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Development of e-Module in Learning Ecosystem to Foster Thinking Skills of Junior High School Students

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Abstract: The aim of this study is to develop a flipped-classroom-based e-module through validity, practicality, and effectiveness test. The method employed in this study is research and development (R&D) with several steps undergone i.e. planning, product development, validity test, revision, and small- and big-scales try-out. The result of this study revealed that the e-module had been very valid based on the input given by the content and media experts with approximate score 91.76% to 98.40%. The practicality on teacher's and students' activity for the whole meeting reached the approximate score 84.44% to 98.10% which is very practical. Students' response on the response on the questionnaire reached the highest score as big as 94.07% which was very good. On the effectiveness test, there was an increase on students' solo taxonomy level. It can be seen from the pre-test which was initially on the pre-structural (59.17%) and uni-structural (40.83%) level elevated to the multi-structural (85%) and relational (12.50%) level during the post-test. The evaluation on the mockup product, the range score on each group is around 83.53 to 90.59 which is very good. It can be concluded that the flipped-classroom based e-module had fulfilled the criteria of validity, practicality, and effectiveness to foster students' thinking skill in SMP Islam Pagimana.

Keywords: e-modul, flipped classroom, ecosystem, thinking skills.

Abstrak: *Tujuan penelitian yaitu melakukan pengembangan e-modul berbasis flipped classroom melalui uji validitas, kepraktisan, dan efektivitas. Metode penelitian berupa metode Research and Development (R&D) dengan tahapan perencanaan, pengembangan produk, uji validitas, revisi, dan uji coba lapangan terbatas dan luas. Hasil penelitian menunjukkan bahwa e-modul memenuhi kriteria sangat valid oleh ahli materi dan ahli media dengan kisaran 91,76% hingga 98,40%. Uji kepraktisan pada aktivitas guru dan siswa pada semua pertemuan berkisar antara 84,44% hingga 98,10% dengan kategori sangat praktis. Respon siswa hasil angket tertinggi sebesar 94,07% dengan kategori sangat baik. Pada uji efektivitas, terjadi peningkatan level taksonomi solo siswa dari pretest di level prestructural (59,17%) dan unistructural (40,83%) meningkat pada posttest di level multistructural (85%) dan relational (12,50%). Untuk penilaian produk maket, rentang nilai pada setiap kelompok berkisar antara 83,53 hingga 90,59 dengan kategori sangat baik. Kesimpulannya bahwa e-modul berbasis flipped classroom memenuhi kriteri validitas, kepraktisan, dan efektivitas untuk melatih kemampuan berpikir siswa SMP Islam Pagimana.*

Kata kunci: *e-modul, flipped classroom, ekosistem, kemampuan berpikir.*

▪ INTRODUCTION

Educational process is in the form of learning activities as it is prominent. Education quality is a major challenge in global progression today. According to Wuryastuti, people have been realizing and considering the low quality of Natural Science education (Wuryastuti, 2008). The indicator used to demonstrate the low quality of Natural Science is a report from United Nation Development Project (UNDP)

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showing that in a Human Development Index (HDI), Indonesia has placed the 107th rank among many countries in the world (UNDP, 2020).

Education quality is decided by various factors, one of which is the teachers/instructors. Although other factors also contributed to the downfall of the education quality, teacher is one of determining factors because they are engaged in a program and interact with the students in a learning process (Mahpudz dkk, 2009; Wibowo, 2015). Education quality is no separated from teachers' role as professional educators who have important job to educate, teach, guide, and facilitate the learning process (Puluhulawa et al., 2022). One of schools in the Province of Central Sulawesi is SMP Islam Pagimana located in the District of Pagimana, Banggai Regency, Central Sulawesi Province.

According to the preliminary observation, SMP Islam often face several problems, whether it is conventional problem related to facilities and infrastructure or problems related to the learning process in the classroom. Particularly in an integrated Natural Science Subject, several problems identified are the learning activities which are dominated by a classroom situation which is teacher as the main source of knowledge, while students only receive the knowledge from the teachers. The learning method implemented by the teachers are considered obsolete, such as using conventional method. Lecturing still becomes the main choice of the teacher in teaching. However, not all scientific process can be developed through a conventional method. One of materials in an integrated Natural Science subject which can be further developed is ecosystem. The problem is the low skill of the students in understanding the ecosystem topic. Besides, the passing grade score of the students on ecosystem topic is more than 50% under the passing grade. Other barriers are the use of learning media which is considered low and lack of alternative learning resource that caused low comprehension skill of the students on the learning materials. Wulandari et al. (2020) in her research concluded that the implementation of an interactive e-module affect students' motivation and learning result simultaneously, yet it does no affect students' learning motivation. Dewi and Lestari (2020) in their research on a project-based interactive module revealed that it has positive impacts toward students' learning result. Thus, the use of e-module in learning today is affirmed to be appropriate to be implemented.

