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PROCEEDING

" Research and education for developing scientific attitude in sciences and mathematics "

4th ICRIEMS

Yogyakarta State University

4th ICRIEMS

4th International Conference on Research, Implementation, and Education of Mathematics and Science 2017

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(Regular Edition)

4th INTERNATIONAL CONFERENCE ON RESEARCH, IMPLEMENTATION AND EDUCATION OF MATHEMATICS AND SCIENCE (4th ICRIEMS)

Yogyakarta, 14 – 16 May 2017

Research And Education For
Developing Scientific Attitude
In Sciences And Mathematics

Faculty of Mathematics and Science
Yogyakarta State University

Proceedings of the 4th ICRIEMS (Regular Edition)

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Preface

This is the regular edition (non-Scopus-indexed) of the proceedings of the 4th International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS) held by the Faculty of Mathematics and Science, Yogyakarta State University, Indonesia on 14 – 16 May 2017. All of the papers in this proceeding are obtained from a selection process by a team of reviewers and had already been presented in the conference. Some selected papers from the conference were compiled under separate proceedings and published by the American Institute of Physics (AIP). This proceedings comprises 9 fields, that is mathematics, mathematics education, physics, physics education, chemistry, chemistry education, biology, biology education, and science education.

The theme of this 4th ICRIEMS is '*Research And Education For Developing Scientific Attitude In Sciences And Mathematics*'. The main articles in this conference are given by six keynote speakers, which are Dr. Jean W.H. Yong (University of Western Australia & Curtin University), Assoc. Prof. Khajornsak Buaraphan, Ph.D. (Mahidol University, Thailand), Prof. Maitree Inprasitha, Ph.D. (Khon Kaen University, Thailand), Prof. Dr. Zuhdan Kun Prasetyo, M.Ed. (Yogyakarta State University, Indonesia), Dr. Liem Peng Hong (NAIS Co. Inc., Japan), and Assoc. Prof. Dr. Nor Azowa Ibrahim (Universiti Putra Malaysia). Besides the keynote and invited speakers, there are also parallel articles that present the latest research results in the field of mathematics and sciences, and the education. These parallel session speakers come from researchers from Indonesia and abroad.

Hopefully, this proceeding may contribute in disseminating research results and studies in the field of mathematics and sciences and the education such that they are accessible by many people and useful for the development of our civilization.

Yogyakarta, June 2017

Editorial Team

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Forewords by Head of Committee of the 4th ICRIEMS 2017

Assalamu'alaikum warahmatullahi wabarakatuh

May peace and God's blessings be upon you all

First of all, on behalf of the organising committee of the 4th ICRIEMS let me welcome you to Yogyakarta State University, Indonesia. This International Conference on Research, Implementation, and Education of Mathematics and Science which is organized by the Faculty of Mathematics and Science is dedicated to the 53rd anniversary of Yogyakarta State University. The theme of this conference is "Research and Education for Developing Scientific Attitude in Science and Mathematics".

This conference facilitates academics, researchers and educators to publish and disseminate their research findings in the fields of pure, application and education of Science and Mathematics. We hope that this conference enable us to establish and maintain cooperation, communication, and networking among academics, researchers and educators in the levels of both national and international.

The succes of this conference depends not only on the committe but also on the the other parties. Therefore, in this occasion I would like to express my highest appreciation and gratitude to the following keynote speakers and invited speakers.

Keynote speakers:

1. Dr. Jean WH Yong - University of Western Australia & Curtin University (Biology);
2. Assoc. Prof. Khajornsak Buaraphan, Ph.D. - Mahidol University, Thailand (Science);
3. Assistant Prof. Maitree Inprasitha, Ph.D. - Khon Kaen University, Thailand (Mathematics Education);
4. Prof. Dr. Zuhdan Kun Prasetyo, M.Ed. - Yogyakarta State University, Indonesia (Physics Education);
5. Dr. Liem Peng Hong - Nippon Advanced Information Service (NAIS Co.,Inc), Japan (Physics);
6. Associate Profesor Dr. Nor Azowa Ibrahim - Universiti Putra Malaysia, Serdang (Chemistry)

Invited speakers:

