DEVELOPMENT OF BIOLOGY LEARNING TOOLS USING DISCOVERY LEARNING ASSISTED BY PODCAST AND GOOGLE CLASSROOM TO IMPROVE SCIENTIFIC SKILLS AND COGNITIVE LEARNING OUTCOMES OF SENIOR HIGH SCHOOL STUDENTS

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Abstract: This research aims to produce biology learning tools using discovery learning-based online a valid, practical, and effective to improve the scientific skills and cognitive learning outcomes of students class X MIPA E2 Sma Negeri 5 Malang. The method of this research is research and development (R&D) with ADDIE model. The objectives of this research and development are (1) to produce instructional design which are syllabus, lesson plan, students whorksheet, assessment sheets, and podcast using discovery learning model and (2) to improve students' Scientific Skills and Cognitive Learning Outcomes trough the implementation of learning tools that have been prepared. The subjects are students of X MIPA E1 SMAN 5 Malang, East Java. Validation test result from the validators stated that the product has average score 92,54% with very valid category. Practicality test result based on field test, conduct a pilot test, and learning syntax implementation consecutively has average score of 84,29%, 87,85%, and 100%. Effectiveness test gained from pretest, posttest, and calculation of N-gain has score 0,26 for cognitive learning outcomes and 0,069 for Scientific Skills with low Category. It can be concluded that (1) the learning tools have very valid and practical category to be implemented on biology learning, and (2) students' Scientific Skills and Cognitive Learning Outcomes improve after the implementation of the biology learning tools, but with low effectiveness criteria.

Keywords: scientific skills, cognitive learning outcomes, discovery learning, podcast

INTRODUCTION

Education is one way to overcome the era of globalization in the XXI century which is characterized by the rapid development of information technology. Along with the demands of the XXI century, the national education system made changes through the 2013 curriculum. The development of the 2013 curriculum is able to produce graduates who are creative, innovative, productive and effective through strengthening knowledge, attitudes, and skills, which are integrated (Kurniasih & Sani, 2014). The curriculum is also considered to be the core of the entire education system (Pratiwi, 2019). The 2013 curriculum is a competency-based curriculum that strengthens the authentic learning and assessment process to achieve competence of attitudes, knowledge, and skills. Strengthening the learning process can be done through scientific approaches, where scientific approaches are able to encourage students to observe, assess, try / collect data, socialize / reason, and communicate (Majid & Rochman, 2015). The development of the curriculum can not be separated from national education problems, such as emergency curriculum imposed during the Covid-19 pandemic.

The Covid-19 pandemic caused by Corona Virus Disease-2019 (Covid-19) with its characteristic is its high spread (Herliandry et al., 2020) this has an impact on the learning system in Indonesia, where the offline learning system becomes an online learning system due to the Covid-19

pandemic. Aji, (2020) stated that there are two impacts of the Covid-19 pandemic on the sustainability of education, namely the short-term impact, in this case the implementation of learning takes place online so that there are many trials and errors because learning with this system has previously been unprecedented and has not been measured and tested for effectiveness. Furthermore, the long-term impact is on aspects of justice between community groups or regions in Indonesia. One of the obstacles of online learning is teachers and students who lack information technology, inadequate facilities and infrastructure, less available budget funds and limited internet access.

The importance of the learning process in school is done to improve students' knowledge and skills. But the existence of the Covid-19 pandemic requires the implementation of online learning so that it is less maximal in improving students' knowledge and skills. The results of observations during the implementation of Field Practice Study on September 22, 2020, namely the class is declared to have completed learning if in the classroom there are 70% of students reaching absorption of more than 76%, but in class X MIPA E1 only 41% of students who complete learning based on the results of daily repeat tests, in addition to the scientific skills of students only by 56.44%, it shows the results of cognitive learning and scientific skills students still need to be improved, especially in the implementation of learning online. One of the factors that lead to students' low cognitive learning outcomes and scientific skills is the learning system.

Learning systems that were previously offline learning undergoing changes into online learning. Submission of materials and assessment systems on online learning is done based on the internet and full online (Awaluddin, 2018). The observations showed that 81.3% of students disagreed that if online learning was done permanently, students had difficulty understanding the material. Meanwhile, based on interviews with biology teachers on November 11, 2020 showed that in SMAN 5 Malang has not prepared online learning patterns, so the online learning system only utilizes Whatsapp Group with the help of Google Classroom to discuss and collect learning tasks and videos, especially for biology materials in class X.