Pandemic is a condition of the spread of certain diseases happened in more than one country. This pandemic had spread in almost all parts of the world, including Indonesia (Jihad, 2020). During the learning process, based on previous research, there is an appropriate method to use in this pandemic situation that is by using blended learning. One type of blended learning is a flipped classroom model. It is a learning model that "flip" the traditional model. Materials are given in the classroom and students do the exercise at home. Flipped classroom blended kind of learning does not only integrate technology for a classroom learning. Instead, the existence of technology in blended learning is focusing on facilitating the students in exploring the learning materials and gaining autonomous learning experience (Jusuf, 2020; Dewi dkk, 2019; Nurhidin, 2022). In this learning model, online and face-to-face sessions are completing one another and continuous. It means that in the online learning session, the discussion focuses on the materials while face-to-face activities focuses on learning, and vice versa (Ariani, 2021). Flipped classroom blended learning can be a learning solution in SMP Islam Pagimana. This is because in Pagimana District has been supported with internet

connection. Besides, the government had handed a leaning quota for students as a solution for a problem in internet quota. This kind of learning has become a solution where online and offline learning are integrated in a learning activity. It is neither always take a face-to-face meeting nor screen-to-screen class.

Based on the explanation afore, the researcher aimed to conduct a research on the development of flipped-classroom e-module on ecosystem to train students' thinking skill in junior high school. The purpose of this research is to describe the validity, practicality, and effectiveness which are flipped classroom-based learning model on the topic of ecosystem

▪ METHOD

Participant

TThis study was conducted on the even semester of academic year 2021/2022. The location of this study was in SMP Islam Pagimana. 15 students from grade VII took parts in a small class and 30 students in a big class. The sampling technique used in this study was simple random sampling where each population has similar chance to be put in a sample where all samples have similar selection probability (West, 2016).

Research Design and Procedures

This study is a research and development (R&D). It is such a creative and systematic work which was conducted to increase knowledge and design a new media from the prior knowledge which had been possessed (Moris, 2018; Yoshikawa, 2012; Gustiani, 2019). It developed a flipped-classroom based learning media on ecosystem topic of Natural Science subject for junior high school students. The subject of this research is students from grade VII in SMP Islam Pagimana and had been conducted for two months.As has been explained in the research design, the steps of this research consists of (a) data collection related to the learning media used, (b) arranging the initial draft of the product in the form of learning module in the form of e-module which is suitable with the goals, materials, and strategy determined previously, (c) determining the facilities and infrastructure, (d) expert validation and revision which were conducted by the validators who are the expert of research and development—this validation is used to assess the appropriateness of the media for Natural Science subject which had been developed consisting of validation sheet of the lesson plan, worksheet, test for learning result, and the e-module (both materials and media) (Latjompoh, 2018), (e) revisions on the design and development of the prototype, (f) limited scale try-out—it was administered to 15 students from grade VII of SMP Islam Pagimana, it is expected to lower the technical errors and possible obstacles when the big-scale try-out is going on, (g) the second revision of the prototype, (h) big-scale try out which was conducted by using the revised product. The try-out design is similar to the small-scale try-out yet the big-scale try-out engaged more students consisting of 30 students of grade VII in SMP Islam Pagimana by using a pre-experiment method and one group pretest post-test design.

Research Instrument

Research instrument is a tool used by the researcher to collect data based on the structure, format, purpose, characteristics, and availability (Sathiyaseelan, 2015). The instrument of this research consisted of a test and non-test. A test-group administered a

test of students' thinking skills covering the pre-test and post-test which had been prepared by the researcher and validated by the experts. The non-test group administered a validation sheet containing critiques and suggestions from the validator. Other non test data come from the questionnaire of students' responses and the realization sheet of the learning activity by implementing the flipped-classroom-based e-module on ecosystem topic. The validation sheets were given to the validators to gain input about the assessment of the expert taking part in the validation of the e-module as learning media prior to its use in the learning process.

Data Analysis Technique

Product validity was decided based on the internal/logical validation, meaning that it must fulfill the construct and content validity (Sugiyono, 2013). The validation result of the e-module which is based on flipped-classroom on ecosystem topic was analyzed by doing a calculation on Validity = (Total of Empiric Score/Total of maximum score) x 100%. The data of the analysis result was then transformed into descriptive quantity with several criteria such as Very Valid if $81.26 \leq Va \leq 100.00$, Valid $62.51 \leq Va < 81.25$, Less Valid $43.76 \leq Va < 62.50$, and Invalid $25.00 \leq Va < 43.75$ (Sujarwo, 2006). The analysis result on the exploration sheet of this analysis was used to know the appropriateness of the learning media based on the applied curriculum.

The practicality analysis can be conducted by using two observers, in this case are the teachers. The formula used to analyze the practicality can be seen on average score (r) = (Total score of each aspect/Maximum Score) x 100%. The criteria of the observation result of the practicality of the lesson plan are Very Practical if $84 \leq Va \leq 100$, Practical $68 \leq Va < 84$, Fairly Practical $52 \leq Va < 68$, Not Practical $36 \leq Va < 52$, and Extremely not practical $20 \leq Va < 36$ (Sujarwo, 2006).

