

Development of Vertebrata Lecturing Program Based on Learning Object to Improving Students Develop Teaching Materials Skills Based on ICT

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Abstract: *This study aims to develop a lecture-based Vertebrata learning program aimed at improving students' ability to develop ICT-based teaching materials. This research was conducted in Education University in DKI Jakarta with 25 students chosen by purposive sampling technique. The research method used is Research and Development (R & D) method, with one group pretest-posttest design. The research procedure is divided into three stages: preliminary study, development, and testing. In the preliminary study it can be seen that the readiness of students as well as facilities and infrastructure have supported the implementation of learning object-based lectures. In addition, at this stage is also done program map planning and preparation of research instruments. Next is the development stage, at this stage is done program map development, story board design, and integration learning object in LMS Moodle. Program maps compiled at this stage are validated and revised until they are eligible for use. Then, the program map becomes the basis for the development of learning objects that are tested in a limited and uploaded to the sub domain www.moodle.hanasusanti.com. The last stage is the testing phase by implementing lecture-based learning object program in Vertebrata lectures conducted with e-learning system as much as 16 times meeting. During the implementation, the course is considered good by the students. None of the aspects of assessment of learning objects that are considered less and very less, most students assess the learning object developed has been in good category. Student activities observed during lectures based on learning objects include attendance, discussion, quizzes, and independent tasks. During this implementation it can be said that all activities are already in good category, this can be seen in attendance log, quiz score, discussion, and self-task. At this stage also, a preliminary assessment of the ability of students to develop ICT-based teaching materials. Qualitatively it can be seen that the teaching materials produced are not yet varied, because all students only use media power point. After the implementation is done re-testing of the ability of students to develop ICT-based teaching materials. At this stage, students have been able to develop various ICT-based teaching materials. The teaching materials developed include blogs (wordpress), websites (wix, webnode, UIN website, and other paid websites), as well as apps using android, macromedia, prezi, and power point inspiring. These materials also got a good average response Of the students and the good value of the evaluator.*

Keywords: learning object, vertebrate, mixed method, embedded concurrency, e-learning, teaching materials, ICT-based teaching materials

1. Introduction

In the world of education, ICT has become part of the radical change of modes of educational information delivery. ICTs can play a critical role in constructing knowledge by allowing to create, manage, and share knowledge. Data from the Directorate General of Higher Education (in Pannen, 2005) shows that awareness in the utilization of ICT in the learning process in universities is still very low. Analysis of teaching grant proposals, 29.69% new just use computer-based media technology. Availability of information technology-based media is also limited. Only 15.54% of state universities (PTN) and 16.09% of private universities (PTS) have the availability of information technology-based media, while about 16.65% of students and 14.59% of lecturers have access to information technology. The survey results on the use of IT in 2004 showed that only 17.01% state universities, 15.44% private universities, 9.65% of lecturers, and 16.17% of students who utilize ICT well. Overall this statistic shows that the adoption of ICT in the world of higher education in Indonesia is still low (Wahid, 2005).

Associated with the low utilization of ICT, SyarifHidayatullah Islamic University Jakarta as one of the state universities, do not want to be left behind in exploiting the development of ICT to support and improve the quality

of learning process, administration, and various other supporting activities. Infrastructure improvements, application development to support the teaching and learning process as well as for administration, as well as the development of local content are carried out continuously. This is because SyarifHidayatullah Islamic University Jakarta in its SWOT analysis stated that one of the weaknesses of the institute is the utilization of information and communication technology (ICT) for academic field that has not been optimal yet. This is due to the limited competence of ICT use among the academicians so that one of the policy priorities in 2015-2016 is to try to increase the use of ICT in learning, by improving lecturers' competence and learning by providing teaching skills for lecturers and Learning skills for students (UIN Jakarta, 2015).

One of the Faculty of Islamic University of SyarifHidayatullah Jakarta which is expected to be a leader in the utilization of ICT is the Faculty of *Tarbiyah* and Teacher Training (FITK). This faculty is one of the EDUCATION UNIVERSITY (Educational Personnel Institution) which is tasked to print prospective teacher so that inevitably have to prepare its student become creative teacher candidate, who can upgrade herself so that can make innovations in learning process (Wahid, 2005).