Biology learning requires students to discover the main concepts of biological materials (Agustina, 2017). One of the materials in biological learning is the diversity and classification of animals. Animal material in Basic Competence 3.9 describes grouping animals into phyla based on body layers, body cavities, body symmetry, and reproduction. Alawiyah et al., (2016) explain that animal material uses Latin and has a wide scope, as well as students have difficulty in describing the characteristics of each animal, classifying, examples and roles respectively. The number of subjects in animal materials plus online learning with one hour of learning is only thirty minutes causing students difficulty in understanding the concept of animal material. Students have learning difficulties that have an impact on low learning outcomes. Improvement of learning outcomes can be done with the application of varied learning models. Observation of learning devices conducted at SMAN 5 Malang shows that the online learning devices used are still not detailed and there are no indicators for 21st century skills, syllabuses and lesson plan made still cannot direct teachers to apply the learning model that has been prepared before because there is no clear learning model syntax.

Based on the background of problems cognitive learning outcomes and scientific skills students can be improved through the application of discovery learning models. Learning with the Discovery Learning model emphasizes on students' ability to discover knowledge based on learning (Majid & Rochman, 2015). While the definition of scientific skills is a skill that is able to direct students to discover and develop their own facts and concepts so that the learning experience obtained can be remembered over a relatively long period of time. Scientific skills in relation to biological learning are the ability to carry out observations, formulate problems and hypotheses, conduct experiments / experiments and data retrieval, analyze data and conclude, and communicate and apply concepts. Scientific skills can be trained with appropriate learning models, such as the Discovery Learning model. Discovery Learning model is a learning model that presents problems in learning then teachers encourage students to find their own knowledge. The Discovery Learning model is focused on developing students' scientific skills because each stage of learning emphasizes more on the discovery of their own concepts by students. Students play an active role in learning with the Discovery Learning model so that they can find their own answers to solve problems (Savittriani et al., 2019). Susanti & Jamhari (2016) explains that there is a significant influence of learning with the

Discovery Learning model on science skills in biological learning. In addition, to train scientific skills and cognitive learning outcomes students can be done by providing a variety of learning media.

Learning media is a student learning tool used in learning activities to achieve learning goals. The learning media used in this study is podcasts. Podcast is a media in the form of audio that can be listened to through a computer / laptop, and smartphone where audio in the form of sound recordings made with scenarios that make the listener carried away in the actual situation (Alawiyah et al., 2016). Mayangsari & Tiara (2019) in the results of his research showed that podcasts are able to increase learning motivation, learning outcomes and practical skills of students. Based on this, the study takes the title "Development of biology learning tools using discovery learning assisted by podcast and google classroom to improve Scientific Skills and Cognitive Learning Outcomes of senior high school Students".

METHOD

This study is a Research and Development (R&D) with ADDIE model. ADDIE model consist of 5 stages which are Analyze, Design, Develop, Implement, and Evaluate. The research used is a quantitative and qualitative approach, with the quantitative data obtained from validation questionnaire scores, practicality, and effectiveness, while qualitative data is obtained from comments and suggestions from expert validators and product users in this case students regarding the advantages and disadvantages of the product. The product of this research are syllabus, lesson plan, student worksheet, assessment sheet, and podcast.

The analyze stage that conducted in September 2020 begins with problem validation to find out the gap between expectations and reality. The analysis stage was conducted out during a field practice study in class X MIPA and interview with biology teacher in class X. From this stage, the problems that can be concluded are monotonous learning process and students' cognitive learning outcomes and scientific skills that are still low.

The design stage that conducted from October to November 2020 begins with designing instructional design based on analysis result by identifying important task in accordance with basic competence of animals kingdom so that learning objectives can be achieved. The animals kingdom sub-materials in this study consist of describes grouping animals into phyla based on body layers, body cavities, body symmetry, and reproduction. The instructional design was designed for three meetings with 2x30 minutes each. In this stage also carried out the preparation of product testing instrument. The validity of the products validated by material expert, instructional design expert, and teacher through validity sheets. The practicality of the products obtained from learning syntax implementation and students' response questionnaire. The effectiveness of the products gained from pretest, posttest, and calculation of N-Gain from students.