Students' activities can be revealed from the observation result on all students' according to the total students decided before. The assessment on students' activities is in the form of checklist. The scoring of students' activities is based on the calculation of the suitability level = (Total proportion of students who chose/total students) x 100%. The result of student's presentation response can be measured through several criteria i.e. Very Good if $81.26 \leq X < 100.00$, Good $62.51 \leq X < 81.25$, Fairly Good $43.76 \leq X < 62.50$, and Poor $25.00 \leq X < 43.75$ (Sujarwo, 2006).

The questionnaire of students' responses is used to measure students' opinion related to the flipped-classroom-based e-module on the ecosystem topic. This questionnaire was administered after all the learning activities were completed. The formula used to analyze students' responses is based on the calculation of the suitability level = (Total proportion of students who chose/total students) x 100%. The result of student's presentation response can be measured through several criteria i.e. Very Good if $81.26 \leq X < 100.00$, Good $62.51 \leq X < 81.25$, Fairly Good $43.76 \leq X < 62.50$, and Poor $25.00 \leq X < 43.75$ (Sujarwo, 2006). The effectiveness of the e-module about ecosystem which is flipped-classroom-based was analyzed quantitatively by using the data of pre- and post-test result. The analysis on students' thinking skill was tested by using essay test. It was then categorized by using evaluation scale namely prestructural, unistructural, multistructural, relational, and extended abstract.

On the instrument sheet, there are 5 answer points with the interval suitable with the Likert Scale (interval 1-5), then analyzing the assessment result of students' project. After that, the percentage of the quality of product (KP) = (Teacher's total score/Total

maximum score) x 100%. The result of percentage of the product quality can be matched with the criteria of product with a description in the following: Excellent if the score reached 81% – 100%, Very Good 61% – 80%, Good 41% – 60%, Fairly Good 21% – 40%, and Poor 0% – 20% (Sarita & Kurniawati, 2020).

▪ RESULT AND DISSCUSSION

Research and Development is a basic research activity which aims at obtaining information of the users' needs (needs assessment), continued by development activities to create a product and examine the effectiveness of the product (Sugiyono, 2009). Validity is an assessment towards a product planning. The validity of learning materials in a research is a learning materials which were developed based on the needs and designed based on the scientific knowledge, and the learning materials developed in a study is logical to be planned (Nieveen, 1999).

In a research and development conducted by the author, the validator team consisted of a graduate lecturer in Biology Education Study Program who have been the expert on the data that will be validated as well as the Natural Science teachers in a junior high school who are also skillful and experienced in teaching. The validation was conducted when doing a focus group discussion on 8 February 2022. The development of the e-module conducted by the researcher had undergone several steps based on the research design. The steps are problem analysis, data collection, product design, calidation design, revision design, product test, and product revision (Rusmanto, 2020).

Problem Analysis and Data Collection

The preliminary observation in SMP Islam Pagimana revealed that teachers at this school often face conventional problems related to facilities and infrastructure as well as problems related to learning process in the classroom. Particularly in an integrated Natural Science course, several problems identified are dominated with the condition of the classroom which is teacher-centered, to that the students only receive the knowledge from the teachers as the resource of knowledge. The teaching method used by the teachers is still conventional in nature that is using lecturing method.

Data collection in this case is the source/e-module reference. It is from the book and module of the research result which was designed based on the references. The book and module as the research result are such as Natural Sciece book for grade VII of Junior High School written by Widodo et al (2017), inquiry training-based learning module of Natural Science written by Tamalene (2018), and a learning module for open Junior High School grade VII written by Herlina & Iskandar (2020). Besides, data on the developed e-module were the primary source of the researcher.

Product Design and Development

Product development in this case in the e-module based on the available book and module which had been developed beforehand. The product design will not always tend to adopt the new technology. The design in this research is related to the additional model of flipped-classroom (Patil, et al., 2017). The initial draft making is in the form of teaching module in the form of e-module which was suitable with the purpose, materials, and strategy which had been decided before. The application used to develop

the e-module was a free application from canva.com. The initial sample draft of the e-module can be seen through Picture 1.