In addition, the phenomenon of ICT utilization in school learning increasingly resonates. Even in the current 2013 curriculum, ICT plays a very important role in the implementation of learning. In the 2013 curriculum it is explained that learning applies the principle of whoever is a teacher, who are students, and everywhere is a class. Therefore, the utilization of ICT is needed in order to improve the effectiveness and efficiency of learning. That is, do not rule out in the years to come, materials and tasks, transferred through ICT. The development of ICT in the world is very fast, from time to time. The development of ICT is certainly a huge potential to improve the quality of education because information technology stores information about all things unlimited. Thus, this can be utilized for the benefit of education development which is no longer limited by time and space. Obviously it will be a big challenge for teachers because it is required to understand, understand, operate, and explore ICT well so that it can be applied in learning. In addition, teachers should think more creative, innovative, and broad-minded so as to improve the quality of learning.

Nurhadi (1996) argues that efforts to improve the quality of teachers can be done by: (1) the teacher should not only master the field of study only, but also mastered science and technology insight in the field of study taught, (2) early on a (3) intensifying teacher interventions in order to encourage children to be aware and willing to go to school, (4) assisting children in reaching information sources that enable children to master science and technology, (5) giving teachers opportunities for further study, (6) improving teacher incentives, and (7) adjustment of education level according to the needs and progress of science and technology for teachers and prospective teachers.

In addition to the ability to use ICT in learning, Government Regulation no. 19 of 2005 article 20, suggests that teachers are expected to develop learning materials, which are then reinforced through the Regulation of the Minister of National Education no. 41 of 2007 on Process Standards, which among others is expected teachers can develop teaching materials as one source of learning. In addition, in the attachment of Permendiknas No. 16 of 2007 on Academic Qualification Standards and Teacher Competencies, also set about the various competencies that must be owned by the teacher, both of the core competence and subject competence. For example, for teachers in senior high school levels, in the guidance of pedagogic competence as well as professional competence, is closely related to the ability of teachers in developing learning resources and teaching materials. The development of diverse and interesting teaching materials will help the implementation of teaching and learning activities so as to produce meaningful both for teachers and for learners.

Teaching materials are a set of materials that are arranged systematically so as to create an environment/atmosphere that allows students to learn. An instructional material contains at least/contains instructional instructions, competencies to be achieved, learning materials, support information, exercises, work manuals such as Worksheet, evaluation, response or feedback/ Towards the evaluation results (Purwanto, 2001).

Development of teaching materials should be able to answer or solve problems or difficulty in learning. There are a number of learning materials that are often difficult to understand students or teachers difficult to explain. Such difficulties may occur because the material is abstract, complex, and unfamiliar. To overcome this difficulty, it is necessary to develop appropriate teaching materials. If the learning materials to be submitted are abstract, then the teaching materials should be able to help students describe something abstract, for example with the use of pictures, photos, charts, schemes, and others. Similarly, complex material, must be explained in a simple way, in accordance with the students' thinking level so that it becomes more easily understood.

In addressing the development and progress of ICT, teachers as professionals are required to be able to develop ICT-based teaching materials. ICT is one of the factors of change in the delivery of information, applications, and also knowledge management that occurs in the world of learning. Based on professional demand, every teacher must master ICT-based learning system especially in school. Currently teaching and learning activities are still dominated by the role of teachers (teacher oriented) and limited classroom. Meanwhile, the rapid development of knowledge has made the learning resources in the library insufficient to accommodate the intellectual training process of the students. In the era of global communication among institutions, experts, and learning resources that vary, interaction can be done anywhere, anytime, and by anyone.

Therefore, teachers' skills in using ICT as a learning resource and teacher's ability in developing ICT-based teaching materials should be trained and developed since teachers are still in the education period at education university. One way is to introduce them to multi-access, multi-source learning that not only utilizes conventional but also ICT-based learning resources. It is the responsibility of the education university to provide education to prospective teachers in order to receive ICT and able to use ICT in the learning process.

The development of the most up-to-date courses is to use e-learning, which is one of the learning models using communication and information technology media, especially internet. E-learning is a popular term in internet-based learning and intranet learning. This e-learning technology is a technology that is bridged by internet technology, requires a medium to be able to display special materials and questions that require communication facilities to be able to exchange information between participants and teachers (Purbo, 2002).

The definition adapted from Wisconsin Online Resource Center, Wiley (2000) states that learning objects have several characteristics, including: (1) learning object is a new way of thinking about the content of learning. Usually the learning content consists of parts that take hours, but the learning object is a smaller part of learning, usually in the range of two to fifteen minutes; (2) learning object is free. Each learning object can be used freely for different purposes; (3) can be grouped. Each learning object can be grouped into larger content sections, including traditional

learning structures; (4) may be tagged (tagged) with metadata; Each learning object has descriptive information that makes it easier when it is searched again.

