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Learning the Biology of Nyale Worms by A Video-Assisted Scientific Approach to Improve Critical Thinking Skills for Senior High School Students in Mataram

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Abstract: The research was carried out with the aim of knowing the effectiveness of the video-assisted scientific approach on students' critical thinking skills. The study used a quasi-experimental method. The research was carried out on high school students in the city of Mataram with a total sample of 323 as the research sample. Data Inferential analysis with Analysis of Covariance (ANACOVA) followed by Least Significance Difference (LSD), was used to test the research hypothesis. The results showed that the learning approach had a significant effect on learning activities with an F hit value of 60.37. The scientific approach is not significantly different from the video-assisted scientific approach, but is significantly different from the conventional approach with a mean value of 62.17 for video-assisted scientific approaches and an average of 64.69 and a conventional approach of 47.48. The video-assisted scientific approach improves students' critical thinking skills.

Keywords: Scientifi approach; Learning videos; Nyale worms; Critical thinking

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Introduction

The story of Putri Nyale is a folk legend in Lombok which tells of a princess who drowned herself into the sea to avoid a war between princes who wanted to marry the princess. The story has become a legend among the public, including students who are part of the scientific community who study Biology at school. In biology, a scientific understanding of nyale worms needs to be taught so that students can provide an understanding of nyale worms scientifically.

Nyale worms are worms that produce nyale (epitoke). Nyale is the back of the worm's body that has a special function for reproduction, which is released into the water for external fertilization (Bachtiar et al., 2020). Nyale worms belong to the Phylum *Polychaeta*. *Polychaeta* on the island of Lombok actually consists of 13 species, but only three species were identified as nyale worms, namely *Lysidice collaris*, *Eunice* (*Palola*) *siciliensis* and *Dendronereides heteropoda* (Jekti et al., 1993).

The Bau Nyale tradition which is held every year in Lombok can be a threat to the preservation of nyale worms if done excessively. Bachtiar et al. (2016) stated that the current taking of the Bau Nyale tradition has exceeded capacity. The Bau Nyale activity was attended by approximately 27,000 people with a catch value of 1.3 tons. Excessive catching of nyale worms can cause a lack of fertilization rate and recruitment of nyale worms, which in the long term threatens the sustainability of the nyale worm population. The magnitude of the potential for damage to the sustainability of nyale worms should be a concern of the government, academics, businessmen and the public. For this reason, efforts to educate the public must continue. Education on learning about nyale worms was carried out by Bachtiar et al. (2020) in the development of a nyale worm biology module for teachers and students. However, the module needs to be taught to students to increase students' understanding of the biology of nyale worms.

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Student learning activities can be carried out using several approaches or learning models, one of which is using a scientific approach. The scientific approach is a learning approach that is mandated in the 2013 Curriculum. The stages of learning the scientific approach consist of 5 M, namely: Observing, Questioning, Gathering information, Processing information (associating), and Communicating (Ministry of Education and Culture, 2013). A structured and systematic learning pattern will certainly have an impact on student understanding. Some research results show the effectiveness of the scientific approach including: Setiawan (2019) the scientific approach can improve students' scientific literacy skills, Bermawi & Fauziah (2016) the scientific approach can improve learning outcomes, Machin (2014) scientific approach has a positive effect on students' cognitive, Alamansyah (2016) scientific approach can improve cognitive learning outcomes.

To maximize the learning outcomes of Nyale worm Biology, it is necessary to use learning media. The learning media needs to be a concern, especially the nyale worm learning media has never been used or discovered by the teacher. One of the media that teachers can use is a nyale worm learning video. The video is certainly expected to be a tool for conveying messages that can clarify information about nyale worms in learning activities. Based on research by Yunita & Wijayanti (2017) there is a very significant difference between learning using video and learning not using video. Hadi (2017) explains that the use of media can improve students' abilities.

For this reason, it is deemed necessary to conduct a research entitled "Learning the biology of nyale worms through a scientific approach assisted by video learning to improve critical thinking skills and cognitive learning outcomes of SMAN students in Mataram City".

Method

This research is quantitative research using experimental method. The design used is *Pretest-Posttest Nonequivalent Control Group Design* which aims to compare the effectiveness of video-assisted scientific learning approaches, scientific approaches and conventional approaches on critical thinking skills of senior high school students in Mataram City. The research design can be seen in Table 1.

Table 1. Quasi-Experimental Procedures *Pretest-posttest Noneequivalent Control Group Design*

Pre-test	Treatment	*Post-test*
O1	P1	O2
O3	P2	O4
O5	P0	O6

(Creswell, 2012)

Description:
P1 = Video-Assisted Scientific Approach
P2 = Scientific Approach
P0 = Conventional
O1, O3, O5 = *Pretest* score of critical thingking skill
O2, O4, O6 = *Posttest* score of critical thingking skill

The study was carried out in November 2021. The population of this study were students of class X SMAN in the city of Mataram. The sampling technique was done randomly and 3 schools were selected, namely SMAN 1 Mataram, SMAN 5 Mataram, and SMAN 7 Mataram with a total of 323 students. Previously, an equivalence test was carried out on the research sample.

