The Effect of Using Evolution Textbook Based on ICT and Metacognitive on Cognitive Competence of Biology Students at State University of Padang

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Abstract. Implementation of evolution lectures at Biology Department Faculty of Mathematics and Natural Sciences State University of Padang has been considered not optimal. The reasons are the limited availability of textbooks and students' learning attitudes. Because currently the students are very familiar with the internet and even has become a necessity, it has developed textbooks of evolution based on ICT and metacognitive. Selection of ICT based is in order to optimize the utilization of multimedia, and this is very compatible with the development of learning technology. While metacognitive based is in order to train students' learning attitudes to be able to think analysis, creative and evaluative. The aim of this study is to determine the effect of the use of evolution textbooks based on ICT and metacognitive to the cognitive competence of students of Biology Department State University of Padang. The data of this research is students' cognitive competence obtained from the implementation of effectiveness test of evolution textbook in the form of student learning outcomes. The research instrument is a learning result test designed to determine students' cognitive competence. The subject of the study is a group of students in evolution course consisting of 33 students. Lectures are conducted through face-to-face and online lectures on Edmodo's platform. The result of data analysis shows that there is an increase of cognitive competence of biology students after learning using ICT and metacognitive based evolution textbook, where average achievement is 77.72 with Percentage of achievement of criteria mastery is 81.25%. Therefore, it can be concluded that the evolution textbook based on ICT and metacognitive is effective in improving cognitive competence of students of Biology Department, Universitas Negeri Padang.

1. Introduction

The nature of education, including higher education, is basically shaping and developing the patterns and ways of thinking of learners so that they can develop their potential to respond and solve problems in daily life later. The development of patterns and ways of thinking are trained intensively through the interaction between learners in the learning process. Students must build knowledge independently. For that, the source of learning, one of the teaching materials should be available and accessible to students easily and quickly. The teaching materials can be said to be good if it has the right content, interesting to use and easy to understand. Teaching materials are materials or lesson materials systematically arranged, used by teachers and students in the learning process [1]. The
teaching materials are part of the learning resource. Teaching materials are a set of subject matter that is organized systematically both written and unwritten so as to create an environment/atmosphere that allows students to learn.

The teaching materials are prepared with the objective to provide materials suitable to the needs of the learner, that is in accordance with the characteristics and setting or social environment of the students, assist the learner in obtaining alternative teaching materials in addition to textbooks that are sometimes difficult to obtain, facilitate the teacher or lecturer in implement learning. Teaching materials serve as: (1) Guidelines for teachers who will direct all activities in the learning process, (2) Guidelines for students or students who will direct all activities in the learning process, (3) Evaluation tool of learning achievement result.

Textbook is one form of printed materials. Benefits that can be obtained by a teacher or lecturer if developing his own textbook, namely (1) obtained teaching materials in accordance with student learning needs, (2) students are not dependent on textbooks that are sometimes difficult to obtain, (3) teaching materials become richer because they are developed using various references (4) increase the knowledge and experience of teachers or lecturers in writing teaching materials, (5) teaching materials will be able to build effective learning communication between teachers/lecturers with students because students will feel more confident to his teacher or lecturer. According to Depdiknas [2], books can be used as reference material, or can be used as a quality written material.

There are three principles that are needed in the development of textbooks. These three principles are relevance, consistency, and adequacy. The principle of relevance means that instructional materials should be relevant to the achievement of competency standards and basic competencies. If the expected ability is memorized facts, then the material presented is fact. If basic competence requires the ability to do something, the subject matter is the procedure or the way to do something. The principle of consistency is grammatical in the development of teaching materials. For example, if basic competence requires students’ ability to master three kinds of concepts, the material presented is also three kinds. For example, the ability expected to be mastered by the students is to construct a deductive paragraph, the material at least the meaning of deductive paragraph, how to construct a deductive paragraph, and how to revise the deductive paragraph. That is, what is being asked is what is given. Principle of adequacy, meaning that the material presented should be sufficient to achieve basic competence. The material should not be too small and should not be too much. If the material is too small, it is likely that students will not be able to achieve basic competencies by utilizing the material. If the material is too much will also take a lot of time to learn it.