The potential of information technology is very interesting to try and be utilized in lectures. One study program that tries to develop this learning object is Biology Education Study Program UIN SyarifHidayatullah Jakarta. The results of several years of observation in this course of study in some subjects such as: Vertebrate Zoology, Zoology Invertebrate, Animal Physiology, and Physiology Development is a difficult course for students to understand. The difficulties of these students can be seen from the results of student exams are generally always lower than other courses (Anonymous, 2015). The same is true in the Department of Biology Education, Faculty of Mathematics and Natural Sciences Education UPI, where the courses of systematic and diversity groups such as Invertebrate Zoology, Vertebrate Zoology, *Cryptogamae* Botany and *Phanerogamiae* Botany are difficult subjects for students to master (Anonymous, 2010). In addition, at the University of Syiah Kuala Banda Aceh also happens the same thing, the course of Vertebrate Zoology also has less than optimal learning results. This can be seen from the data of the study result of the students of Biology Education Study Program in the academic year 2010/2011 with the minimum passing limit of C, from 35 students who get A 10%, B 35%, C 48% and D 7% (Akmal, 2015). Nur (2013) also reported that Vertebrate Zoology in University of Muhammadiyah Malang is difficult subject for students, it can be seen from the end result of this subject which tend to less satisfactory. Few students get A and B grades. The average student earns a C grade, even with low qualifications.

Generally, this problem is caused by (1) the use of learning model which is dominated by lecture and less precise discussion, thus causing boredom to the students, (2) teaching materials used not yet as needed, and (3) the carrying capacity of creativity development related to the development of science and Inadequate technology (Ulfah, 2013 in Widowati and Pratiwi, 2015). In addition, this difficulty is caused also because of the wide scope of the material, which is the history, morphology and anatomy, structure and function as well as the ecology of vertebrate animals. Some of the material is obviously can be sensed directly by students, but some other material is abstract and cannot be observed directly by students.

Especially in the Biology Education Study Program of UIN SyarifHidayatullah Jakarta, the low achievement of students in the lecture is caused by inadequate facilities and lessons, such as the number of local for lectures available today is considered less, because only 5 classes, which is also used for lectures by Two other courses. Laboratories that currently only amount to two spaces cause the use of space is very high, so the lab does not run optimally.

Therefore, it is necessary to test the lecture system that can minimize the use of lecture space (e-learning), utilize the latest information technology (multimedia), accessible by students anytime and anywhere, and can train students using various learning resources available Online on the internet.

Starting from the above thinking, the authors are interested in conducting research entitled "Development of Learning Object-Based Vertebrata Program to Improve Student's Ability in Developing ICT-Based Vertebrate Instruction Materials".

In this study, developed object learning is part of an integrated lecture program between Vertebrata and e-learning that has controlled learning stages, using interactive multimedia such as audio, video, and other applications that have standards from SCORM. Learning object is developed for use in Vertebrata lectures, which is a lecture with a load of 3 credits consisting of 2 credits face to face in the classroom and 1 credits laboratory in the laboratory. Learning object developed is used in face-to-face in the classroom, whereas for practicum Vertebrata is done in the laboratory after the lecture. Furthermore, this Learning object is integrated using Learning Management System (LMS) Modular Object Oriented Dynamic Learning Environment (Moodle) to create and manage links between learning objects.

2. Method

This research uses research and development (R & D) research method. The development research steps used refer to the steps developed by Borg and Gall (1989). This research is also included in quasi experiment research because it uses only one class only as research subject. The design used is adjusted using the design of one group pretest and posttest design. More clearly the design of the study is presented in the following table:

In addition to the ability to use ICT in learning, Government Regulation no. 19 of 2005 article 20, hinted that:

Table 1: Research Design of One Group Pretest Posttest Design

Pretest	Treatment	Posttest
O ₁	X	O ₂

O1: Initial test (pretest) before treatment is given

O2: The final test (posttest) after the treatment is given

X: The treatment of experimental group is by applying Vertebrata learning program based on Learning Object.

The procedure in this study used three stages according to Borg and Gall (1989), namely preliminary study, development, and testing. This research was conducted in the academic year 2015/2016 at education university in Jakarta, which has Biology Education program. Students who are the subject of research are all students of Biology Education Study Program, which take the courses of Vertebrata. Sampling is done gradually. The first stage is done by purposive sampling, by giving a questionnaire to all students who take Vertebrata course. Questionnaire is aimed to select students who meet the requirements to follow the learning object-based lectures with e learning system. The second stage is done randomly, to select the students who used the research sample. The number of samples taken as many as 25 students.