The instrument used in this research is a critical thinking test in the form of multiple choice questions by emphasizing questions on critical thinking indicators. The test was carried out twice, namely before learning using the think talk write type model (*pretest*) and after using the think talk write learning model (*posttest*). The type of multiple choice questions for students' critical thinking is an objective test sheet containing 15 items and for cognitive ability tests using multiple choice questions with 15 questions. Previously, empirical validity had been carried out on the questions and obtained 12 valid questions because r hit > r t with a value of 0.258. The validity test aims to see whether the instrument used is in accordance with the measured variables. Test the validity of the items for the test of scientific literacy and critical thinking skills using the *product moment* correlation formula. The learning videos used have also been validated by experts, namely media experts and biology education learning experts.

After doing the validity test, the instrument is valid and then the level of reliability is measured. The reliability test was used to determine how much confidence the research instrument had as a data collection tool. A reliable instrument means an instrument which, when used several times to measure the same object, will produce the same data (Sugiyono, 2012). The reliability test was carried out using the *Cronbach Alpha* equation formula in the *SPSS 17.0* program.

$$r_{11} \left(\frac{n}{n-1}\right)\left(\frac{S2-\sum pq}{S2}\right) \quad (1)$$

Description:
r_{11} = Test realibility
p = Proportion of subject who answered the item correctly
q = Proportion of subject who answered the questions incorrectly (1-p)
$\sum pq$ = Sum of product of p and q
n = Number of items
S = Standard deviation

The research process begins with giving a pretest before learning begins. Furthermore, the teaching and learning process was carried out for two weeks. After completing the learning, a posttest was conducted to obtain data on the results of students' critical thinking. The data obtained in the next study were analyzed using descriptive and inferential statistics. Descriptive analysis is used to describe critical thinking skills and cognitive learning outcomes. The results of the analysis are presented in the form of tables and histograms based on the average value, and the percentage change in the pretest and posttest values. Inferential analysis with *Analysis of Covariance* (ANACOVA) followed by *Least Significance Difference* (LSD), was used to test the research hypothesis. Before testing the hypothesis using the Anacova test, a prerequisite test was carried out which included tests for normality and homogeneity. Calculation analysis using *SPSS 16.0 for Windows* program at a significance level of 0.05 ($P < 0.05$).

Result and Discussion

Learning activities must be designed by the teacher as much as possible to get maximum learning outcomes, including determining the learning approach used. The 2013 curriculum mandates learning to be carried out using a scientific approach. One of the goals is to train students' reasoning skills to be able to think critically. Reasoning can be done effectively if students are trained in their thinking skills in stages starting from easy knowledge as material for further thinking.

The study was conducted in three schools where each school has a control class and two experimental classes, namely the video-assisted scientific approach and the scientific approach. Based on the results of the average *pretest* and *posttest* of critical thinking skills in each approach, the highest pretest average was found in the scientific approach, namely 39.6 with a poor category; while the lowest in the conventional approach is 29.08 with less category. The highest average posttest critical thinking score was obtained in the scientific approach, namely 61.6 with a good category, while the lowest in the conventional approach was 46.43 with a moderate category as presented in Table 2.

Tabel 2. Average of *Pretest* and *Posttest* of Each Approach

Type of Approach	Pretest	Category	Post test	Diffe-rence	Category
Video-Assisted Scientific Approach	35.31	Minus	60.30	24.99	Good
Scientific	39.60	Minus	61.60	22.00	Good
Conventional	29.08	Minus	46.43	17.35	Medium 12qzs

Before the data was analyzed, prerequisite tests were carried out, namely the homogeneity and normality tests presented in the Table 3.

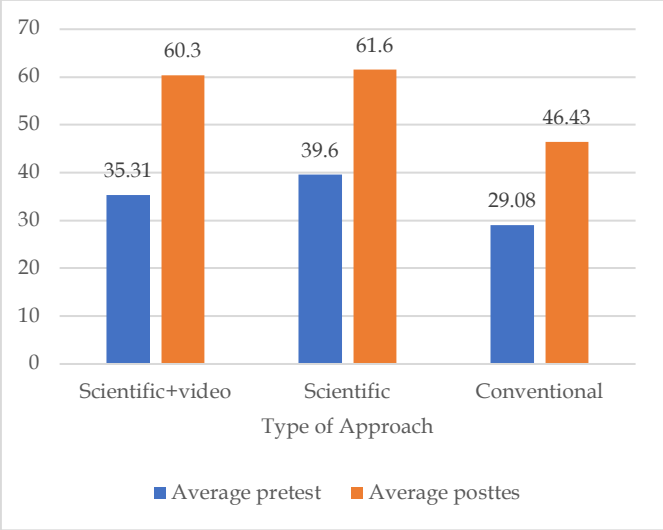

Figure 1. Average *Pretest* and *Posttest* Results for Each Approach

Table 3. Normality and Homogeneity Test Results on Each Approach

Variable	Signifcance (2-tailed)	Alpha	Description
Video-assisted scientific approach pretest	0.001	0.050	Unnormal
Scientific approach pretest	0.098	0.050	Normal
Conventional pretest	0.000	0.050	Unnormal
Video-assisted scientific approach posttest	0.200	0.050	Normal
Scientific approach posttest	0.330	0.050	Normal