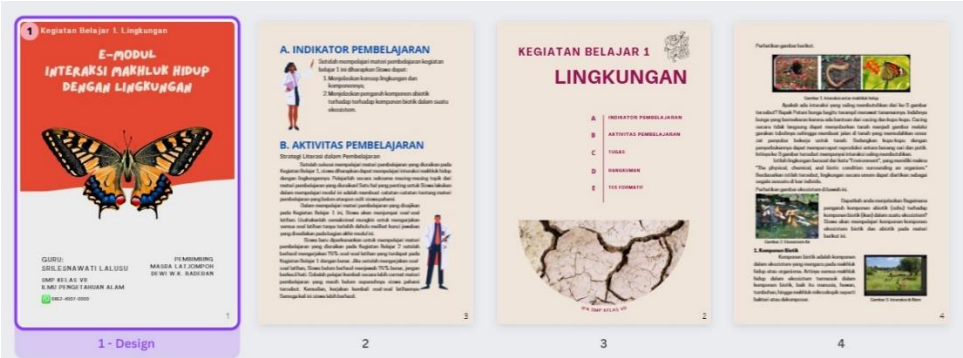


Figure 1. The screenshot of the initial draft of flipped-classroom based e-module of natural science

In arranging the initial draft of the e-module, the researcher followed several steps such as the module framework (Prastowo, 2014). The initial module draft was designed by using canva.com application (https://bit.ly/3zoExsK). At the beginning of the draft, the researcher focused on the indicator and learning activities.

E-Module Validity

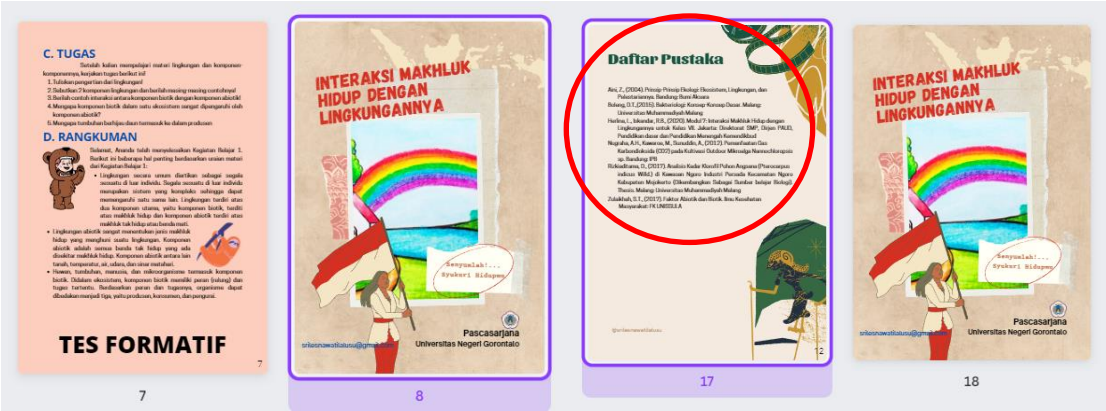
The assessment aspects of the e-module are generally divided into three: learning aspects, the correctness of the content, and language use (Handayani, 2020). The input from the validators of content expert can be seen through Table 1.

Table 1. Input from the validator of content expert for revising the materials of the e-module

No	Before Revision	After Revision
1.	The references does not match the citation of the e-module content	The references had been revised and suitable with the citation of sources in the e-module.
2.	The source of the picture had not been displayed.	Source consisting name and year of the citation had been written on the picture.
3.	Pictures and Videos are not suitable with the situation and condition of the surrounding.	Pictures and Videos in the e-module had been matched with the situation and condition of students' surrounding.
4.	The interpretation in the video was not completed yet.	The interpretation of the video in the e-module had been added.
5	Core Competence and Basic Competence should be included in the e-module	Core Competence and Basic Competence had been added

The materials referred by the researcher is the instructional materials. The instructional materials is the manifestation of materials or a media of learning substance to help the teachers/instructor in the teaching and learning activities which was arranged systematically to fulfill the applied competence standard (Tuimur & Chemwei, 2015). Learning materials were placed in the higher position above the whole curriculum, which must be prepared so that the teaching and learning could run well and reached the learning goals. The goals must be tailored to the core competence and basic competence that must be achieved by the students. This implies that the materials decided for a learning activity must be a material that really support the achieved core competence and basic competence as well as the achieved competence indicator. The learning materials which had been validated is the materials contained in the e-module developed by the researcher.

The first correction from the validator was related to the location of the reference. In a scientific work, reference has an important role as the source of reference in citating the theories in the e-module. The revision from the draft to the result of the correction of the reference can be seen through Figure 2.



(a) (b)

Figure 2. E-Module as a learning media: (a) Before the revision without the reference, (b) After the revision with added reference that match the citation

The expert validators also did a correction on the source of the pictures and videos. It highlighted the importance of using pictures and videos related to the real condition of students' surrounding. This should be shown to make the students easier in training their thinking skills since the object being observed is the one that is often seen by the students visually. The transformation of the video and the added picture source which had been revised can be seen through Figure 3.

The researcher added the source of the citation on the picture as well as changing the performance of the video by directly taking and interpreting the video of the nearest environment and put them into the e-module. The researcher also added some other parts of the e-module such as the Formative Test and Glossary. The final correction highlighted the needs to put the core and basic competence in the e-module. This had been completed by the researcher.

Based on the total validation score, the score of content expert validation is thoroughly 78 (91.76%). This score determined the category of the validation

assessment with total assessment aspects 17 with the highest score 85 (100%) and the lowest score 7 (8.24%), so that the interval score is categorized very valid ($81.26 \leq Va \leq 100.00$) with reference from Sujarwo (2006).