Instrument in this research consists of various forms of questionnaire, sheet observation, assessment sheet and

validation sheet. Techniques in collecting data using the instrument research conducted by observation, filling in questionnaires, interviews, and documentation. The collected data is then analyzed to obtain meaningful results. The data in this study consists of two major parts of the data development process and the feasibility of lecture courses and various responses related to implementation. The data of the development process is analyzed by describing and interpreting the data qualitatively. While the feasibility of lecture program data as well as various responses related to implementation. Analyzed by first converting qualitative data into quantitative data using score processing guidelines as presented in the following table:

Table 2: Scoring Assessment Guidelines

Data Qualitative	Score
SB (very good)	5
B (good)	4
C (enough)	3
K (less)	2
SK (very less)	1

The data that has been collected is then calculated by using the following formula:

$$\bar{X} = \frac{\sum X}{N}$$

Keterangan: $\bar{X}$ = skor rata-rata
 $\sum X$ = jumlah skor
 N = jumlah penilai

Next is to change the average score to a qualitative value with the following criteria of assessment:

Table 3: Total Assessment Criteria

Rumus	Rerata Skor	Klasifikasi
$X > \bar{X}_i + 1,8 \times sb_i$	$>4,2$	Sangat Baik
$\bar{X}_i + 0,6 \times sb_i < X \leq \bar{X}_i + 1,8 \times sb_i$	$>3,4 - 4,2$	Baik
$\bar{X}_i - 0,6 \times sb_i < X \leq \bar{X}_i + 0,6 \times sb_i$	$>2,6 - 3,4$	Cukup
$\bar{X}_i - 1,8 \times sb_i < X \leq \bar{X}_i - 0,6 \times sb_i$	$>1,8 - 2,6$	Kurang
$X \leq \bar{X}_i - 1,8 \times sb_i$	$\leq 1,8$	Sangat Kurang

3. Results and Discussion

3.1. Introduction Study (Analysis)

1. Readiness Analysis of Lecturing Vertebrate Learning Object.

a. Analysis of Readiness of Facilities and Infrastructure
 Lectures by using learning object cannot be separated from the readiness of facilities and infrastructure in support of the ongoing lectures. In this case, the readiness of facilities and infrastructure refers more to the availability of facilities and infrastructure within the Faculty of *Tarbiyah* and Teacher Training (FITK), UIN SyarifHidayatullah Jakarta. This is because, in general Vertebrata lectures based on learning objects done in FITK environment. In general, based on observations it can be seen that FITK environment is ready to implement and facilitate lectures by using learning object. This is evident from the availability of an adequate internet network, the availability of various applications supporting lectures, the availability of hardware such as computers, and buildings that already have a special room for the computer

lab. In addition, in every room and public facilities FITK also been equipped with Wi-Fi.

b. Analysis of Student Readiness Following Vertebrata Learning Based Learning

1) Analysis of Hardware and Software Availability

After analyzing the readiness of facilities and infrastructure in the Faculty of *Tarbiyah* and Teacher Training (FITK) UIN Syarif Hidayatullah Jakarta, further analysis of readiness of students to follow Vertebrata learning object-based learning.

The first analysis is an analysis of the availability of hardware and software owned by students. Availability of hardware and Internet network, shown in Table 4 and Table 5.

Table 4: Ownership of Student's Hardware

No	Hardware	Percentage of Ownership
1	Personal Computer (PC)	24%
2	Laptop/Notebook	96%
3	Smartphone	96%
4	Lainnya	24%

Based on the data in Table 4, it shows that 24% of students have personal computers, 96% have laptops / notebooks, 96% have smartphones, and have tablets. Thus, all students already have the hardware needed to follow the lectures. The distribution of student hardware ownership is in the high category. The findings of Wahyono and Pujirianto (2010) indicate a relatively significant relationship between students who have the mobility of finding sources with productive use of ICTs where ICTs tend to be used to seek academic-based information. Meanwhile, students who do not have ICT support facilities such as personal computers or connectivity and accessibility to low internet networks tend to emphasize recreative aspects and relatively low mobility in searching for information sources.

Table 5 Types of Internet Networks Students use

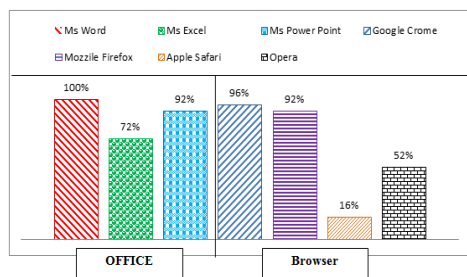
No	Internet Networks	Percentage
1	Personal Wi-Fi	56%
2	Campus Wi-Fi	52%
3	Rent Wi-Fi	16%
4	Others (Modem, PaketKuota, Provider)	60%

Based on the data in Table 5, all students already have internet network access. The internet network used by students mostly uses a private internet network (56%), campus Wi-Fi (52%), modem packages, quotas, and providers, etc. (60%), and only a fraction (16%) hire at Internet cafes.

