The Development of natural science module web integrated with local plants toward cooperation skills and environmental care attitude of students

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Abstract The research is about to develop a valid natural science module web integrated local plants on cooperation skills and environmental care attitudes. The research method used is Research and Development which is limited to the developing stage. The research sample was 16 students of 8th grade of Junior High School. The instruments in this study were expert validation sheets, science teacher assessment sheets, peer assessment sheets and students' readability sheets using a questionnaire with Likert scale. Validation data were analyzed using descriptive analysis. The results of the assessment by experts with the score is 3.6, from science teacher with the score is 3.5, peers review with the score are 3.7, 3.7 and 3.4 and the readability level of students 3.7. All scores are in the excellent category. It can be concluded that the web natural science module can be used in learning. This research is important because it utilizes technology and is integrated with the environment.

1. Introduction

Learning from time to time has been developing according to the needs and demands of the times. At present, the 21st Century learning has entered into. The 21st Century learning is learning that increases the ability of students how to face global challenges such as critical thinking skills, the ability to communicate effectively, innovate and problem-solving through negotiation and collaboration [1]. The importance of this learning achievement signifies that learning outcomes must be able to be a tool to face global challenges. One of the most important skills of the 21st century is how to solve the problems through negotiation and collaboration. Negotiation and collaboration are abilities that must be possessed in teamwork.

Cooperation skills can be enhanced by learning that the students sometimes use in discussions with teachers, also appropriate learning models such as think, pair and share [2], group investigation [3], project-based learning [4], student team achievement division (STAD) [5], cooperative type TGT [6] and the other models. Cooperation skills needed in learning because it will be easier to solve problems. Cooperation skills are needed in the social community because, in their application, the world of work needs workers who can work together synergistically in groups [7]. Cooperation skills are individual attitudes that are very important in every individual in social life. Efforts to improve cooperation skills while achieving learning goals and reduce social problems, learning models need to be chosen that allow the accommodating learning principles of cooperative skills, namely: (1) understanding students about cooperative skills that need to be learned, (2) providing opportunities for students to practice or practice these skills and (3) give awards and feedback [8]. The implication of this opinion to improve
collaboration skills is that learning models need to be selected that enable students to understand the learning material and can also gain an understanding of cooperation skills, gain opportunities to practice and gain appreciation and feedback on cooperative skills that have been learned. On the field, skills cooperation is still not optimal, this is based on observations at SMP N 3 Mlati wherein group work only a few students are dominant in the discussion and presentation. Observations are made at the practicum, where the ability of students to collaborate can be observed. In addition to observations in the form of collaboration skills, practicum conducted by students also left waste that was less clean experiments. Apart from collaborating in the learning process, students should also cooperate in environmental cleanliness.

Environmental cleanliness is a clean condition that is free from dirt, including, among others, dust, garbage and odors [9]. To maintain cleanliness, students must be instilled with an attitude of caring for the environment, one of which is the existence of a program of caring and cultured environmental schools [10]. To improve the attitude of caring for the environment itself, it can use environment-based learning, because this has a greater influence compared to learning that is normally done [11]. So it can be said that environmental cleanliness is an indicator of the level of environmental attitudes. The attitude of caring for the environment is a concept that refers to various phenomena of awareness of environmental problems to support environmental sustainability, which is reflected through attitudes, knowledge and behavior [12]. The problem of environmental care attitude that is reflected during classroom observation also has a relationship with cooperation skills. This is because the character of caring can affect cooperative skills [13]. Both of these abilities can be grown and enhanced in learning, especially about nature and phenomenons such as science learning. Science learning emphasizes environmental care by learning it. Also, Science Learning strongly emphasizes cooperation in achieving its goals [14].

Science learning is a systematic collection of theories, its application is generally limited to natural phenomena, born and developed through scientific methods such as observation and experimentation and according to scientific attitudes such as curiosity, openness, honesty and so on [15]. Science learning is a unit in studying natural phenomena. This unity is an integrated science, meaning learning science that links the material in various fields in an object. The benefits of this integrated science are the linkages of concepts with what students learn contained in each subject on some topics, enabling students to use their skills to learn the relationships between subjects, train students to make inter and inter-subject relationships, help students solve problems and think critically to develop through skills in real situations, improve students' memory by providing topics in a variety of situations and conditions, as well as ease of transfer of learning when the learning situation is close to real situations [16]. In learning science, the learning process and concept discovery are done by scientific methods, it is necessary to have cooperation in learning. Cooperation skills in science learning can be trained during group discussions in conducting experiments and practicum [17].

Science learning to improve cooperation skills and attitudes to care for the environment has been done a lot, such as cooperation skills on learning tools [18], [19] and also using learning media [20]. Environmental care attitudes have also been integrated into learning through learning tools [21]–[23] and also learning modules [24]. Along with the times, science learning should also be packaged in digital form because the use of technology in learning media helps improve the ability of cooperation [25] and environmental attitudes [26]. The development of Information and Communication Technology (ICT) in the 21st century in the field of education requires learning that adopts digital learning where learning is centered on technological innovation [27], [28]. However, studying in science is currently relatively not using IT effectively in schools [29]. One of the uses of technology in learning science is the use of module web.