Teaching materials for evolution course in Biology Department Faculty of Mathematics and Natural Sciences Universitas Negeri Padang are available. However, the implementation of evolution lectures has not been felt optimally. The author finds three conditions that become the main cause, the pattern of lecturing, limited textbooks, and attitudes of students. Prior to 2009, evolution lectures were dominated by the use of lecture methods and reading assignments. As a result, students become less creative and few are involved in understanding the concept. Starting in 2009, the authors have improved the implementation of learning in accordance with the paradigm of active learning, which involves more students through assignments, presentations, and class discussions. However, the authors still see this lecture not yet optimal because the available teaching materials have many limitations. The type of teaching materials available and used as the main teaching material so far in evolution lectures is the handout. This evolutionary teaching material (handout) has a language that is less straightforward. Some students find it difficult to find the meaning of sentences per sentence nature of the teaching materials used. In the exam, the student is only able to rewrite the contents of sentence as stated in hand out. As a result, students' thinking ability only develops at the level of recall (C1), which is the lowest level of thinking ability according to Bloom's Taxonomy.

The next weakness of this handout is the way of displaying monotonous material and incomplete material coverage. Based on interviews with several students, it was revealed that the handout structure did not interest students to read it because it was just a description of the material in the paragraphs, without any colored drawings/schemes/charts that facilitate the understanding of the
material. Handout also does not have a full description of the material in accordance with the course syllabus that led. The topics described in the handout are only 5, while the topics demanded in the syllabus are 14.

The reading material in print or electronic media is actually available enough to be used by students, both written in Indonesian and English. However, the student's initiative to actively select and use various sources of learning is still low (the results of interviews with students). The reasons put forward are that the material on these available books is not very much in line with the syllabus. In addition, the material that can be found in the translation book is difficult to understand and confuses the students.

Other learning resources that are widely accessed by students are internet media, especially blogs/web that are accessible through Google search engine. Based on writer's search for a number of Indonesian blogs, the description of evolutionary material tends to be subjective and refers to the opinion of certain groups of scientists. As a result, students sometimes get caught up in the subjectivity of the opinion and find it difficult to understand the material in accordance with the objectivity of science.

This evolution handout has been used for more than 10 years. However, there has not been a good revision of the content, structure and display components. Handouts still use general and specific instructional terms. This indicates that hand out design does not support the achievement of competence, because instructional objectives describe the achievement of learning outcomes in the cognitive domain, while the competence emphasizes the achievement of learning outcomes in the cognitive, affective and psychomotor aspects. In response to the above issues, the authors have developed textbooks based on information and communication technologies (ICT) and metacognitive competence for evolution courses in Biology Department State University of Padang. ICT-based textbooks intended are teaching materials that are also used with edmodo networks.

Edmodo is a social network-based learning platform intended for teachers, students and parents. Edmodo was first developed at the end of 2008 by Nic Borg and Jeff O'hara and Edmodo itself is practically an e-learning program that implements an easy, efficient and more enjoyable learning system. With edmodo allows teachers to share content, distribute quizzes, assignments, and manage communication with students, colleagues, and parents [3].

ICT-based election is a manifestation of the demand of the 2013 curriculum, especially on the optimization of multimedia usage, and is consistent with the development of learning technology. In addition, ICT also allows textbooks to connect with several electronic learning sources such as video or process animations. ICT-based textbooks can also make it easier for students to access materials outside the lecture schedule. Development of ICT-based textbook is very compatible with e-learning courses that have been implemented in the course of evolution, but not optimal in terms of providing appropriate teaching materials. Evolutionary textbooks based on information and communication technologies (ICT) and metacognitive competencies developed have been tested for validity, and validated by validators with a validity value of 87.60. But the effectiveness of this textbook has not been tested, therefore it is necessary to conduct research to test its effectiveness. The purpose of carrying out this effectiveness test is to measure the extent to which textbooks that have been produced can improve student learning outcomes.