Based on these results seen that in general they are accustomed to utilize the Internet (100%), although with a variety of different ways. This habit can be one of the factors that motivate them to seek more information. This is in accordance with the opinion of Affeid and Munif, 2001 in (Hasbullah, 2006) states that by utilizing the internet students will be easily motivated and will soon adjust. Moreover, with the access of information technology by learners is seen to improve the effectiveness and efficiency of learning.

2) Analysis of Student Ability in Using Basic Computer Applications

The availability of hardware and software support will not be meaningless without the ability of students in using it. Therefore, next conducted a search about the basic applications of office and browser controlled by students. The results of this search can be seen in Figure 1



Gambar 1 Diagram Kemampuan Mahasiswa Menggunakan Aplikasi Dasar Office dan Browser

Based on the results of research in Figure 1, it appears that students have mastered the basic applications needed. In basic office applications, students' ability to use it is almost evenly distributed across the three basic types of applications, while in basic browser applications, students' ability is more on the use of Google Chrome and Mozilla Firefox. The next trace is searching for students' ability to use social media. The results are illustrated in Figure 2.

Based on the results of the research in Figure 2, it is seen that almost all students have the ability to access social media. The search results related to the availability of facilities and infrastructure, the ability of students to use basic applications and social media support the ability of students to receive and follow the Vertebrata program based on Learning Object.

Another thing that became the findings in this study is about the ability of students in using basic computer applications. This basic application consists of basic office applications, browsers, and social media. The ability of students to use basic office applications in word processing (Microsoftword) shows 100% results. This result explains that all students are able to run basic Microsoft office word applications. While 71.43% and 93.88% have been able to use Microsoft office excel and Microsoft power point. Furthermore, the ability of students in using basic applications browser and social media is good. Browser application is highly controlled by students in the form of google chrome with percentage above 90%. While above 80% of students have been able to use social media.



Figure 2: Student Ability Diagram Using Social Media

The results of this study indicate that all students already have a general knowledge about computer, application software and social media. Pannen (2005), states that the development of ICT has enabled the interaction between lecturers and students to take place easily and relatively quickly through electronic media such as email, video conferencing, blogs and chat applications. The research results are also in line with Purwo's opinion (in Hardjito 2002), which states that among the Internet verbs there are five standard applications that can be used for education purposes, namely email, mailing list, News Group, FTP, and Web (www). This is in line with the case of Soekartawi's research (2003), that through e-learning students it is possible to keep learning even if not physically present in the classroom. Lecture activities occur through student interaction and learning resources that are available and accessed from the internet.

2. Program Map Creation

Before the making of Vertebrata learning program based on learning object, firstly done map making program Making a map of this program is intended to be a guide in developing learning tools based on learning object consisting of hosting and domain, software LMS, tools maker object learning, and preparation of the instrument about the readiness of students follow the lectures Vertebrata based learning object with e-learning system.

At this stage made the map program to facilitate the preparation of learning object. As mentioned earlier, the programmap is tailored to the Vertebrate lecture syllabus consisting of six materials: chordate, Pisces, amphibians, reptiles and mammals. Program map of each material, generally embodied in several sub subjects and learning point. The sub-subject and the learning point in the program map consist of origins / history, characteristics, classification, morphology and anatomy, physiology, way of life, adaptation, benefits and roles, as well as independent tasks.

3.2. Development Stage (Design and Development)

1. Display of Learning-Based Vertebrata Program Learning Program.

Learning object-based lecture program is a digital instructional material used in lectures. The advantage of digital learning object is its ease to be edited, produced, and delivered through telecommunication media. Therefore, the concept of usability (the expression of a teaching object in the context of learning topics or other fields) can be introduced as one of the important characteristics of a learning object. This program has several features that are assignment, chat, choices, forums, quizzes, and scrom /AICC packages. Below are some examples of Vertebrata learning programs based on Object learning.



Figure 3: Initial View of Course Program



Figure 4: Course Program Lecture Display



Figure 5: Display Introduction of Material



Figure 6: Course Program Lecture Display

2. Validate Eligibility Learning Object

Learning object that has been developed further validated its feasibility by the expert. The purpose of this validation is to determine whether the learning object that has been developed can be used and feasible applied in Vertebrata lectures. Based on the results of expert validation, the learning object that has been prepared is feasible to use. However, there are some improvements made before, especially the adjustment of learning objects with the age of the students. It is intended that the learning object in accordance with the stage of development of student psychology. In addition, visualization should be done with the learning point between the use of images, text, animation, and video for each learning point.