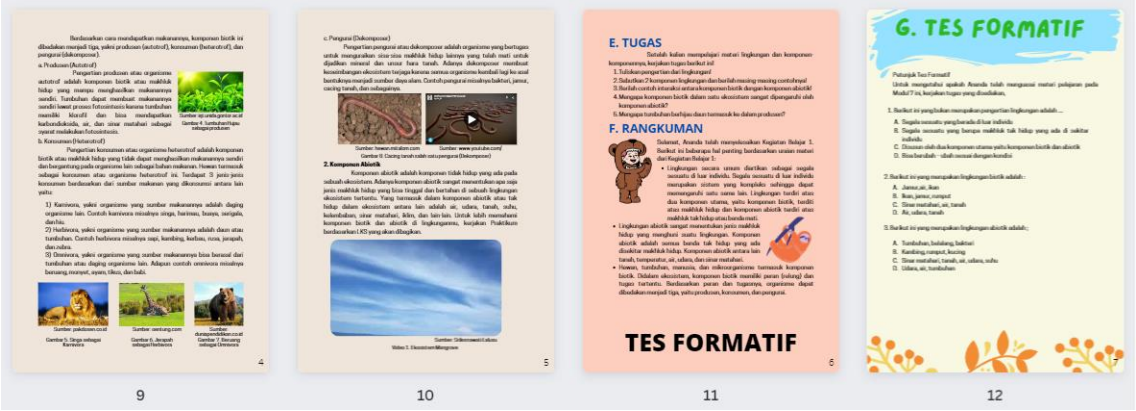


Figure 3. Source of the citation of each picture had been given and the videos in the e-module had been matched with the condition of students' surrounding

The input from media expert on the assessment of the cover of the media, design of the module's content, appearance of the pictures, and language can be seen through Table 2.

Table 2. Input from the experts validator to revise the e-module

No	Before Revision	After Revision
1.	The color of the cover of the e-module particularly in meeting 1 has not been made maximally, revision should be made.	The cover color has been revised.
2.	The combination of the alphabets is not similar to some parts of the module including the size of the fonts.	Font type and size had been made uniform throughout the e-module.

In developing a learning media, the researcher has undergone several development steps such as (1) analyzing students' characteristics, (2) determining and focusing the purpose of the learning goals, (3) formulating and improving the materials framework in details that support the achievement of the learning goals, (4) returning the measurement tools of success particularly on the improvement of students' thinking skill, (5) writing the materials for the media appropriately, and (6) administering tests and revision. The revision on the cover of the e-module can be seen on Figure 4.

Cover of the e-module affected student' interest when they open the e-module at the first time. To increase the attractiveness of the e-module, the researcher revised the cover of the e-module as seen in Picture 4. Besides the revision on the cover, the researcher had also revised the font size of each paragraph. Out of 25 assessment aspects, the validation score obtained from the media expert reached 123 points (98.40%) from the highest score that is 125 (100%) and 25 (20%). Based on the interval

of validation score ranging from 81.26 ≤ Va ≤ 100.00 is categorized very valid and can be used as the media for a research and development. Based on the validation result from the media expert, score obtained was as big as 98.40% which is very valid. All inputs from the validator of media expert can be used as reference in revising and developing the learning media. The revised version of the e-module can be seen through the following link: https://bit.ly/3meLbtT.

(a) (b)

Figure 4. E-Module covers: (a) before revision, (b) after revision

Small Scale Try-Out

The small-scale try-out was administered to students grave VII in SMP Islam Pagimana. According to the steps of research and development, it was started in a small-scale to see the evaluation result of the observer before it was applied to wider users. The meeting was conducted for three times with 15 people in a small class.

Teachers' Activity

Teacher's activity is generally divided into several activities: the pre-teaching activity, whilst teaching activity, and post teaching activity when the teachers become the learning source, advisors, examiners, and motivator (Wedlund et al., 2022). The teachers' activities are divided into three types. At the first meeting, teacher did a pre-class virtually. At the second meeting, the teacher meet the students in person in the class room. At the third meeting, teachers and students learn together outside the class.
The assessment result on teachers' activity in the first, second, and third meeting on the field evaluation (small-scale) particularly in the first meeting reached an observation score result as big as 81.11%. According to Table 3.2 related to the criteria of the observation result of the lesson plan, the score was within the range of 68 ≤ Va < 84 which was categorized practical. Next, the increased score of the observation result happened during the second meeting which was as big as 90.00% in which the realization of the lesson plan is categorized very practical. The following assessment was on the third meeting in which the realization of the lesson plan reached score as big as 96.19% which was very practical. Based on the result, the realization of the lesson

plan was considered successful as the results were categorized practical and very practical.