The development stage that conducted from December 2020 to January 2021 aimed to produce the instructional design, validate and test the product. Data obtained from this stage are qualitative and quantitative. Qualitative data obtained from comments and suggestions from validators, while quantitative data is score obtained from validation questionnaires by validators with a rating scale of 1-5. The validated product then tested on 25 Students in class XI MIPA with a small group trial and 30 Students in class X MIPA with a conduct a pilot test.

The implementation stage that conducted in February 2021 aimed to implement the product to X MIPA E1 students in the learning process. This stage begins with preparing the teacher then preparing students. Pretest was held before learning at the first meeting begins. Learning process was done through Google Classroom, including students worksheet and podcast link sharing. Posttest was held after the learning process at the last meeting had been completed.

The evaluation stage aimed to determine the effectiveness of the products in order to improve students' cognitive learning outcomes and scientific skills. This stage begins by determining the

evaluation criteria for the validity, practicality, and effectiveness test. Evaluation criteria can be seen on Table 1, 2, and 3.

Table 1. validity test score interpretation

Validity percentage (%)	Validity criteria	Description
85,01-100,00	Valid	Can be used with small revision
70,001-85,00	Valid enough	Can be used with revision
50,01-70,00	Less valid	Suggested not to be used
01,00-50,00	Not valid	Can't be used

Source: Akbar (2013)

Table 2. Practicality test score interpretation

Validity percentage (%)	Practicality criteria
85,01-100,00	Practical
70,001-85,00	Practical enough
50,01-70,00	Less practical
01,00-50,00	Not practical

Source: Akbar (2013)

Table 3. Effectiveness test score interpretation

No.	Effectiveness score (N-Gain)	Criteria
1.	n-gain $\geq$ 0,7	High
2.	0,3 < n-gain < 0,7	moderate
3.	n-gain $\leq$ 0,3	low

Source: Hake in Majdi et al (2018)

Table 4. Criteria for the value of students' scientific skills

value	Criteria
86-100	Very good
71-85	Good
56-70	Enough
$\leq$ 55	less

Source: Kemendikbud in Kholifah (2018)

Validity and practicality test data analyzed quantitatively using following formula:

$$X = \frac{\Sigma xi}{\Sigma x \; max} \; x \; 100\%$$

In which : X = validity/practicality percentage

         Σ xi = score obtained from validators

         Σx max = maximal score

Analysis result determined the validity or practicality of the product based in Table 1 and 2.

Effectiveness of the products from the result of pretest-posttest in the form of gain score. Gain score indicates the level of learning effectiveness that refers to the pretest-posttest value. The gain score can be calculated by the following formula, with the effectiveness criteria can be seen in Table 3.

$$N - gain = \frac{posttest \; score - pretest \; score}{maximal \; score - pretest \; score}$$

Scientific skills indicates the level of learning effectiveness that refers to the pretest-posttest value. The scientific skills can be calculated by the following formula, with the criteria can be seen in Table 4.

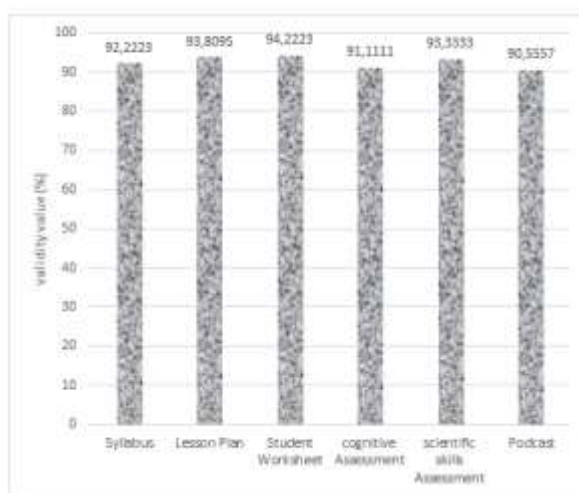$$X = \frac{\Sigma xi}{\Sigma x\ max} \ x\ 100\%$$

RESULT AND DISCUSSION

1.1   Result

Validity test result of syllabus, lesson plan, student worksheet, assessment sheet, and podcast can be seen in Figure 1.