1. Prof. Muthuraaman (Madras University, India)
2. Prof. Pipat Chooto (PSU Thailand)
3. Dr. Azlan Kamari (UPSI Malaysia)

4. Beni Setiawan, M.Pd. (UNESA)

5. Prof. Dr. Abdullah Dolah Dalee (Yala Rajabhat University, Thailand)

6. Prof. Dr. Eddy Hermawan (LAPAN Indonesia)

7. Dr. Hongki Julie (USD Yogyakarta)

Furthermore, allow me to inform you that the number of papers to be presented in this conference is about 304 papers out of 400 applicants from six countries, i.e. Australia, Indonesia, India, Japan, Malaysia, and Thailand. There are more or less 130 selected papers will be published by AIP Publisher which is Scopus Indexed. The rest of the papers will be published on selected DOAJ Journals and Regular ICRIEMS Proceeding. Therefore, we address very big appreciation and many thanks to all presenters and participants who have been actively involved in this seminar. Without your participation, we – the committee – are nothing.

Finally, I would like to say thank you very much to all members of the committee who have been working very hard since November last year in order to ensure the success of this conference. However, nothing is perfect, of course except the God, so if you find any shortcomings and inconveniences in this conference, we really apologize, indeed. We hope that this conference will be very succesful. Have a nice conference and enjoy Yogyakarta

Thank you very much.

Wassalamu'alaikum warahmatullahi wabarakatuh.

Yogyakarta, May 2017

Drs. Joko Sudomo, MA

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Forewords by Dean of Faculty of Mathematics and Sciences Yogyakarta State University

Assalamu'alaikum warahmatullahi wabarakatuh

May peace and God's blessings be upon you all.

On behalf of the Organizing Committee, first of all allow me to extend my warmest greeting and welcome to the 4th International Conference on Research, Implementation, and Education of Mathematics and Sciences 2017, held in Yogyakarta State University, one of the qualified education universities in Indonesia.

To celebrate the 53rd Anniversary of Yogyakarta State University, our faculty, has an opportunity to conduct the 4th ICRIEMS 2017 with the theme of Research and Education for Developing Scientific Attitude in Sciences and Mathematics. This conference proudly presents six keynote speeches by six fabulous speakers: Dr. Jean WH Yong, Assoc. Prof. Khajornsak Buaraphan, Ph. D., Assistant Prof. Maitree Inprasitha, Ph.D., Prof. Dr. Zuhdan Kun Prasetyo, M.Ed., Dr. Liem Peng Hong, and Associate Profesor Dr. Nor Azowa Ibrahim.

This conference is aimed to pull together researchers, educators, policy makers, and practitioners to share their critical thinking and research outcomes. Therefore, we are able to understand and examine the development of fundamental principle, knowledge, and technology. By perceiving the matters and condition in research and education field of mathematics and sciences, we could take a part in conducting qualified education to reach out the real independence of our nation.

This conference will be far from success and we could not accomplish what we do without the support from various parties. So let me extend my deepest gratitude and highest appreciation to all committee members. I would also like to thank each of participants for attending our conference and bringing your expertise to our gathering. Should you find any inconveniences and shortcomings, please accept my sincere apologies.

To conclude, let me wish you a fruitful discussion and a very pleasant stay in Yogyakarta.

Wa'alaikumsalam warahmatullahi wabarakatuh

Yogyakarta, May 2017

Dr. Hartono

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Forewords by Rector of Yogyakarta State University

Assalamu'alaikum warahmatullah wabarakatuh.

May peace and God's blessings be upon all of us.

Education is in Indonesia has long been an object of criticism. Mathematics and Science Education, in particular, has been considered pretty low in terms of international ranks. In reports released by Program for International Student Assessment (PISA), for example, the students' mathematics achievement were very low, that was rank 66 0f 72 countries in 2015. Although it improved when compared to the rank released in 2012 – rank 71 of 72 countries, it is still far behind the other countries, even from Thailand (56), Malaysia (45), Vietnam (22), and Singapore (1). Science is not much better when referring to PISA report. Indonesian students Science achievement was only slightly better than that of Mathematics. In addition, many students consider Mathematics and Science among the most difficult and scary school subjects. Many students feel depressed because they have Math in the schedule, or would rather escape, when it is possible.