Students' Activity

Students' activities are activities done by the students during the learning process. It was started with the pre-learning, discussion process, and post-learning. The assessment of students' activities was conducted online based on the online class in the first meeting, and the offline class for the second and third meeting. The online learning was assisted with Google Classroom and Zoom Meeting for direct learning. The offline learning was conducted in the classroom for the second meeting and outside the classroom in the third meeting. According to Sumiati (2013), students' activities are any activities conducted in the classroom during the teaching and learning process that results in an attitude that affects students' learning result. In other words, students are demanded to be active in receiving materials by answering teachers' questions, asking, and sharing opinions.

Both students' and teachers' activities revealed the practicality score on the use of the e-module. The process in assessing students' activities is similar to the processes done to evaluate teachers' activities. The observer would observe students' activeneness in the classroom when the teaching and learning activities are going on. The final result is in the form of assessment score that will be converted to percentage and scored based on the category of practicality evaluation.

According to the observation result, in the first meeting, the assessment score reached 80.00% which was categorized Good. The second meeting reached 88.00% which was Very Good and the third meeting reached 95.24% which was categorized Very Good. According to the three evaluation results, it can be concluded that the realization of the learning process had ran well and very well and the lesson plan used can be used for a big-scale try-out.

Students' Responses

Students' response is a learning that involves students actively in any learning activities (Karpin & Mahmudatussa'adah, 2020). Based on the observation result, nine aspects of students' response towards the e-module reached a series of data as big as 92.59% which was Excellent, 5.93% was Very Good, and 1.48% Good. The Good criteria is for aspect number 5 and 9. Aspect number 5 showed that some students were not familiar with the scientific names and terms shown in the e-module. Thus, revision was needed to add more scientific names in the glossary and in the realization of the learning activities in a wider class that needs more emphasize on the scientific names. From the assessment result which was dominated with very good category, it means that based on students' response, the e-module designed and developed by the researcher is very practical and attractive for the students and their thinking skills.

Students' Learning Result on Small-Scale Try-Out

According to Kuswana (2012), thinking skill is a process of solving a problem and the use of ideas or icons as the substitute of an activity that can be seen physically. Thinking skill can be trained by the teacher to the students through a certain learning scenario. In a small-scale try-out, number of the students engaged in the learning

process and assessment was 15 students in total. The examination process was conducted by administering the test consisting of 4 items that must be done by each student under the supervision of the teacher/researcher and an observer. The guidance of the question items had been possessed by the teacher and become the basis in determining the level of solo taxonomy. The result of the pre- and post-tests of the students in the small-scale try out can be seen through Figure 5.

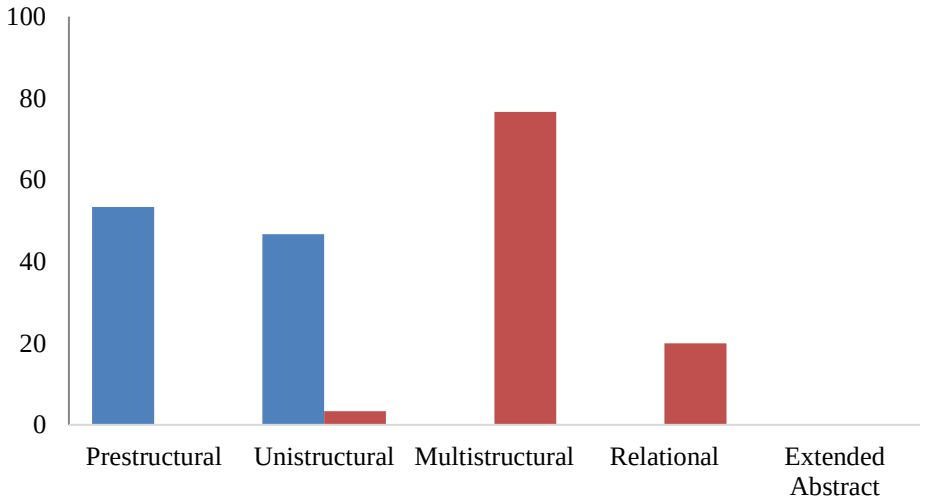


Figure 5. Graphic on the comparison of thinking skills among the students in grade VII based on solo taxonomy (small-scale try-out). Pretest and postest is represented by blue and red, respectively

Types of the question items developed by the researcher is the ones related to the interaction of living creatures with the environment. To increase students' response towards the question items, the types of the items is formed into a case study which focused on one of items related to mangrove, a place that is moving due to the formation of mud and land that happens continually, so that they gradually becomes a semi-land (Baderan & Rahim, 2014). In a small class, students' score on pre-test in the pre-structural category was as big as 53.33% and in the uni-structural category 46.67%. It means that most of the students had not understood the materials of ecosystem. Some students only remembered without understanding the concept. This impacts to their thinking skill in analyzing the answer which is considered low. It can be concluded from the pre-test that students' thinking skill is considered low thus it needs an improvement on their thinking skills so that it can match with the level of solo taxonomy.