The development of information technology is a reason that requires the need for adjustment of learning patterns that are more flexible from face to face to learning in cyberspace. Currently many universities are responding to these trends by offering courses that can penetrate the distance or distance learning. Recent widespread availability of educational resources on the World Wide Web holds great potential for transforming education. In science education, for example, students can access real-time images from space exploration (Anonomous)[4]. Online learning resources is one component that helps the implementation of online lectures. Universities are very potential in providing online teaching materials as they consist of logical personnel who are trusted to develop content and design, although not necessarily involved in technical matters. ICT-based teaching book is a media that supports ICT-based lectures.
Since 2012, at Padang State University all lectures have been implemented through e-learning facilities that are managed directly by each lecturer. With this facility, students are expected to more easily obtain information quickly and efficiently. The source of information is no longer focused solely on the text of the book alone, but broader than that. The ability of multimedia technology that has been connected the internet increasingly adds ease in getting the information expected.

Evolution is a theoretically explicit course and an applicative example using ICT-based learning media. The main character of this course is to have a very high relevance to the various fields of science both within and outside the scope of biology, such as genetics, biochemistry, biomolecular, paleontology, archeology, and anthropology. Related material content can be easily accessed and visualized with multimedia facilities that users can download, including videos and animations that explain past events like continental separation. Therefore, lectures that were initially considered abstract and monodisciplinary will be more easily studied and understood in a multidisciplinary integrative manner. Multimedia is the channel of choice in conveying information in a more memorable way.

According to Saroso [5] the advantages of ICT-based media in education are: (1) The learning system is more innovative and interactive, (2) Able to combine text, images, audio, music, animated picture or video in one mutual unity support for the achievement of learning objectives, (3) Being able to generate pleasure during the learning takes place. (4) Be able to visualize material that has been difficult to explain only with conventional explanations or props, and (4) Relatively easy and flexible storage media.

Edmodo is an electronic learning site that can be used as a supporting medium of learning process. According to Rismayanti [6], Edmodo is a social media platform often described as Facebook for schools and can function even more as needed. Edmodo is a social networking site where data sharing, events, schedules and so on for teachers/lecturers and students. In this study, the use of edmodo sites allows for a virtual classroom that can assist students in understanding the material of evolution. The Edmodo website allows for a virtual classroom that will assist students in understanding the material of evolution. The Edmodo website comes with instructional materials in .doc, .pdf, .swf and .mp4 formats. Lecturers can also form discussion forums and include lecturing agenda in one week to one month. Thus learning and lectures will become more structured because students can find out a well-organized schedule. In addition students can also access Edmodo anywhere as long as there is an internet connection network.

Metacognitive is a term introduced by Flavell in 1976. According to Flavell, as quoted by Livingstone [7], metacognitive consists of metacognitive knowledge and metacognitive experiences or regulation. Metacognitive knowledge refers to the acquisition of knowledge about cognitive processes, knowledge that can be used to control cognitive processes. While metacognitive experience is the processes that can be applied to control cognitive activities and achieve cognitive goals. Livingstone (1997) defines metacognitive as thinking about thinking. Metacognitive, according to the figure is the ability to think where the object of thinking is the process of thinking that happens to yourself. Margaret W. Matlin [8] states that “Metacognition is our knowledge, awareness, and control of our cognitive process”. According to Wellman (1985) quoted Usman Mulbar [9], metacognition is a form of cognition, a second or higher order thinking process which involves active control over cognitive processes. It can be simply defined as thinking about thinking or as a person's cognition about cognition.

Taccasu Project [10], describes metacognitive as follows: (1) Metacognition is the part of planning, monitoring and evaluating the learning process; (2) Metacognition is knowledge about one's own cognitive system; thinking about one's own thinking; (4) Metacognition involves both conscious awareness and consciousness of one's learning, (5) Metacognition involves both consciousness and consciousness of learning, (6) Metacognition is learning how to learn in situ learning learners encounters.

Based on several definitions that have been put forward in the above description can be identified the basic ideas about metacognitif as follows: (1) Metacognitive is the ability of the soul included in
the group of cognition, (2) Metacognitif is the ability to realize, know, the process of cognition that occurs in (3) Metacognitive is the ability to direct the process of cognition that occurs in yourself, (4) Metacognitif is the ability to learn how should be learned which includes the process of planning, monitoring, and evaluation, (5) Metacognitif is a high-level thinking activity, because this activity is able to control the thinking process that is going on for yourself.

According to Preisseisen (in Paulinna Haren, et al, 2001), metacognitive consists of four skills: problems solving, decision making, critical thinking, and creative thinking. To gain tremendous learning success, teachers must train students to design what they want to learn, monitor student learning progress, and assess what has been learned.