Such a condition is not ideal and should be a significant consideration for Mathematics and science teachers, lecturers and researchers to devote more works to improve the quality of not only students' mathematics achievement, but also leaning processes. It is through The 4th International Conference on Research, Implementation and Education of Mathematics and Science (4th ICRIEMS), that we expect to find solution to the problems. The 4th ICRIEM brings together teachers, lecturers, researchers, and practitioners in Mathematics and Science Education to sit together, discuss, and share their experiences, research findings, and ideas to make better practices and innovations in Mathematics and Science Education, and thus improve students learning and achievement.

Yogyakarta State University (Universitas Negeri Yogyakarta), with its new leaderships, has high commitment and is highly determined to promote research and publications among the university members to help improve the quality of Mathematics and Science learning in particular, and the quality of education in general. Furthermore, with the commitment to lead to the World Class University, Universitas Negeri Yogyakarta strive to increase its impact on the education worldwide, by promoting research and publications to journals with international reputation. In addition, Universitas Negeri Yogyakarta with its new leaderships has launched a commitment to a transformative leadership by promoting transparency, participation, and collegiality. With this commitment, it is expected that Universitas Negeri Yogyakarta can contribute better in improving the educational system in particular, and the society in general.

Finally, appreciation and gratitude are for those who have been working hard to make this conference possible. I also hope that this conference be one of the conferences that really contribute to the upbringing of the scientific life.

Wassalamu'alaikum warrahmatullah wabarakatuh.

Yogyakarta, 15 May 2017

Prof. Dr. Sutrisna Wibawa, M. Pd.

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4th ICRIEMS Proceedings
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Integrating Learning Of Science Through Concept Mapping For Improving Biology Teacher Candidates Competency In Lessons Planning

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Abstract: This reasearch is motivated by the idea that integrated learning model which is not commonly used by lecturers on campus. Using integrated learning is believed to improve learning outcomes. Integrated learning model by using concept mapping and Content Representation (CoRe) is believed to improve the planning of lessons which is the creativity is needed by the teachers. The reaserch is done by using single pretest group and post test design. The participants as samples are taken from biology education students of private universities in the province of west java that takes evolution, ecology, animal and microteaching as many as 13 people by using sampling techniques combined between the two sampling techniques is purposive and quotas. The integrated model which is used in this reasearch is connected model with the theme of speciation. The instrument that is used in this research is observation sheet, work sheet of concept map, CoRe, speciation tests and questionnaires. Data were analyzed using quantitative descriptive analysis and non-parametric statistical analysis test wilcoxon. The result of the research showed that there is an increasing mastery of concept 86,16 % and based on the stastitical test with significance values obtained Wilcoxon test was 0,001. It is meaning that the value of the test 1 and the test scores 2 there are significant differences. This study also found that integrated learning using concept maps and CoRe make the students have the ability to lesson planning with difficult material into a material that is easy to understand for the students.

INTRODUCTION

The concepts in the evolutionary courses abctract so that students have difficulty learning in understanding them and are less interested in learning them. In addition to the abstract concept, understanding the concepts in the course of evolution, such as speciation materials, requires students' ability to link and generalize as they study other subjects such as morphology, botany, evolution and ecology in different times with different press points. The concepts in evolution are prone to confusion and conflicts in students in relation to previously acquired understanding through religious education. Until now in some circles of religionists are still developing understanding of the theory of creation, while the theory of evolution contrary to the theory of creation. To overcome this, one of them through the application of integrated learning on the course of evolution and animal ecology. Through the application of integrated learning students are expected to be able to understand the concepts of evolution as a whole and meaningful. In the subject of animal ecology, there are several materials that can be integrated into the speciation material in the course of evolution, which is the principle of exclusion of the Gause rule competition, the principle of coexistence, the divergence principle, the ecological equivalent, the allopathic species, the sympatric species, the natural selection and the characteristic shift. These materials can be used as reinforcement when the lecturer of evolution course explains the concept of speciation. This is in accordance with the opinion of Hewitt *et al* [1] that one of the material that can be integrated in evolution is natural selection, adaptation and speciation.