After the researcher conducted a learning process based on the lesson plan, providing materials tailored to the e-module, and doing group activities based on the worksheet and flipped-classroom, the result of students' thinking skill based on the post-test score reached 3.33% in the uni-structural category and 76.67% in the multi-structural level where students are able to answer the questions correctly by applying several relevant aspects, explaining some conceptual components, explaining more than one facts/concepts in detail, and 20% in the relational category where the students could

answer the questions correctly and give explanation by applying more than one facts/concepts, explaining the relation between facts/concepts with the theory. The improvement in the form of percentage to the multi-structural and relational category marked students' understanding on the materials of ecosystem which is not only remembering concept but deeper comprehension.

The Second Revision of E-Module Prototype

After conducting the learning process and measuring students' thinking skill in a small-scale try-out, it was continued with revising the e-module based on the input, correction, and evaluation result on the small-scale try-out. Some changes conducted by the researcher is that all of the e-modules in meeting 1, 2, and 3 were merged into one solidunit, font type of the e-module content become Times New Roman size 12, except the title, chapter, and sub-chapter.

(a) (b)

Figure 6. Screenshots of the e-module content on the font type and size: (a) before revision, (b) after revision in times new roman style size 12

The main reason of doing this revision is to improve students' interest so that they were attracted in the beginning. This can make students willing to read the e-mpodule given to them in an online and offline learning. The samples of changes of the font type and size in the e-module can be seen through Picture 6. Besides, the researcher also added a footnote in the e-module.

Big-Scale Try-Out

The Implementation of Learning (Teachers' Activity)

Teacher's activity is one of activities conducted by the teachers in the process of teaching and learning inside and outside the classroom, either directly (face-to-face) or indirectly through online social media. In the learning process, teacher must share their knowledge, attitude, and skill to the students. In doing the learning activity, teachers are equipped with lesson plan as the guidance in running the activities. Students who were taking parts in the test are the seventh graders of SMP Islam Pagimana with total 30 students. The meeting was conducted for three times. From all of the meeting, data obtained in meeting 1 revealed the assessment score given by the observer was as big as

91.11% which is very practical. In meeting 2, the total score reached 94% which is very practical and the implementation of the lesson plan in meeting 3 reached a score as big as 98.10% which is very practical.

Students' Activities

Besides teachers, students' activities are also observed by the observer. Students' activities are any kinds of learning activities that can guide the students to actively engage in the learning process either in the form of interaction between students or students and teachers in the learning process and the process could run actively.

The assessment result of the students in a big class for three meetings showed an increase in each meeting. In meeting 1, the assessment score is 84.44% which is very good. In meeting 2, the score reached 92.00% that is very good, and meeting 3 reached score as big as 97.14% that is very good. The conclusion of the observation result from three meetings is that the lesson plan used during the learning process was very good and can be used as standardized media at school particularly grade VII on ecosystem topic.

Students' Responses

Besides doing the assessment towards the worksheet, students are also given a questionnaire to see the responses towards the e-module. The total evaluation aspect is 9 aspects. The result of the questionnaire on students response towards the e-module used for learning process. The total respondents are 30 students. Based on the result of the questionnaire, the total score of students' response is 95.07% which is very good, 5.19% which is good, and 0.74% which is fairly good. According to these results, it can be concluded that the e-module can be used for learning process.

Students' Learning Result (Problem Solving Skill Analysis)

The effectiveness of the Flipped-Classroom-based E-Module on ecosystem topic was analyzed quantitatively using the result of pre- and post-test. The question items on the pre- and post-test were made based on level gradation based on solo taxonomy to measure students' thinking skill. The level of solo taxonomy used in this study consist of the pre-structural, uni-structural, multi-structural, relational, and extended abstract. The comparison result between students' pre- and post-test can be seen through Figure 7.

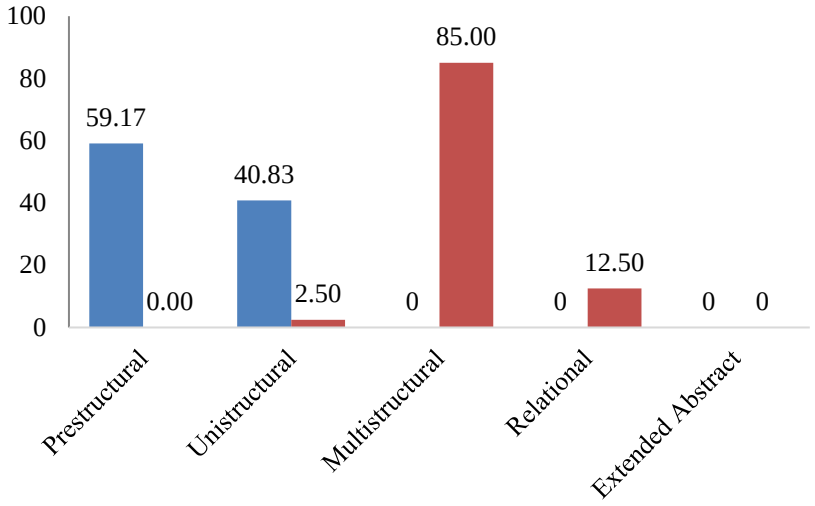


Figure 7. Comparison of students' thinking skill based on solo taxonomy. Score in pretest and posttest is represented by blue and red, respectively

