) research that the aspect of making further explanations is trained at the proof stage.

The strategy and tactics indicator obtained an n gain of 0.40 (medium) in the control class and an n gain of 0.45 (medium) in the control class. This means that students can identify assumptions, determine an action, and interact with others.

Based on the explanation above, it can be seen that in the experimental class, the highest n-gain value was obtained, namely in the indicator of providing simple explanations and building basic skills which had a high n-gain category. This is because the experimental class used learning media in the form of animated videos at certain stages of the discovery learning model, namely at the stimulation and data collection stages. In line with the research of Atika et al., 2018 through the discovery method in the learning process, video media functions as stimulation or data collecting and facilitates data processing activities. In line with Putri's (2022) research learning with the discovery learning model with the help of animated videos facilitates the stimulation stage and collects data that makes it easier for students to complete various levels of data processing activities (Putri et al., 2022).

In the video, there are elements of moving images accompanied by sound so that the explanation is more real than just from a book. Following Dale's cone of experience, which states that learners will gain more experience if in a learning process the more real the explanation is. Learning media used is more real will create better critical thinking skills. The use of animation and special effects is very good and effective in attracting the attention of learners in learning situations either from the beginning or the final series of learning (A lee & Owens, 2004).

Audio-visual video media makes it easier to share new information with learners. Visualization facilitates abstract concepts and the learning process becomes faster so that students think critically, the ability to solve problems increases and there is interest and success in learning (Atika, 2018). Developing and strengthening critical thinking skills is through the right learning process, not just improving students' intellectual skills, learning should also be able to develop critical thinking in students through learning videos.

The implementation of learning with Discovery Learning assisted by this animated video was carried out three times a meeting. To see the implementation of the syntax of the Discovery Learning model assisted by an animated video using an observation sheet, the assessment was carried out by an observer, namely the Biology teacher of SMA Negeri 1 Lahat. Based on the results of the analysis of the learning implementation observation sheet, shows the average of all aspects with a percentage of 90.56%. Overall, the learning process with the discovery learning model assisted by animated videos has gone well even though there are stages that have not been implemented yet, namely at the verification stage. At this stage, the researcher did not provide opportunities for many groups to reveal the results of the discussion due to the lack of time to carry out activities at certain stages so the time available was limited to the final stages.

In the application of the discovery learning model assisted by animated videos at the last meeting of learning in the experimental class, a response questionnaire was distributed to students in order to find out the students' response to learning. The results of the questionnaire data analysis (Table 8) show that from all aspects, the average total response of students is highest in the very good category and good category. That way it shows that students respond well to learning with the Discovery Learning learning model assisted by animated videos. According to Hartati et al. (2020) the response to learning media can be seen from the expression, the ease of mastering the message to be conveyed through the media, and how motivated students are after using the media.

Based on the explanation above, the syntax in the Discovery Learning model, namely stimulation, problem statement, data collection, data processing, verification, and generalization assisted by animated videos, can improve students' critical thinking skills. So, it can be concluded that the Discovery Learning model assisted by animated video affects the critical thinking skills of class XI students on the material of the digestive system at SMA N 1 Lahat.

## Conclusion

Based on the objectives of the research, the results and discussion of the research can be concluded that the Discovery Learning model can improve critical thinking skills because it has a medium category gain, but using animated video assistance is better in improving critical thinking skills, especially on indicators of providing simple explanations and building basic skills because it has a gain in the high category. The results of observations of the implementation of learning with the Discovery Learning model assisted by animated videos showed a percentage of 90.56% including the very good category. Students' responses to learning with the Discovery Learning model assisted by animated videos showed a percentage of 57.14% of students responded very well and 42.86% responded well.

## Acknowledgement

We would like to sincerely thank the following people for helping with this research project: Department

of Biology Education, Universitas Sriwijaya. Furthermore, I would also like to thank the biology teachers and students in SMAN 1 Lahat for all their participation and involvement in this research. Hopefully, this article is useful for researchers and readers

## Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

## Author Contributions

**Y. Anwar:** methodology, analysis, review, and editing. **A. Slamet:** validator and review. **Ulfa Daniaty:** collect the data, writing original draft preparation

## References

Agustriana, A., Ningrum, E., Somantri, L. (2015). Pengaruh penerapan model pembelajaran discovery learning terhadap kemampuan berpikir kritis siswa. *Antologi Pendidikan Geografi, 3*(1)

Agustia, S. (2019). *Efektivitas model discovery learning dalam meningkatkan pemahaman konsep matematis siswa SMP swasta pelita medan pada pokok bahasan pola bilangan T.A. 2019-2020*.