According to Fogarty [2] those are ten models of integration that is; Fragmented, connected, nested, sequenced, shared, webbed, threaded, integrated, immersed, and networked. The model is fragmented, connected, and nested to integrate basic competencies in one discipline. For example the combined of physics natural Sciences, biology, and chemistry. Model sequenced, shared, webbed, threaded, integrated to integrate across disciplines. For example, natural Sciences is combined with , social Sciences Religious education and Physical Education. The model is immersed and networked to integrate one discipline as well as across disciplines. This research combines BC (Basic Competence) Evolution: students can describe concept of natural selection and adaptation, speciation concept, and specification mechanism with BC Ecology: students can describe the concept of adaptation and behavior and ecological niche with connected model so that it has integrated BC : Understand the concept of evolution based on theory, evidences, and mechanisms of evolution and its relation to other biological sciences.

The integrated learning model is essentially a learning approach that allows learners both individually and in groups to actively seek, explore, and discover concepts and principles in a holistic and authentic way. This learning is a model that tries to integrate several subjects [3]. As one of the recommended models in curriculum implementation, students of biology education who are prospective teachers must master the integrated learning model. For that matter the students need to be trained how to plan and implement integrated learning. One method that can be used to equip prospective teachers in the ability to plan integrated learning through the concept map and CoRe (Content Representation).

Concept maps were originally developed by Novak [4] The concept map is a tool for organizing and presenting knowledge that emerges from Novak's research into the development of children's natural Sciences knowledge. Like many good teaching ideas, concept maps have been used, adapted and familiarized by teachers over time. According to Novak, concept maps are used to express meaningful relationships between concepts in the form of propositions. Propositions are two or more concepts connected by words in a semantic unit. Because learning is meaningfully easier to take place when new concepts are linked to a more inclusive concept, the concept map must be structured hierarchically. The relationship between concepts for a person is idiosyncratic, meaningfulness of concepts is typical for each person. Concept maps can serve as learning strategies[5] and effective learning tools [6]. Learning using concept maps can improve conceptual understanding[7]. Concept maps can be used as a cognitive and constructivist learning strategy in teaching and learning in adult education and human resource development [8].

CoRe contains descriptions of concepts or materials that are important in teaching a particular topic. CoRe is usually written in tabular form. The horizontal direction contains important ideas or concepts in teaching a particular topic, The vertical direction contains the considerations and thinking of the teacher in teaching the topic. Usually includes: Why do students need to learn the idea / concept ?; Why is it important for students ?; What difficulties do students usually face ?; How do students think of the concept ?; What other factors influence the teaching of the concept ?; How does the procedure teach it ?; How do students understand or confuse learn the concept? Loughran et al [5]. CoRe can be used as an instrument to know the ability of a teacher's PCK (Pedagogical Content Knowledge) (teacher's initiative), both novice and senior teachers [10][11][12].

Concept maps and CoRe when applied in integrated recovery will be able to equip prospective teachers in terms of learning planning abilities. According to Anne Humme [13] CoRe can be used by science teachers as a tool to improve the ability of PCK teachers [14][15]. Through CoRe teachers will focus on providing students with an understanding of the keys of a Gess-Newsome material [16]. This is consistent with Sa'ud et al. [17] that integrated learning, often referred to as coherent learning, considers integrated learning as an approach to developing a learning program that brings together and connects educational programs. With the practice of making concept maps, the students can find out which concepts are essential and which are non-essential concepts of the material to be taught. In addition, students can generalize the overall concept that exists in the material to be taught and understand the interrelationship of one concept with another concept as one meaningful unity. With the training to make CoRe, then the prospective student teachers are able to make learning plans that can package learning materials that make it easier for students to understand the material materials. The way of packing the learning experience designed by the teacher is very influential on the meaningfulness of the experience for the students. More learning experience shows the relation of conceptual elements to make the learning process more effective. The conceptual linkages studied with the relevant fields of study will form the scheme, so that the child will acquire wholeness and unanimity of knowledge. The acquisition of wholeness of learning, knowledge, and unanimity of views on life and the real world can only be reflected through integrated learning. In addition, students when making learning plans already know what material is appropriate to be given to the student, what learning strategies are appropriate to the material to be taught, and the evaluation to be used [18].