There are 3 metacognitive strategies that can be developed to achieve student learning success, namely: (1) stage of learning conscious process, (2) learning planning stage (3) stage of monitoring and reflection learning. Metacognitive strategies are important because when students are able to design, monitor, and reflect their learning process consciously, in essence, they will become more confident and more independent in learning. Learning independence is a private possession for students to continue their long journey in meeting intellectual needs and discovering an infinite world of information. The task of the educator is to develop the metacognitive ability of all students as a learner, without exception.

Yula Mirand [11], revealed that metacognitive learning in cooperative learning strategies improves students metacognitive abilities in biological subjects. Yuni Wibowo, Asri Widowati, Titik Krisnawati [12], revealed that students' cognitive and metacognitive abilities of SMAN 1 Ngaliik Sleman increased through learning using Ruondhouse diagrams. It can be reflected that the use of images, visual symbols and simple reminders can help students shape their knowledge. Maulana [13] uses a metacognitive approach as an alternative to mathematics learning to improve students' critical thinking skills.

2. Research Method
The research was conducted to test the effectiveness of evolutionary textbook based on Information and Communication Technologies and metacognitive which has been developed to the cognitive competence of the students of Biology Department, State University of Padang. So the effectiveness test in this research is the implementation stage of teaching materials that is the use of textbook in evolution lectures naturally through face-to-face and online lectures on Edmodo platform. After the textbook is used in the lecture, its influence on students' cognitive competence is tested. The test results are used for the purpose of evaluation and further improvement of teaching materials. Thus, the test design is adapted from "Single Subject Design". According Thiagarajan, this design is widely used in order to evaluate learning materials.

The subjects were 33 students of Biology Department who enrolled in the evolution course in the semester of January-June 2016. The study was conducted for one semester. The implementation of evolution lectures using learning resources in the form of textbooks based on ICT and metacognitive. The data collected is primary data in the form of students’ cognitive competence. The research instrument used to collect data is a test of learning outcomes. The influence of textbook implementation is described quantitatively.

The study was conducted in two cycles. In cycle 1, students use evolutionary textbooks as learning resources in face-to-face learning. In addition, students learn also by using edmodo site with the guidance of lecturers. Different with cycle 1, in cycle 2, students in addition to learning by using textbooks and edmodo platforms, are asked to present the results of their discussion. This is done based on the reflection of learning outcomes cycle 1.

3. Results and Discussion
Cognitive competence is the result of student learning measured in two cycles of activity. From the results of this study obtained the data as follows:
Table 1. Average cognitive competence and achievement criteria mastery

| Cycle | Average Cognitive Competence | Achievement Criteria Mastery (%) |
|-------|------------------------------|---------------------------------|
| 1     | 75.46                        | 59.37                           |
| 2     | 77.72                        | 81.25                           |

The result of data analysis shows that there is an increase of cognitive competence of Biology Education students after learning using ICT and Metacognitive evolution based textbook. In cycle 1, the average achievement of students’ cognitive competence is 75.46, but the percentage of achievement criteria mastery still not reached 75%. From cycle 1, as many as 40.63% of students achieve cognitive competence under the minimum mastery criteria, and students who have reached the minimum mastery criteria as much as 59.37%.

In cycle 2, the average achievement of students’ cognitive competence is not too much different from cycle 1 that is 77.72, but the percentage of students who have reached the completeness criteria has reached 81.25%. So, students who have not reached the minimum completeness criteria are only 18.75%.

In construction, textbook consists of 3 parts, namely: introduction, material description, understanding reflection and competency test. In the preliminary section there is a column "explore the initial understanding", this space serves as a column to know the initial knowledge of students on the material to be studied. This column also acts as an apperception. Through apperception teachers or lecturers can focus the attention of learners on what will be studied. Metacognitive on the book is presented in the column of "critical thinking" and "inference", through this column, students trained to be able to think critically. Through inference activities students are trained to be able to analyze what has been observed. This is in line with the opinion of Trianto (2014)[14], that inclusion is the use of what has been observed to explain something that has happened.