A Lee, W. W., & Owens, D. L. (2004). *Multimedia-based instructional design.*

Anwar, Y., Slamet, A., & Tania, A. (2023). Developing critical thinking skills assessment of excretory system. *Biosfer: Jurnal Pendidikan Biologi, 16*(2), 220-231. https://doi.org/10.21009/biosferjpb.23171

Anwar, Y., Permata, S., & Ermayanti. (2020). Measuring biology educations students' critical thinking skill using online systems. *Journal of Physics: Conference Series, 1480*(1). https://doi.org/10.1088/1742-6596/1480/1/012068

Aryani, Y. D., & Wasitohadi, W. (2020). Pengaruh penerapan model discovery learning terhadap kemampuan berpikir kritis muatan IPA siswa kelas IV SD Gugus Diponegoro. *JRPD (Jurnal Riset Pendidikan Dasar), 3*(1), 34–40. https://doi.org/10.26618/jrpd.v3i1.3221

Atika, D., Nuswowati, M., & Nurhayati, S. (2018). Pengaruh metode discovery learning berbantuan video terhadap hasil belajar kimia siswa SMA. *Jurnal Inovasi Pendidikan Kimia, 12*(2), 2149 – 2158. https://journal.unnes.ac.id/nju/index.php/JIPK/article/view/15474

Dafira, I. S., & Widodo, W. (2021). Efektivitas model discovery learning berbasis digital terhadap pemahaman konsep materi sistem pencernaan. *Pensa E-Jurnal : Pendidikan Sains*, *9*(2), 182–187.

Dafrita, I. E. (2017). Pengaruh discovery learning terhadap kemampuan berpikir kritis dan analitis dalam menemukan konsep keanekaragaman tumbuhan. *Jurnal Pendidikan Informatika Dan Sains, 6*(1), 32–46. https://doi.org/http://dx.doi.org/10.31571/saintek.v6i1.485

Djepy, A. N., Tolangara, A. R., & Nur, T. D. (2022). Pengaruh penerapan model pembelajaran discovery learning berbantuan video pembelajaran terhadap kemampuan berpikir kritis dan pemahaman konsep IPA siswa SMP Negeri 44 Halmahera Barat. 5, 124–133.

Elfina, S., & Sylvia, I. (2020). Pengembangan lembar kerja peserta didik (lkpd) berbasis problem based learning (pbl) dalam meningkatkan kemampuan berpikir kritis siswa pada mata pelajaran sosiologi di SMA Negeri 1 Payakumbuh. *Jurnal Sikola: Jurnal Kajian Pendidikan Dan Pembelajaran, 2*(1), 27–34. https://doi.org/10.24036/sikola.v2i1.56

Ennis, R.H. (2011). The nature of critical thinking: an outline of critical thinking dispositions and abilities. Chicago: University of Illinois.

Ennis, R. H. (2015). *Critical Thinking: A Streamlined Conception*.

Ferazona, S. (2020). Century generation. XI (1)

Felipe, L., Contreras, M., Nussbaum, M., Paredes, R., Gelerstein, D., Alvares, D., & Chiuminatto, P. (2023). Education sciences developing critical thinking in technical and vocational education and training.

Hartati, S. H., Koto, I. K., & Hambali, D. H. (2020). Penerapan model discovery learning untuk meningkatkan kemampuan berpikir kritis dan kecakapan kerjasama pada pembelajaran IPA siswa kelas V SD Negeri 32 Bengkulu Tengah. *Jurnal Pembelajaran Dan Pengajaran Pendidikan Dasar*, *3*(2), 98–112. https://doi.org/10.33369/dikdas.v3i2.12330

Jayawardana, H. B. A. (2017). Paradigma pembelajaran biologi di era digital. *Jurnal Bioedukatika, 5*(1), 12. https://doi.org/10.26555/bioedukatika.v5i1.5628

June, S., Yaacob, A., & Kheng, Y. K. (2014). Assessing the use of youtube videos and interactive activities as a critical thinking stimulator for tertiary students: An action research. *International Education Studies, 7*(8), 56–67. https://doi.org/10.5539/ies.v7n8p56

Karim, F. binti A., & Cheng, T. J. (2018). Readiness in Applying Higher Order Thinking Skills after Attending Courses. *Journal of Techno Social*, *10*(2), 035–041. https://doi.org/10.30880/jts.2018.10.02.006

Km, I. G. A., Kt, T. I., Gd, A. I. B., & Abadi, S. (2020). Pengaruh model discovery learning berbantuan media animasi terhadap kompetensi pengetahuan IPA. 4(1), 73–81.

Laeni, S., Zulkarnaen, Z., & Efwinda, S. (2022). Model discovery learning terhadap kemampuan berpikir kritis siswa SMA Negeri 13 Samarinda Materi Impuls dan Momentum. *Jurnal Literasi Pendidikan Fisika (JLPF), 3*(2), 105–115. https://doi.org/10.30872/jlpf.v3i2.935.