The results of the analysis of the prerequisite tests for normality and homogeneity using the *Levenes' test of equality of error variance* in table 3 show that the data are normally distributed and the results of the homogeneity test of the *pretest* and *posttest* of critical thinking skills in all classes are homogeneous. Measurement of critical thinking skills is carried out before and after learning. The data obtained were then analyzed using anacova. The results of the Ananova test showed that there were differences in students' critical thinking abilities in the biology of nyale worms between those who were treated with video-assisted scientific approaches, scientific approaches and conventional ones. The results of the anachova effect on the students' critical thinking skills can be seen in Table 4.

Table 4. Anaova Test Results the Effect of Learning Approach on Students' Critical Thinking Ability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	18719.002[a]	3	6239.667	60.371	0.000
Intercept	82870.438	1	82870.438	801.799	0.000
perlakuan	8549.456	2	4274.728	41.359	0.000
pretest	5489.847	1	5489.847	53.116	0.000
Error	24391.931	236	103.356		
Total	802936.000	240			
Corrected Total	43110.933	239			

Table 4 shows that the results of the anacova test on the effect of the learning approach on students' critical thinking skills obtained a Fcount score of 60.37, with a significance value of 0.00. The significance value is smaller than the alpha value (0.05), which means that the research hypothesis which states that there are differences in the critical thinking abilities of high school students in Mataram City who uses a video-assisted scientific approach, scientific and conventional approaches is accepted. Because the F hit value is higher than the F tab, it is concluded that the learning approach has a significant influence on students' critical thinking skills.

There are differences in critical thinking abilities in each learning or treatment approach, then the analysis is continued by using the *Least Significance Difference* (LSD) data analysis technique or the Least Significant Difference Test (BNT). The results of the analysis are presented in Table 5.

Table 5. BNT Test Results Differences in Critical Thinking Skills in Each Learning Approach

Learning Approaches	X (Pretes)	Y (Posttes)	Selisih	YCor	Notasi Lsd
Video-assisted science	35.31	60.30	24.99	62.19	a
Scientific	39.60	61.60	22.00	64.69	a
ConvenTional	29.08	46.43	17.35	47.48	b

The results of the LSD further test in table 5 show that the average *posttest* results are 62.19 for the video-assisted scientific approach and the *posttest* average score is 64.69 for the scientific approach without video, while the control class or those used as comparisons get an average score *posttest* of 47.48. The results of the BNT test showed that the highest mean was found in the scientific approach, but it was not significantly different from the scientific approach assisted by learning videos and significantly different from the average conventional approach. This shows that the scientific approach and the video-assisted scientific approach both have a good effect on learning. Although the posttest average corrected by the scientific approach was higher than the video-assisted scientific approach, the difference between the *pretest a*nd the posttest was highest in the scientific approach assisted by video learning.

There was no difference in results between the experimental classes because the students did not pay much attention to the use of video. So far, students have not been able to learn to use videos or learn by observing learning videos, so the presence of video does not have a better effect when compared to the scientific approach without video. However, the scientific approach whether using video or without using video has better results than conventional classes. This is because in a scientific approach class without video, if students do not understand the subject matter students can ask the teacher directly so that the interaction between teachers and students is effective. While in the control class using conventional learning the teacher is used as an information center, students are less involved in learning which will cause boredom or boredom in students which will ultimately interfere with students' ability to process and remember information. As for the experimental class that uses a scientific approach with video assistance or does not use video, learning activities involve more students, so that learning activities run more conducive and fun.

The steps in the scientific approach, namely observing, asking questions, processing data and communicating can help students learn more meaningfully, tested and can be accounted for. Significance in learning can be seen from the increase in work activities, thinking skills and student learning outcomes. The more learning activities such as thinking, asking, answering, observing and communicating, the information will be processed better. The effectiveness of the scientific approach does not only improve thinking skills but can also help students improve student learning outcomes as the results of research by (Faqih, 2019). Furthermore, Pahrudin & Pratiwi (2019) explained that the scientific-based learning process must avoid non-scientific traits or values which include intuition, common sense, prejudice, discovery through trial and error and from critical thinking. Ministry of Education and Culture (2013) explain that the learning process based on a scientific approach, with criteria; fact-based learning material or phenomena that can be

explained by certain logic or reasoning, not just guesswork, fantasy, legend or fairy tales.

Conclusion

Based on the results of the study, it can be concluded that the learning approach has a significant effect on learning activities in terms of students' critical thinking skills. The scientific approach was not significantly different from the video-assisted scientific approach but significantly different from the conventional approach with a mean value of 62.19 for video-assisted scientific approaches, an average of 64.69 for the scientific approach and the average conventional approach of 47.48.

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