To further improve the cognitive competence, in the second cycle, the presentation was done. The presentation was chosen based on the results of reflection, because in cycle 1, students are still not too ready with the activities in the textbook so it needs a review in the form of a presentation that aims to refresh the understanding of reading that has been done at home. Through the presentation, students are more prepared to learn and try to understand the material in textbooks in depth, so that their initial teaching schedule is sufficient. Early teaching includes the type and scope of knowledge that has been mastered and known to learners, level and stage and type of cognitive, affective and psychomotor ability that has been achieved by learners.

According to Adney (1985), Barby (1982), Griffiths and Grant (1985), and Mark (1986) as cited by Suparwoto and Yusman Wiyatmo (2005)[15], the low learning achievement in the classroom among others are: (1) erroneous opinions based on their own judgments, (2) learners develop a misconception of the experience they get in the classroom, (3) classroom learning is not always effective in reducing errors that students have. So the initial teaching of the students is necessary for more effective classroom learning. So the provision of early knowledge of students is necessary for more effective classroom learning.

4. Summary
Based on the results of the study can be concluded that the use of textbooks of evolution based on ICT and metacognitive affects the cognitive competence of Biology Department students, State University of Padang which can be seen from the improvement of the learning result of evolution.

References
[1] Belawati, Tian, dkk. 2003. Pengembangan Bahan Ajar. Jakarta: Pusat Penerbitan Universitas Terbuka.

[2] Depdiknas. 2008. Panduan Pengembangan Bahan Ajar. Jakarta: Direktorat Jenderal Manajemen Pendidikan Dasar dan Menengah.

[3] Zakaria, Muhammad. 2017. Tentang Edmodo: Pengertian, Manfaat, dan Fitur-Fiturnya yang Wajib Anda Ketahui. http://www.nesabamedia.com/pengertian-manfaat-dan-fitur-edmodo/

[4] Anonimous. Introduction to Online Learning Resources. http://ocw.usu.edu/instructional-technology-learning-sciences/producing-distance-education-resources/introduction.htm

[5] Saroso, Siswo. 2009. Upaya Pengembangan Pendidikan Melalui Pembelajaran Berbasis Multimedia.

[6] Rismayanti, A. 2012. Mengenal Lebih Dekat Edmodo (online). http://id.scribd.com/doc/138248827/

[7] Livingstone, Jennifer A. 1997. “Metacognition: An Overview” http://www.gse.buffalo.edu/fas/shuell/CEP564/Metacog.html.

[8] Matlin, Margaret W. 1998. Cognition. Philadelphia: Harcourt Brace College Publisher.

[9] Mulbar, Usman. 2008. “Metakognitif Siswa dalam Menyelesaikan Masalah Matematika”. Tersedia pada: http://www.usmanmulbar.files.wordpress.com.

[10] Taccasu Project. 2008. “Metacognition” Tersedia pada: http://www.hku.hk/ccpe/taccasu/ref/metacognition.html.

[11] Miranda, Yula. 2010. Dampak Pembelajaran Metakognitif dengan Strategi Kooperatif terhadap Kemampuan Metakognitif Siswa dalam Mata Pelajaran Biologi di SMA Negeri Palangkaraya. Jurnal Penelitian Kependidikan, Th. 20, No. 2, Oktober 2010.

[12] Wibowo, Y, Widowati, A, Krisnawati, T. 2012. Pengaruh Pembelajaran Diagram Roundhouse terhadap Kemampuan Kognitif dan Metakognitif Siswa SMAN I Ngalik Sleman Yogyakarta. Jurnal Bioedukasi, Vol. 5, No.2, Februari 2012.

[13] Maulana. 2008. Pendekatan Metakognitif sebagai Alternatif Pembelajaran Matematika untuk Meningkatkan Kemampuan Berpikir Kritis Mahasiswa PGSD. Jurnal Pendidikan Dasar, No. 10, Oktober 2008.

[14] Trianto. 2014. Model Pembelajaran Inovatif dalam Teori dan Praktek. Surabaya: Pustaka Ilmu.

[15] Suparwoto dan Yusman Wiyatmo. 2005. Penjajanan Bekal Ajar Awal dan Hasil Belajar Akhir pada Mata Kuliah Fisika Dasar Program Studi Fisika FMIPA UNY. Prosiding Seminar Nasional Penelitian, Pendidikan & Penerapan MIPA, Yogyakarta, 8 Februari 2005.