Mayarni, M., & Nopiyanti, E. (2021). Critical and analytical thinking skill in ecology learning, a correlational study. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *7*(1), 63–70. https://doi.org/https://doi.org/10.22219/jpbi.v7i1.13926

Meidinda, F., Azhar, E., & Jusra, H. (2018). Pengaruh model pembelajaran discovery learning terhadap kemampuan berpikir kritis matematis siswa kelas VIII. 418-429.

Meriyana, R., Suprapto, P. K., & Hernawati, D. (2020). Discovery learning terhadap kemampuan berpikir kritis peserta didik pada sub konsep bryophyta dan pteridophyta di kelas X SMA. *Jurnal Metaedukasi,* 64–78. http://jurnal.unsil.ac.id/index.php/metaedukasi/article/view/2512

Muhammad Ridho, Hasruddin, E. D. (2017). Pengaruh penggunaan media animasi dan pengetahuan awal siswa terhadap kemampuan berpikir kritis siswa pada materi sistem pencernaan makanan manusia SMA Swasta Hang Tuah Belawan. *Prosiding Seminar Nasional III Biologi Dan Pembelajarannya,* September, 607–617. http://digilib.unimed.ac.id/id/eprint/28414

Nababan, R. (2021). Perbedaan Kemampuan Berpikir Kritis Matematis Siswa Antara Model Pembelajaran Problem Posing Dan Discovery Learning. Sepren, 2(2), 1–10. https://doi.org/10.36655/sepren.v2i2.550

Nurjanah, R. R., Rinanto, Y., & Prayitno, B. A. (2019). Pengaruh model pembelajaran discovery learning terhadap kemampuan berpikir kritis pada materi virus kelas X SMA Negeri 8 Surakarta Tahun Pelajaran 2018/ 2019. *BIOEDUKASI: Jurnal Pendidikan Biologi*, *12*(2), 195–201.

Nurrohmi, Y., Utaya, S., & Utomo, D. H. (2017). Pengaruh model pembelajaran discovery learning terhadap kemampuan berpikir kritis mahasiswa. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan, 2*(10), 1308–1314. http://journal.um.ac.id/index.php/jptpp/

Potu, T. R., & Poluakan, C. (2020). Pengaruh model discovery learning berbantuan multimedia interaktif terhadap kemampuan berpikir kritis siswa di SMPN 2 Poigar. *SCIENING : Science Learning Journal*, *1*(2), 41–45. https://doi.org/10.53682/slj.v1i2.560

Putra, E. D., Setyowati, D. L., & Linuwih, S. (2015). Perbedaan jenis pembelajaran model ctl dan discovery learning ditinjau dari motivasi belajar IPS. *Journal of Primary Education*, *4*(2), 117–123. http://journal.unnes.ac.id/sju/index.php/jpe

Putri, A. K., Setiawan, B., Mahdiannur, M. A., Surabaya, U. N., Belajar, H., & Siswa, R. (2022). Penerapan discovery learning berbantuan video animasi untuk meningkatkan hasil belajar pada. 10(3), 571–577.

Putri, I. S., Juliani, R., & Lestari, I. N. (2017). Pengaruh model pembelajaran discovery learning terhadap hasil belajar siswa dan aktivitas siswa. *Jurnal Pendidikan Fisika*, *6*(2), 91–94.

Savitri, K., & Wibawa, I. M. C. (2020). Efektivitas HASIL BELAJAR IPA melalui model discovery learning berbantuan media visual siswa kelas IV SD. *Jurnal EDUTECH Universitas Pendidikan Ganesha*, *8*(1), 46–58. https://ejournal.undiksha.ac.id/index.php/JEU

Snyder, L.G. dan Snyder, M.J. (2008). Teaching critical thinking and problem solving skills. *The Delta Pi Epsilon Journal*, 2, Spring/Summer.

Suryanti, Widodo, W., & Budijastuti, W. (2020). Guided discovery problem-posing: An attempt to improve science process skills in elementary school. *International Journal of Instruction, 13*(3), 75-88. https://doi.org/10.29333/iji.2020.1336a

Syah, M. (2016). Psikologi pendidikan dengan pendekatan baru. PT Remaja Rosdakarya.

Tiara, Adinda. (2020). Pengembangan Soal Berbasis Kemampuan Berpikir Kritis pada Materi Sistem Pencernaan Untuk Sekolah Menengah Atas. Skripsi. Palembang: Jurusan Pendidikan Biologi Universitas Sriwijaya Palembang.

Trianto. (2010). Mendesain model pembelajaran inovatif progresif. Kencana
Yusnia, N., Sugeng, U., Dwiyono, H. (2017). Pengaruh model pembelajaran discovery learning terhadap kemampuan berpikir kritis mahasiswa. *Jurnal Pendidikan, 2*(10)
Wulandari, D. A. (2019). *Pengaruh model discovery learning terhadap kemampuan berpikir kritis siswa pada konsep sistem ekskresi di MAN 3 Jakarta*.