The module web is an internet-based electronic module. The use of module web can be an option because it can be accessed anywhere while there is an internet network so that its reach is broad [30]. The Module web that has been studied can improve student learning outcomes [31]. When observing at SMAN 3 Mlati, Sleman, the use of the natural science module web can be applied because of the availability of the school's internet network but it unknown whether it can be used optimally.
Based on the results of observations and problems above, the integrated environmental science module web in the form of local plants is developed towards the cooperation skills and the students’ environmental care attitude.

2. Method
This study uses the method of research & development (R&D). The development model used is ADDIE but is limited to the development stage. The steps in this study are (1) Analyze, the analyze stage is the stage to determine the needs and information on product development following the characteristics of students, learning environment, materials and curriculum that applies; (2) Design, the design stage is carried out to produce product development guidelines and lattices of research instruments; (3) Development, the development stage is carried out to produce products in the form of a valid integrated natural science module web for local plants and research instruments. Product revision based on expert judgment, science teacher, peer reviewers and limited product trials. The development stage consists of several activities, namely: (a) initial product development, (b) development of research instruments, (c) initial product feasibility assessment and assessment instruments, (d) first product revision, (e) limited product trials and (f) advance product revision.

This research was conducted at SMP N 3 Mlati, Sleman District, Yogyakarta in the even semester 2019/2020. The sample in this study amounted to 16 students and the population was all students of class VIII odd semester. Students who are the subject of research will be given a product that is developed, then assess the product. The assessment instruments in this study were expert validation sheets, science teacher assessment sheets, peer assessment sheets and students’ readability sheets using a questionnaire with a Likert scale. The scale are from one until four with 15 items. Validation data were analyzed using descriptive analysis with steps:

(a) Calculating the average rating score using the equation:

\[ \bar{X} = \frac{\sum x}{n} \]  

Where \( \bar{X} \) = mean (average), \( \sum x \) = number of scores and \( n \) = amount of data;

(b) Finding the ideal mean \( \bar{X}_i \) and standard deviation (SBI) by:

\[ \bar{X}_i = \frac{1}{2} (\text{ideal maximum score} + \text{ideal minimum score}) \]  

\[ \text{SBI} = \frac{1}{6} (\text{ideal maximum score} - \text{ideal minimum score}) \]  

(c) Convert scores into values with the following criteria and compare them with the results of the assessment obtained.

| Respondents                  | Categories       |
|------------------------------|------------------|
| \( X > \bar{X}_i + 1.0 \text{SBI} \) | Very High |
| \( \bar{X}_i + 1.0 \text{SBI} > X > \bar{X}_i \) | High |
| \( \bar{X}_i > X \geq \bar{X}_i - 1.0 \text{SBI} \) | Low |
| \( X < \bar{X}_i - 1.0 \text{SBI} \) | Very Low |

3. Results
This research resulted in a final product in the form of an integrated natural science module web for local plants. Each stage of development provides results, which was:

3.1. Analyze
The analysis stage produces information data from students, teachers and school observations of product needs. From this analysis, it is known that the school where the research has used technology in learning, such as the use of LCD projectors and the internet but its use is still limited to displaying learning videos and PowerPoint slides. Learning using internet media is used to find learning material from several
sources in the form of internet articles and learning videos. The material taught is still dominated by the printed book and its contents have not been integrated specifically on local potential, but it is known also that the skills of cooperation and concern environment of the students still low.

3.2. Design
The design stage of guidelines for product development and grating research instruments. Development guidelines serve as a reference for product development and appraisal. Product development guidelines include development objectives, materials, specifications and eligibility criteria, storyboards and making an overview of the natural science module web.

Table 2. Storyboard of the natural science module web.

| No | Appearance (in Time New Roman) |
|----|--------------------------------|
| 1  | Web Main                      |
| 2  | Homepage                      |
| 3  | Competency Map                |
| 4  | Material                      |
| 5  | Competency Test               |
| 6  | Overview of Local Plants      |

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3.3. Development
The development stage of the products with module web and natural science instrument research in the form of expert validation sheets, assessment sheets of science teachers and peers, then analyzed and revised, after which a small-scale trial was conducted to determine the product readability of students using the student readability questionnaire sheet.

Figure 1. The web interface of the natural science module.
The results of the assessment of the validator, science teacher and peers and readability of the students are as follows.