Until now, there has been a lot of research on integrated learning in Indonesia, especially on science subjects. For example, research that has been done by K. Dewi et al [19] which examines the development of

Integrated Science learning devices with guided inquiry setting to improve understanding of students' scientific concepts and performance. In their research, they succeeded in developing integrated science learning materials with the validity of learning tools at the category level is very valid, the value of understanding the concept of 85.16 and the scientific performance above the Minimal mastery criteria value. There is another study conducted by P. Rahayu et al [20] on the development of Integrated natural Science learning by using problem base learning model through lesson study. However, research is generally conducted at the primary or junior high school level, very rarely integrated learning research is undertaken in college. The number of Integrated natural Science study in Indonesia occurred after the enactment of Competency Based Curriculum (CBC) in 2006 because the integrated learning model is one of the suggested models in the curriculum. Nevertheless, up to now, very rarely integrated learning models are used by teachers in everyday learning. This happens because one of them is the teacher difficulties integrating the natural Science concepts into integrated learning.

Based on the description of the background can be formulated problems in this research is how the application of integrated lectures using concept maps and CoRe on the theme spesiasi in order to equip the ability to plan integrated learning for prospective biology teachers?

EXPERIMENTAL

This research was conducted in one private university of West Java Province Biology Education Study Program with the number of samples of 13 students of 5th semester who were taking courses such as animal ecology, evolution and microteaching. The sampling technique used a combination technique between three sampling techniques, namely purposive and quota. Purposive because researchers deliberately determine the samples taken from students participants subjects animal ecology, microteaching and evolution. Kuoata because the researchers limit the number of samples from each category.

The instruments used in this study are learning planning observation sheets, Student Worksheet, questionnaire on the ability of mastery of speciation material, CoRe and questionnaire. The instrument is tested to the student one level above the sample.

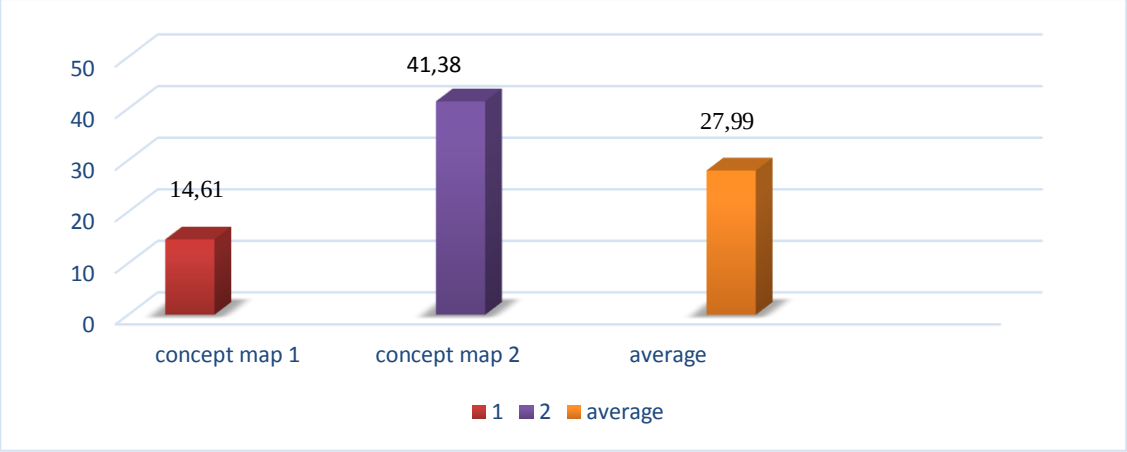
The method used is quasi experiment. The research design used was one group pretest and posttest design [21]. In this design the observation is done 2 times ie before treatment (treatment) and after treatment. Observations performed before treatment (O1) are called pretest, and post-treatment (O2) observation is called posttest. Integration model used: connected model. The connecting theme used is speciation.

In general, this research covers three stages, namely preliminary stage, design stage and implementation phase. The preliminary stage is done by determining the steps of linkage model which include: analyzing the Competence Standards (CS) and Basic Competence (BC) from evolutionary and animal ecology subjects, analyzing material relevance, determining theme, analyzing learning outcomes, preparing CS, BC , Indicators of animal evolution and ecology, create a network of topics / indicators. The design stage includes preparing the initial syllabus, lesson plan, Concept Map, CoRe, material, student worksheet, grids, test questions, answer keys and assessment rubrics. Learning implementation phase includes: Testing instrument, Pre test, Implementation of learning and Post Test.