Products that have been validated and revised according to validator's suggestion then will be tested before being implemented to X MIPA E1 students. The trial was conducted with a small group design to 25 students of XI MIPA who had studied kingdom animals and conduct a pilot test to 30 students of X MIPA who were going to study the kingdom animals through filling out readability questionnaires. The questionnaire aimed to assess the ease of student worksheet, podcast, and the problem presented.

Product that have tested the implemented to 30 students X MIPA E1. At the implementation stage, practicality test data and effectiveness test are obtained. The practicality test result which are learning syntax implementation and students, response questionnaire can be seen consecutively in Figure 2 and 3. Pretest and posttest can be seen in Figure 4.


Fig 1. Validity result of syllabus, lesson plan, student worksheet, assessment sheet, and podcast

From the figure 1, it can be concluded that all product that have been developed gained valid category according to Table 1. Based on these results, the online learning tools developed can be used but with minor revisions before being tested.
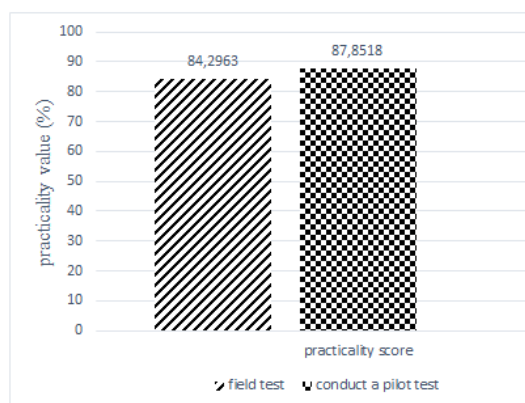
Fig 2. Practicality result from students' response questionnaire

From the figure 2, it can be conclude that learning tools have very practical categories. The results of this trial are used as a reference for researchers to revise online learning tools to obtain better results during implementation.
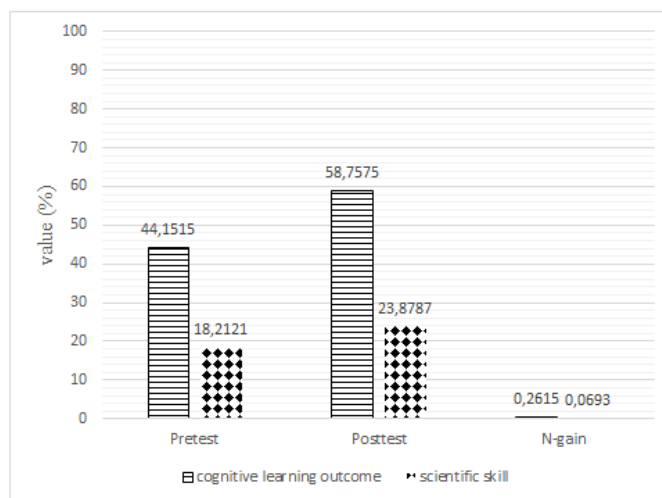
Fig 3. Students' pretest and posttest result

From the Figure 3, it can be calculated the N-gain score of cognitive learning outcome and scientific skills that the online learning tools developed have low effectiveness criteria according to Table 3. The results were supported by observations of the implementation of learning syntax that showed a score of 100%, and the observation result of students' scientific skills of 72.7272 that showed good criteria according to Table 4.

DISCUSSION

Product development in this research has gone through all stages of research resulting in a valid, practical, and effective online learning tools, and product development can improve the cognitive learning outcomes and scientific skills.

Validity learning tools can support the achievement of learning goals and the achievement of conducive learning. The validity of learning devices can be seen from the interrelationships between the characteristics of learning models applied with each component of learning tools developed (Patmawati, 2016). Aida et al (2016) stated that valid learning tools have validation results in the category valid enough. Validation of learning devices in this study uses three validators by instructional design expert, material experts, and teacher through validity sheets. Validation results are used to determine the feasibility of the product. The validation results that have been shown in Figure 1 are the average validation results from the instructional design experts show a validity score of 97.9127 with valid criteria, validation results from material experts show a validity score of 98.4127 with valid criteria, and validation results from teacher through validity sheets show a score of 81.3016 with valid criteria. The validation results have been developed gained valid category, thus learning tools can be implemented but there needs to be revisions according to comments and suggestions from validators. The learning tools before implementation is tested first. These trials aim to get feedback from students and are then used for improvements before implementation so that learning tools are more effective (Branch, 2009).