Table 3. The results of the natural science module web assessment.

| No. | Appraisers              | Score | Category   |
|-----|-------------------------|-------|------------|
| 1.  | Expert Validator        | 3.6   | Very Good  |
| 2.  | Teacher                 | 3.5   | Very Good  |
| 3.  | Peer Reviewer 1         | 3.7   | Very Good  |
| 4.  | Peer Reviewer 2         | 3.7   | Very Good  |
| 5.  | Peer Reviewer 3         | 3.4   | Very Good  |
| 6.  | Students                | 3.7   | Very Good  |

4. Discussion

4.1. Analyze
The analysis stage aims to get information from students, teachers and the state of the school as a basic reference for product development. Information about students is done by using interview and observation techniques where the results indicate that students are on average 14-15 years old. At this age, students experience changes in the development of cognitive, affective and psychomotor aspects. In the cognitive aspect of the ability of students to think symbolically and be able to understand something meaningfully without any concrete objects, so at this time students already can be imaginative. In the affective aspect, students at this age can pay attention to a phenomenon of a complex nature which is an internal factor of the individual as a basis for responding, respecting values, organizing and applying. Whereas in the psychomotor aspect, students at this age tend to have stiff and slow movements in learning, this is because students are still in the learning stage to control their movements which not infrequently will also make them make mistakes. But this age is a good age to train and direct the psychomotor abilities of students [33]. With the ability at this age, learning using a module web is assumed to be able to be implemented by students according to their level of development.

Learning applied in schools, in general, has made use of available facilities, teachers skillfully use technology in learning such as utilizing projectors in learning to display powerpoints and tutorial video. Also, teachers use internet media in learning. Internet media are used to access learning related material, such as articles and learning videos. Learning like this has been fully supported by schools in the presence of wifi school and computer laboratories. This technology can support effectiveness in learning that is dominated by the use of printed books in the form of student books and teacher books. Thus, the ability of teachers and the facilities available in schools are feasible to be implemented in the science learning module web.

Learning material refers to the K-13 curriculum syllabus. Natural science learning material that is contained in the form of knowledge that is still general for use throughout Indonesia, there is no integration of the potential of the local area so that learning becomes more contextual such as the integration of local plants in additive material. Science learning integrated with local potential can be contained in textbooks, the technology used, or learning activities such as practicum. Under these circumstances, learning can be integrated with local plants that contain additives by displaying them in a natural science module web in the form of plant explanations, pictures and videos. Also, the practicum can be used by local plants such as turmeric to test the presence of preservatives in food.

4.2. Design
The design stage aims to produce guidelines for product development and grating instruments used in the study. Product development guidelines are made based on the needs and objectives to be achieved. This guideline contains; (1) the purpose of floating is to develop a module web of integrated science for
local plants on cooperation skills and students' environmental care attitudes; (2) learning material, namely additive material which is a subchapter of the subject matter of additives and addictive substances integrated with local plants; (3) product specifications and eligibility criteria are explanations of the things that characterize the developed natural science module web. The specifications are internet-based modules, containing learning images and videos, integrated local plants, modules focused on stimulating cooperation skills and attitudes to care for the environment. This specification is a reference for the appropriateness of the developed natural science module web; (4) storyboard is a series of descriptions describing the parts of the developed natural science module web; (5) general description of the natural science module web is a layout design of the natural science module web components such as the home page, material page, etc. In addition to product development guidelines, at this stage, a research instrument grid is also made. The research instrument grid is the basis for making the research instrument. Making this grid begins with reviewing theories about the variables studied and adjusted to the objectives to be achieved.

4.3. Development

The stage of development aiming to produce a module web natural science integrates local plants against the skills of cooperation and concern environment of the students and to produce a research instrument in the form of sheets of expert validation, assessment sheets science teacher, assessment sheets peers and sheets legibility students. To achieve this goal through the following stages: (1) initial product development, namely producing a product in the form of an integrated natural science module for local plants that have just been developed and has not been validated and assessed; (2) the development of research instruments that is to produce research instruments to assess the appropriateness of the use of a local plant-themed natural science module; (3) the assessment of the feasibility of the initial product is a step that involves an expert validator, natural science teacher and colleague as the product evaluator. Appraisers give a score on the assessment sheet and then analyze to determine the product feasibility score. From the results of this assessment, the average score of the expert validator was 3.6 in the excellent category, from the Science teacher with an average of 3.5 categorized as very good, an assessment of 3 peers with a mean of 3.7, 3.7 and 3.4 with a very good category; (4) first product revision is a revision after an assessment by experts, science teachers and peers. This revision took the form of suggestions, input and comments provided; (5) limited product trial is an activity to find out the level of readability of students on the use of the developed natural science module. This stage involves 16 students of class VIII. The average score of assessment of students is 3.7 with a very good category; (6) advance revision of the product is a revision based on an assessment of the level of legibility of the students. With these results, we get a web of integrated science modules on local plants towards cooperative skills and a caring attitude for students in a valid environment. The eligibility criteria for the assessment of experts, science teachers and peers as well as readability by students refer to the following table 4 which is made based on the formula contained in table 1.

| Table 4. Category Range | Rating |
|-------------------------|--------|
| Respondents Range Score | Categories |
| 3.0 - 4.0                | Very High |
| 2.5 - 2.9                | High    |
| 2.0 - 2.4                | Low     |
| 0.0 - 1.9                | Very Low |

Conclusion

The development of natural science module web products in the form of a valid natural science module web both from expert validators, science teacher, peers as well as from the readability of students. This science module web can be used in learning science grade 8th in additives and addictive sub-section. The advantages of the module web are the module can be utilized in learning and it can be used in various places with local potential so that contextual learning occurs.
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