RESULTS AND DISCUSSION

Concept Maps

The first concept map was created by prospective teachers before they obtained very simple speciation material. This is not strange because the students do not know which concepts are essential to the speciation material so that the concept map value is low. In the initial concept map created by participants, generally they have not been able to distinguish the essential concepts with non essential, has not come up with examples, already know the hierarchy but filled with the wrong concept and not yet know the crosslink. So the concept map value obtained is also small. So far they have not learned about concept maps. Based on posttest result, generally ability to make concept map participant has increased by 64,69%. Nevertheless, most of the students are still weak in making cross link which has the biggest rating weight. Below figure 1 is about the development of participants' ability in concept map creation :



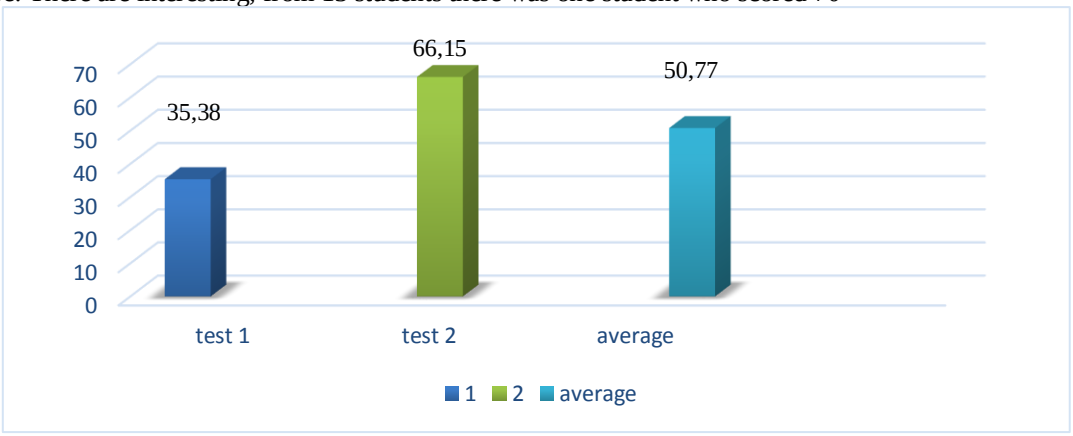
Notes : maximum score 77

FIGURE 1. Development Concept Maps 1 and 2 The Candidate of SMA Biology Teacher

From the result of statistical test with wilcoxon test, the significancy value is 0.001. This means that the value of 0.001 <0.05, then H_0 is rejected and H_1 accepted means the value of concept map 1 and the concept map 2 there is a significant difference

Mastery of speciation material

Mastery of speciation material for prospective teachers before obtaining lecture on speciation of lecturers is low. This is reasonable because no matter how speciation material has been given specifically to other courses or before. There are interesting, from 13 students there was one student who scored 70



Notes : Maximum score 100

FIGURE 2. The Development of The Ability to Mastery Speciation Material

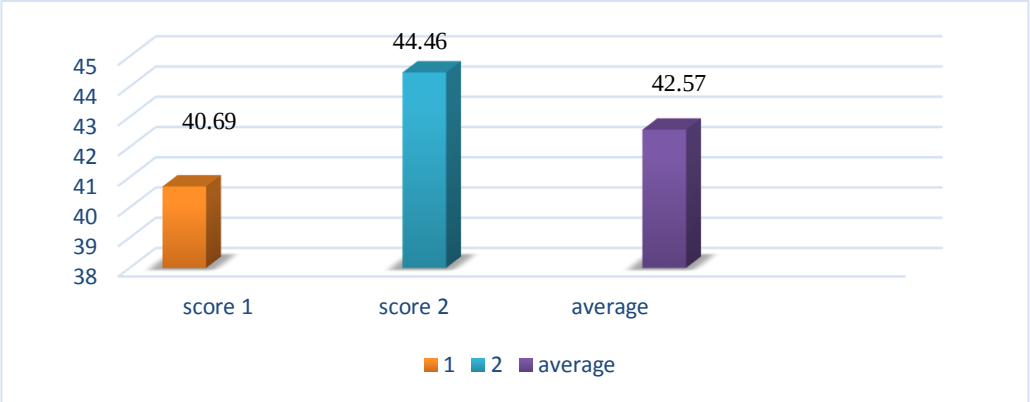
Based on the picture above 2, from the posttest result of the students it appears that the ability of mastery of the participants' matter generally increases although the average is still around diangka 66.15 which the range of assessment is still around the value of B. Based on the average number then there is an increase of 35, 38 to 66.15 around 86.97%. A very good hike.