Practicality of learning tools means that easy to use by researchers and students who will use the learning tools, so in its preparation must pay attention to the instructions and language in each product developed. The practicality of learning tools can be seen from the ease of implementing these devices and can be implemented properly (Patmawati, 2016). Mustami et al (2017) stated that learning tools can be said to be practical if there are two criteria that are met, namely learning tools developed can be established according to experts and learning tools can be applied in the field. Efforts to find out the practicality or readability of learning tools so that they can be applied properly are done with one to one trial, small group trials, and field test (Syahbana, 2012).

One to one trial aim to find out the readability of products that have been validated. As for small group trial are used to get feedback related to the product developed, that the product developed needs to be revised again or not. But in this study one to one trial were not conducted. Small group trial was conducted on 25 students of class XI MIPA SMAN 5 Malang. The test results showed that the learning tools had a practicality score of 84.2963 and included very practical criteria to use. Based on the trial there are comments and suggestions from students for improvement of learning tools before implantation. Furthermore, the revised learning tools conducted a pilot test in class X MIPA that will take animal material. The results of the conduct a pilot test showed a score of 87.8518 and included very practical criteria. This shows that the online learning tools developed are very practical and can be used in online learning of animal materials. The practicality questionnaire assessment shows that the online learning tools has met the practicality criteria. The trial aims to find out the feasibility of the product before it is implemented.

Effective learning tools can be seen through the average test results given to student learning tools users. The learning tools can be effective if the learning tools is able to increase student learning activities (Nabilah & Raharjo, 2018). The effectiveness of learning tools was demonstrated by improvements in students' cognitive learning outcomes and scientific skills after analysis based on N-Gain scores.

The study examined cognitive learning outcomes obtained from pretest scores before online learning and posttest after online learning. Cognitive tests are given to determine the level of student mastery of the subject matter conducted before learning and after three meetings. The test used is a test that has been validated so that it has measured the specified learning indicator.

The online learning tools that has been developed, based on Figure 3 has an N-Gain score of 0.2615 with a low effectiveness. Test results showed improved cognitive learning outcomes but based on N-gain scores had less effective criteria in improving cognitive learning outcomes. The results showed that online learning tools developed based on the Discovery Learning model aided by podcasts and google classroom were less effective at improving students' cognitive learning outcomes. Learning tools developed in this study include syllabus, lesson plan, student worksheet, assessment sheet, and podcasts. Syllabus, RPP, and LKS are developed based on the Discovery Learning model, which encourages students in concept discovery. Discovery Learning model in its application is able to engage students actively and able to convey and discover their own ideas or ideas, all students' abilities are involved to the maximum in conducting systematic, critical, and logical investigations so that students can formulate their own discoveries. Students in the learning process with the Discovery Learning model are able to find out about problems related to existing phenomena and students provide solutions based on the information obtained. Learning with the discovery learning model finally requires students to find their own information and organize something that is already known and understood (Syarif & Susilawati, 2017). Sundari (2018) in his research mentioned that student learning outcomes can increase from 37% to 43.75% with the implementation of the Discovery Learning model. Discovery Learning model is able to improve the results of biology learning class XI IPA at SMAN 2 Sukoharjo with the average value of the results of learning biology students the realm of knowledge, attitude, and skills in the experimental class is greater than the control class (Ulumi et al., 2019).