3. Limited Trial of Learning Object Use in Vertebrate Lectures

In addition to the assessment by experts, the resulting learning object was tested to 10 students from the Faculty of Science and Technology. After completion of the trial, students are asked to provide suggestions on Vertebrate learning objects. The data obtained indicate that the content of the lecture is in accordance with the Competency Standards, and Basic Competence. The views of learning objects are considered too simple and less appealing to students, as well as online tasks and learning interactions.

The data collected at this stage indicates that there are still many things that need to be improved, especially on the look, the scoring system, the presentation of the material, and the ease of accessing the learning object. These results are then used as the basis for the improvement and refinement of learning object so that it can be used in the actual lectures.

3.3. Stage of Testing (Implementation)

1. Student Activities During Vertebrata Learning Implementation Learning Object

In this research, the implementation is intended as the implementation of e-learning lecture system based on learning object in the lecture. In the Law of Teachers and Lecturers No. 14 of 2005, there are four competencies that must be achieved are pedagogic, professional, personality, and social competence. Teachers and lecturers in this professional competence are required to apply varied learning methods and use various relevant tools, media, and sources. During this lecture implementation, observation based on student attendance indicator, student activeness in discussion, question, response, and response. In addition, also observed the ability of students to answer questions in the form of quizzes and make independent tasks. Here is a description of the Vertebrate learning-based learning object.

a. Time and Number of Meetings

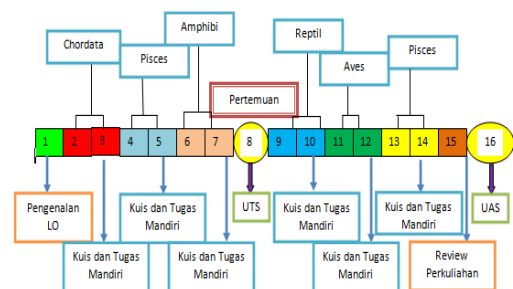


Figure 7: Number of Lecture Meetings and Activities

Vertebrate learning based on learning object is done by mixed method between synchronous and asynchronous system. According to Rosenberg (2001) there are two types of delivery in e-learning, namely synchronous and asynchronous. Synchronous delivery is the mode of lecture delivery where the meeting time is determined by lecturers and students. While the asynchronous delivery is where students use the materials provided through the website for use at any time so that students can access the teaching materials as needed.

Synchronous online lectures are conducted every Monday at 09.20-11.00 WIB. This is intended to keep interaction between students and lecturers, especially for discussions about lecture materials that are still unclear or unintelligible. Asynchronous lectures online can be done anytime and anywhere. This means that students can access this learning object in accordance with the needs of each.

As previously described in the Vertebrate lecture syllabus, the Vertebrate lectures are held for sixteen meetings. The meetings include introduction, submission of materials, and examinations, be it a midterm exam (UTS) or final semester exam. Introduction in this case is an introduction to the students about learning object that will be used in Vertebrata lectures. In addition to the introduction, at this initial meeting also provided a short training to students to operate the learning object. This brief training is intended to prevent the technical constraints that may arise in Vertebrate lectures can be minimized. The training was conducted in a computer laboratory within the Faculty of *Tarbiyah* and Teacher Training (FITK), UIN SyarifHidayatullah Jakarta. In this case, faculty and student lecturers are conducting lecture trials under the guidance of a learning object development team.

B. Lecture Presence

The attendance of students in this lecture is the attendance recorded on logs in LMS Moodle every Monday at 09.20-11.00 WIB. The presence of these students can be seen in Figure 8.

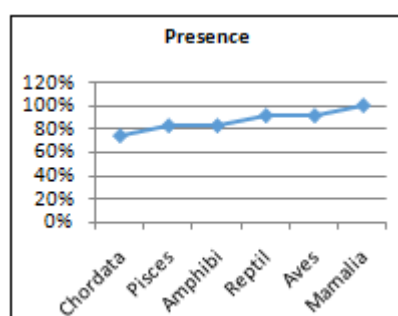


Figure 8: Graph of Student Presentation in Lectures

Based on the observation of attendance presented in the picture above, it can be seen that the attendance of students in the lecture continues to increase at every meeting. The lowest percentage of student attendance was found in the Chordata concept of 75% and the highest in mammalian concept with 100% percentage. As for the concept of Pisces and Amphibian respectively 83.30%, and the concept of Reptile and Aves, the percentage of student attendance that is equal to 91.60%.