From the result of statistical test with wilcoxon test, the significancy value is 0.001. This means that the value of 0.001 <0.05, then H_0 rejected and H_1 accepted means the value of Test 1 and Value Test 2 there is a significant difference.

Ability to plan lessons

The value of the ability to make the participant planning is generally good, that is, on average they get a score of 40.69 from a maximum of 55 before obtaining the speciation material and get an average score of 44.46. This means there is an increase in the ability to plan learning by 8.48. However, there are some points in the ability of lesson planning that is still lacking the ability to:

• Item 2 on the formulation of learning objectives provides learning opportunities through inquiry and the discovery of new information
• point 3 on the formulation of learning objectives that reflects the development of student skills
• item 4 concerning the formulation of learning reflecting the development of values within its social function.
• Item 11 on developing performance evaluations and assessing for different conditions
The following figure 3 on the development of students' learning ability skills:



Note: Maximum score 55

FIGURE 3. The Development of Lesson Plan of the Students

From the results of statistical tests with the test wilcoxon obtained significancy value is 0.011. This means that the value of 0.011 <0.05, then H_0 rejected and H_1 accepted means the value of the ability to plan learning before treatment and value after treatment there are significant differences

The effect of X_1 to Y, significancy value is 0.088> 0.05 means there is no significant effect. The effect of X_2 on Y, significance value is 0.187> 0.05 means there is no significant effect. Where the variable X_1 is the mean value of the concept map (figure 1), the variable X_2 is the average value of mastery of the speciation material (figure 2) and variable Y is the mean value of the ability to plan the lesson. However, based on the calculation of the correlation value (R) obtained 0,527, meaning that the correlation is strong.

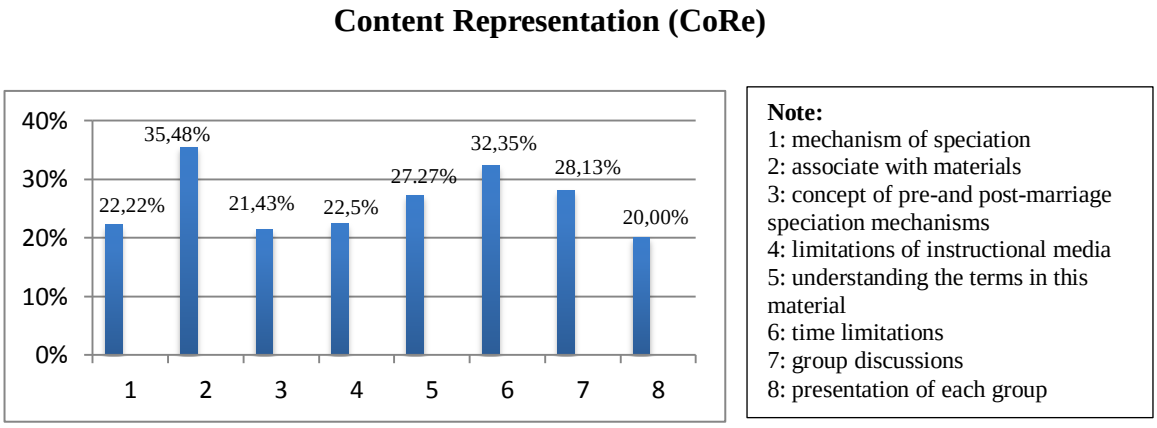


FIGURE 4. Percentage Content Representation based on Student answers

Based on student answers on the CoRe table, then the following percentage of most of the celebrations: for what questions do you want students to learn from this idea ?, 22.22% of respondents answered the mechanism of speciation. For the question why is this important to know by students ?, as many as 35.48% of respondents answered in order to associate with other materials. For the statement column other things of this material that you know but not yet known by the students, as many as 21.43% answer the explanation and the overall examples of the concept of pre-marriage and post-marriage speciation mechanisms. For the statement of difficulty / limitations column related to how to teach this material, as many as 22.5% of respondents answered the limitations of instructional media. For the statement column: knowledge of the students' thinking that

influences you in teaching this material, as many as 27.27% answer the students are still confused in understanding the terms in this material. For the statement column: other factors that affect the way you teach this material, as many as 32.35% of respondents answered the time limitations. For the statement column: the teaching procedure (and the specific reason for its use), 28.13% of respondents hold group discussions. For the statement column: a specific way to ensure students' understanding or confusion about this material, as many as 20.00% of respondents answer the presentation of each group.