Improved student learning outcomes can also be supported by the learning media used. Learning media acts as a tool in learning activities to achieve the goal of learning. Learning media encourages the efficiency of learning activities, especially when learning online during the Covid-19 pandemic (Lisman et al., 2021), in this study the learning media used is podcasts. Podcasts as one of the learning media that is easily accessible to students. Podcasts such as video or audio in general, which contain original audio or video recordings and are divided into several episodes. Podcast is a medium in the form of audio that can be listened to through a computer / laptop, and a smartphone where audio in the form of sound recordings made with scenarios that make the listener carried away to the actual situation (Toyib et al., 2013). The most common use of podcasts is for additional material that students tend to listen to at home and the main benefit of podcast videos is to review missed material or not understand the subject matter in class (Hew, 2009). Copley (2007) explains that students download more podcast-based subject matter. Mayangsari & Tiara (2019) in his research explained that improving students' learning outcomes, learning motivation, and practical skills can be

done through learning with podcasts. Students are more aware of the material delivered through podcasts, because podcasts can be used anytime and anywhere so that students can understand the material better, repetition in listening to the material can train students' memory (Asmi et al., 2019).

The effectiveness of learning tools can also be seen through the improvement of students' scientific skills. Students' scientific skills can be observed through the provision of tests and observations. Based on the N-Gain score on Figure 3 the average scientific skills of students is 0.0693 with a low effectiveness rate. Data on improving students' scientific skills are also supported by the results of scientific skills observations that show a score of 72.7272, the results show that students' scientific skills are in good criteria according to Table 4. The improvement of students' scientific skills is also supported by the application of learning models that are in accordance with learning objectives. The learning model used is Discovery Learning. Widiadnyana et al (2014) in his research showed that the Discovery Learning model is able to improve students' scientific skills, there is a significant average value of scientific skills, learning with the Discovery Learning model has a higher average learning than learning with a direct learning model. Students' scientific skills are able to increase by 23% on learning by applying the Discovery Learning model (Hidayati, 2017).

Based on the description, the effectiveness of learning tools is also influenced by the suitability of the learning model applied so as to improve students' cognitive learning outcomes and scientific skills, but have less criteria. This is related to the disadvantages of online learning in the Covid-19 pandemic, namely the lack of technological devices and inadequate internet networks, because not all students have technological devices and internet networks that support. In addition, students are less used applications that result in difficulties in interacting digitally during online learning (Arosyd & Usman, 2020). Suhery et al., (2020) stated that online learning is a lack of interaction between teachers and students so that it slows down the formation of values in the learning process, and students who do not have high learning motivation tend to fail.

Overall, biology learning tools using discovery learning assisted by podcast and google classroom to improve cognitive learning outcomes and scientific skills but with a low level of effectiveness. Learning that has been applied using discovery learning assisted by podcast and google classroom makes students able to learn online easily. The learning tools developed is able to facilitate students in understanding animal materials because in their learning activities using student worksheets with a comparison table that contains morphological traits, anatomy, and physiology of invertebrate animals and chordata. Students can group animals into invertebrate or cordate groups based on traits that have been included in the comparison table. Nonetheless, developed learning tools have their drawbacks and advantages. Here are the disadvantages and advantages of the products developed.

1) Product advantages

The products developed of biology learning tools using discovery learning assisted by podcast and google classroom are able to improve students' cognitive learning outcomes and scientific skills and based on the results of tests of validity and practicality, online learning tools developed have valid and practical criteria to improve students' cognitive learning outcomes and scientific skills. Development of biology learning tools using discovery learning assisted by podcast and google classroom to improve Scientific Skills and Cognitive Learning Outcomes of senior high school Students

2) Product shortage

The lack of developed products is less effective for improving students' cognitive learning outcomes and scientific skills due to their low effectiveness. In addition, biology learning tools using discovery learning assisted by podcast and google classroom its development are not one to one trial so that conformity to the needs of students cannot be maximized. In addition, this learning tools is limited to the Discovery Learning syntax on online learning so that the application at the learning lift developed can only be applied to online learning.

CONCLUSION

Based on the results and discussions it can be concluded that the online learning tools developed has valid, practical, and less effective criteria with details, namely: (1) all online learning tools based on validation results have valid criteria (2) practicality questionnaire results show positive

student response and products developed are suitable for use, (3) online learning devices are less effective, although able to improve cognitive learning outcomes and scientific skills achievement of students but with low effectiveness criteria. Researchers suggest that developed online learning tools could be used by teachers to improve students' cognitive learning outcomes and scientific skills but adapted to conditions in the field.

Based on the most crucial factors that have been identified in this study, please suggest the new direction, new objectives, and new method for this similar study in the future. Adding this section adds value to the article by building upon the findings of this research and addressing the limitations and unanswered aspects of this study.

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