As it is known that the problems that often arise with lectures outside the classroom is the difficulty of controlling student activities. Activities such as attendance and learning activities of students in lectures during this time is still difficult to be controlled and observed with lectures without face-to-face. However, this can be overcome by using this learning object. Learning object with Moodle can overcome this. The system in Moodle allows the lecturer to examine student attendance easily. The time, activity, and attendance of students in the online classroom can be viewed and

examined easily. Thus, learning-based lectures are tantamount to face-to-face lectures. The thing that distinguishes it is the unlimited time and space in the lectures online with learning object.

During the lecture it is seen that the average attendance of students reaches a percentage above 80% and increases over time. This is because the lectures by using this system, providing breadth to students to follow the lecture without having to be bound by space and time. These results are in line with Zain, et al. (2015) who argue that thanks to the development of the second millennium information technology, the conventional learning process that has been limited by time and space undergoes an innovation process. The learning process is no longer fixed on conventional models that can only be held in the same space and time, but can be carried out in different spaces and at different times. In addition to the attendance, the activities carried out at the implementation stage are discussing the discussion forums used, answering the quiz given at the end of each course and performing the task independently. For the three activities the average student has done well and very well.

2. Student Assessment of Vertebrata Learning Program Based on Learning Object.

In this Vertebrate lecture, students are given the opportunity to assess the learning object used. Aspects of assessment consist of material aspects, aspects of media design, and aspects of technical quality. In general, students' assessment of Vertebrata learning program based on learning object is categorized as very good and good. None of the students stated that the Vertebrata learning program based on learning object is in the category of less or very less. A more complete student assessment is presented in the following graph.

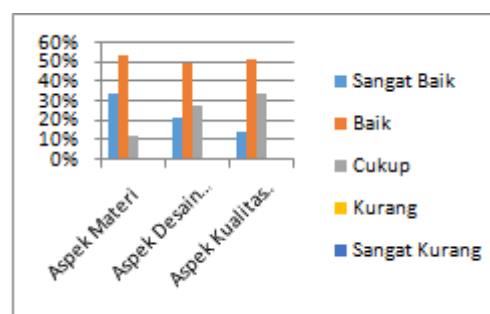


Figure 9: Graph of Student Assessment Against Vertebrata Program

3. Student Response to Vertebrata Learning-Based Learning Object

Student response or response to lectures, became one of the aspects identified in this study. This response / response screening is done after the series of learning object-based Vertebrata learning is done. This is intended to find out how the response / response of students to Vertebrata lectures by using learning object. These responses include student opinions on components, novelty, ease, and satisfaction with learning object components. It also captured responses on student responses to lecturers and interest in using learning objects in other subjects. In general, students claim that Vertebrate lectures fall into very good and good categories. This indicates that lectures by utilizing the learning object is acceptable and run by the students.

4. Students' Ability to Develop ICT-Based Teaching Materials

Students who follow lectures based on learning objects are obliged to make appropriate teaching materials for high school students. Teaching materials that have been prepared by students are described in accordance with the form, function, and the material. The results of the development of teaching materials developed by the students before the lectures are described in the diagram below.

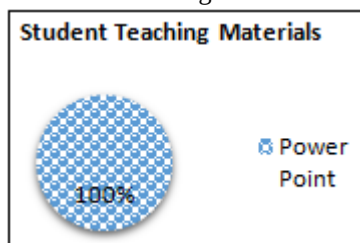
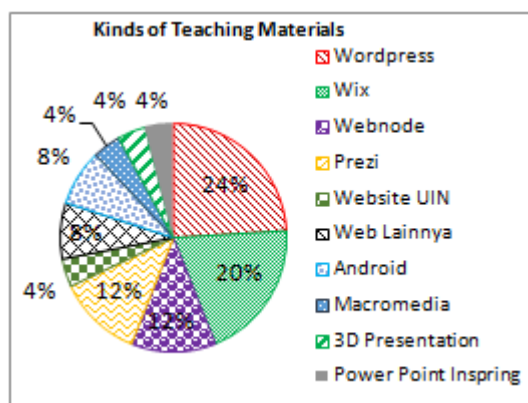


Figure 10: Teaching Materials Students Develop Before Lecture

After the lecture is finished, the students are asked to return to develop the teaching materials with the same material. The results of the development can be seen in Figure 10. From Figure.10 it appears that > 20% of students use Wordpress and Wix, 12% of students use Webnode and Prezi, while less than 10% use Web UIN, Other Web, Android, Macromedia, 3D Presentation, And Power Point Inspiring.