According to the result of pre-test from 30 students, the assessment score on pre-structural level was 59.17% and uni-structural as big as 40.83%. The assessment score for multi-structural, uni-structural, and extended abstract are all on 0% position. This marked that students' thinking skill stays only on the pre- and uni-structural level. Further, the learning process using the learning media referred to flipped classroom. There was a change on students' thinking skill which was marked with the decreasing score on the pre-structural and uni-structural assessment. In contrast, an improvement happened on multi-structural level as big as 85.00% and relational level as big as 12.50%. this shows that flipped-classroom-based learning media is effectively used in a learning process and system particularly on ecosystem topic.

Project-Based Assignment

After doing an evaluation on the learning result based on the level of solo taxonomy, it was continued with the implementation of practice on mockup making, exhibition, and product presentation. In the process of mockup making, the researcher divided the students into 5 groups with different themes. Group 1 mock-up on zoo ecosystem, group 2 forest, group 3 marine ecosystem, group 4 freshwater ecosystem, and group 5 land ecosystem. In general, the assessment was based on the practical activity process including collaboration and group's active engagement, the shape and model of the product made, and the process as well as how the product exhibition was presented with the total aspect evaluated as big as 17 aspects. The assessment result of each group can be seen through Figure 8.

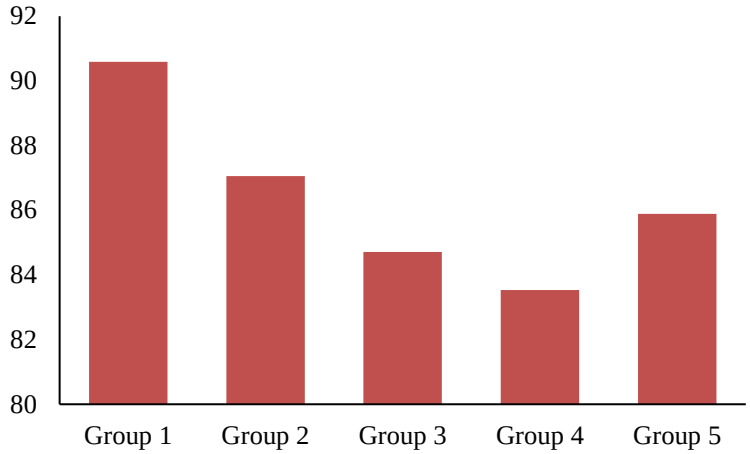


Figure 8. The percentage result on the assessment of practical quality, product, and mock-up product presentation based on flipped-classroom

Based on the assessment result of the five groups, group 1 reached 90.59 which is very good, group 2 87.06% which is very good, group 3 84.71% which is very good, group 4 83.53% which is very good, and group 5 85.88% which is very good. A learning process that implements a flipped-classroom-based e-module was effective to support the teaching and learning process and improve students' skill proven through a very good score.

Three assessment focus on students' project skill is first, students' practical assessment that consists of skill in providing the tools and materials and students' collaborative skill in doing a group work in making a mockup based on the steps shown in the worksheet. Second, the assessment on the product that involved the suitability of the theme and product made, creation and innovation skills, color of the product, clarity of visuals, fonts, creativity, tidiness, and cleanliness. Third, the assessment of the presentation of students' product exhibition that involves the suitability of the explanation with the mockup being exhibited, the mastery of each role among the group members, time efficiency during the presentation, capacity in answering questions from the audience, the completeness of parts in the mockup, the regularity in presenting the materials, cleanliness, and tidiness of the presentation location.

Third Revision of the E-Module Prototype

After doing the big-scale try-out outside the class, based on the inputs given by the Natural Science teacher who are also responsible in becoming the observer, the revision was done to better the cover and it should use the photos of the process and result of the research. In the introduction session, the writer's, advisors', experts', and layout team's profile should be added. The revision result of the e-module can be seen through https://bit.ly/3MpBrrG.

▪ CONCLUSION

According to the research result and discussion, several conclusions drawn are: 1) the validation result from the expert validator team and users of the e-module, the whole materials had shown high score which was categorized very valid so that the learning

media can be used in this research and development, 2) The learning process both teacher's activities and students' activities as well as students' response had reached a score > 84% which showed that the e-module developed is practical to be implemented in learning activities and is appealing for the students, 3) students' thinking skill improved after using the e-module which shifted from the pre-structural and uni-structural category moved to multi-structural and relational category, 4) the e-module developed by the researcher can be used and applied at school particularly in Junior High School Grade VII in Natural Science subject.

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