Based on all of the above descriptions, quantitative descriptions and statistical analyzes show that through integrated learning in the evolution course on the concept of speciation using concept maps and CoRe can improve the mastery of concept maps, the ability of mastery of materials and the ability to make learning plans. By making CoRe participants indirectly train themselves to make learning plans that can facilitate students to understand learning materials. Through CoRe a teacher is required to know from the material that will be learned to students about: 1) the essence of the material to be delivered; 2) learning strategies that will be used so that students easily understand the material to be received; 3) learning difficulties experienced by students; 4) how to overcome learning difficulties experienced by students; 5) factors affecting the success of learning; 6) Assessment to be used Loughran et al. [5]. Through CoRe a teacher is training self-development and also sharing learning experiences. Based on the experience of making CoRe can influence or inspire a teacher when teachers make learning plans**.**

Through the concept map a prospective teacher practiced mastering the material to be learned in its entirety. Through a concept map according to Novak [4] a prospective teacher also means knowing the essential concepts of a material, can relate one concept to another, and automatically acquired knowledge will settle longer (retention) in one's memory because By using the concept map then someone will automatically read the material repeatedly. After understanding the material read, then the concerned can create a concept map. It also means that someone who has created a concept map not only learns through reading but also pours the results of reading it in the form of writing / drawing. Based on this, it is not surprising that in this study the value obtained in the mastery of the speciation material averaged 66.15 (B value). Though this material is considered difficult by students but students are able to master this material well. Concept mapping also contributes to the ability to make planning of one's learning because by making a concept map one easily makes learning objectives, facilitating the teacher in organizing the material to be taught, facilitating the teacher in determining learning strategy and learning evaluation. In addition, the concept map itself can serve as an evaluation instrument.

The integrated learning developed by the lecturers on the speciation material (evolution course) by combining the speciation material with the adaptation material, the ecological habitat and ecology (animal ecology course) causes the students to understand the speciation material as a whole, not bits and pieces. Students practice to integrate one material with other materials so that students' understanding is meaningfull. This is seen when students are able to work on concept maps, CoRe and lesson plan as well. Similarly, students were able to present the speciation material well when they were given the task of presenting the speciation material as seen from the questionnaire results. Their understanding of the speciation material is also very good and increased by 86.97%. A very high level of understanding. This further strengthens the results of research in developmental and cognitive psychology which suggests that one learns best when dealing with ideas relating to one another. The results of this study are in accordance with research K. Dewi et al. [19] that the development of Integrated natural science learning tools with guided inquiry setting is able to show the value of students' concept comprehension and 100% scientific performance above the minimal mastery criteria , with an average understanding of the concept is 85.18.

The learning outcomes shown by the prospective teachers after attending integrated lectures in terms of mastery of materials, the ability to create concept maps and the ability to plan learning strengthen the opinions of Sa'ud, et al. [17] that the acquisition of wholeness of learning, knowledge, and unanimity of views on life and the real world can only be reflected through integrated learning.

The learning done by the researcher actually not only combines the learning materials but also integrates the teaching methods or approaches of lectures, presentations, assignments, the use of concept maps, CoRe and lesson plan in one learning unit. This is important because the course of evolution is pursued in conjunction with animal ecology and microteaching courses that require the ability to plan learning. The results of this study that integrate multiple methods in harmony with the results of research Pujiastuti et al. [22] who examined the development of integrative learning model (Science process skills, Cmap Tools, and Cue Framework) to equip the ability of thematic learning plan, that is integrative learning model can equip prospective students Teachers the ability to construct thematic learning with good and excellent effectiveness. This is shown by the quality of the products produced by the students.

CONCLUSIONS

Integrating learning for evolution using concept of speciation with concept map and CoRe increased understanding concept map, ability to lesson plan of difficult material into a material that is easy to understand for the students, and students have the ability create content representation correctly. Integrating learning using concept maps and CoRe should be accustomed to its use in college because it can produce a good mastery of the material and improve the ability to plan learning. Learning planning skills students need when they are taking courses microteaching and or Practice field experience. Because generally microteaching course taken in conjunction with the course of evolution and ecology of animals.

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