5. Student Response to Teaching Materials developed by Student

Teaching materials that have been produced by students are tested to students from three high schools / madrasah aliyah, with the aim to see students' responses to teaching materials developed by students. Each teaching material is assessed by three students from different schools.

Student responses to ICT-based teaching materials developed by students seem to be that none of them judge less. In general they rate quite good and good. When viewed from the average, the greatest value (3.21) appears for the 3D Presentation material. As it is known that one of the tasks of educators is to provide a pleasant learning atmosphere. Educators need to find ways to make learning fun and put aside threats during the learning process. One way to make learning fun is to use fun teaching materials as well, that is teaching materials that can make learners feel interested and happy to learn the teaching materials.

Vertebrata lectures based on learning objects in this study have the ultimate goal to get information about the ability of students to develop teaching materials.

However, different results are obtained after the application of Vertebrata learning based learning object. Based on the observations, the form of teaching materials of students evolved from the subject matter of view to the interactive teaching materials. All students combine some of the media in developed materials. Starting from text, images, graphics, animation, audio, and video combined in a teaching material. This is in accordance with the opinion of Prastowo (2013) which states that interactive material is a combination of two or more media (audio, text, graphics, images, animation, and video) that the user is manipulated or treated to control a command or natural behavior of the presentation. The result of development of teaching materials by students after Vertebrata learning object-based learning, as a whole has entered into interactive materials. This is because the teaching materials developed allow students to interact directly or indirectly with students using the developed materials. This interaction is possible with the chat facilities for teaching materials that can be accessed online.

Quantitatively the results of the assessment of teaching materials developed by students before the lecture get an average result of 54.74. While after the lecture, the average result of the evaluation of the materials by the evaluator got the result of 83. The highest score of the teaching materials developed before the lecture is 73.37 and the lowest is 35.71. After Vertebrata lectures learning object done, the highest score obtained by students is 94, with the lowest value of 77. Students who get the highest score in accordance with the evaluation of the evaluator is a resource that utilizes web node. While the lowest results obtained by teaching materials Prezi.

Assessment of teaching materials by evaluators includes some of the things that are used as a reference in the assessment that is: the feasibility of content, language, presentation, media tools, and media usage. Based on the results of the assessment, the highest-value teaching materials developed before the lecture covering 77% of all assessed aspects. Meanwhile, after the lectures, the achievement of all aspects of the assessment is 94%. Thus, it can be seen that the evaluator's assessment is better on student teaching materials developed after the lectures.

4. Conclusions and Recommendations

4.1. Conclusion

Based on the results of research that has been implemented, it can be concluded that the Learning Object Vertebrata Program can improve students' ability in developing ICT-based teaching materials. It can also be concluded several things as follows:

- 1) The readiness of students to follow vertebrata lectures based on learning object is good which is reflected from the students' ability to use computer application, application software, and social media. In addition, the

readiness of facilities and infrastructure within the Faculty of *Tarbiyah* and Teacher Training (FITK) UIN SyarifHidayatullah Jakarta, is ready to support ICT-based lectures.

- 2) Learning object developed can be viewed at www.moodle.hanasusanti.com; The results of this development have been declared eligible for use in Vertebrate lectures based on expert validation results and limited trials by students.
- 3) Implementation of learning-based Vertebrata lectures, as a whole goes well. Discussion forums with liveliness values above 75%, independent tasks with 78 values, and a quiz with an average rating of 91. This indicates that discussion forums, independent assignments, and quizzes in the Moodle learning object program work well.
- 4) Student response to learning object developed from material aspect, media design, implementation, and technical quality is good. Likewise, the lecture component that includes teaching materials, LO display, online tasks, college atmosphere, lecturers' way of teaching, and discussion forums have been well expressed by the students.
- 5) After studying Vertebrata based on learning object, students are able to develop interesting and interactive teaching materials by utilizing Information and Communication Technology (ICT) which consists of WordPress, Wix, Web node, Prezi, Website, Android, Macromedia, 3D Presentation and Power Point Inspiring.
- 6) Students 'responses to teaching materials of students' development outcomes are generally stated to fit into the category quite well.

4.2. Recommendations

Based on the conclusion of the research, the authors recommend the form of suggestions as follows:

- 1) Learning-based learning object, can be tested on other subjects and at different universities with due attention to the readiness and ability of students follow the lecture.
- 2) Implementation of learning-based learning object, conducted by different methods such as synchronous and asynchronous only.
- 3) Teaching materials produced by students after this lecture, can be used as a further research material related to its exposure in Biology subjects in SMA / MA.

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