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2013

Turning Dreams into Reality: Current Trends in Mathematics, Science and Computer Science Education

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PREFACE

The Seminar under the theme “Turning Dreams into Reality: Current Trends in Mathematics, Science and Computer Science Education” is conducted by Faculty of Mathematics and Science Education, UPI at October 19, 2013. The aim of the seminar is to provide a forum where teachers and researchers can exchange didactical, pedagogical, and epistemological ideas on mathematics, science, and computer science education which is expected to stimulate research in those areas. The seminar also provides an exceptional opportunity for all participants to contribute to the world of mathematics, science, and computer science education.

Some of outstanding scientists and educators from Germany, Australia, Hongkong, Malaysia, Singapore, Netherland, and Indonesia joined in this seminar made the seminar trully international in scope. There were 485 participants, had many fruitful discussions and exchanges that contributed to the success of the seminar. 153 papers discussed in the parallel session. The papers were distributed in 6 fields. 42 papers in mathematics or mathematics education, 19 papers in physics or physics education, 23 papers in chemistry or chemistry education, 25 papers in biology or biology education, 9 papers in computer science or computer science education, and are 18 papers in science education. Of the total number of presented papers, 153 included in this proceeding.

Generous support for the seminar was provided by SEAMEO QITEP in Science and Himpunan Sarjana dan Pemerhati Pendidikan IPA Indonesia. The support permitted us to gave an opportunity for a significant number of young scientists and persons from many universities and other institutions brought new perspectives to their fields.

All in all, the seminar was very successful. We expect that these future seminar will be as stimulating as this most recent one was, as indicated by the contribution presented in this proceeding.

Chief of Organizing Committee,

Dr. Sufyani Prabawanto, M.Ed.
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INTEREST AND RECRUITMENT IN SCIENCE (IRIS) STUDY IN INDONESIA

Tatang Suratno, Ari Widodo, R. Asep Kadarohman
Indonesia University of Education

ABSTRACT
The Indonesian Interest and Recruitment in Science (IRIS-Ina) study examined factors influencing recruitment, retention and gender equity in science, technology and mathematics (STEM). By drawing on theoretical frameworks of expectancy-value model of achievement-related choices, sociological account of youth in late modern society, and feminist perspectives, the IRIS consortium developed questionnaire, called IRIS Q. This online survey involved 448 first year STEM university students to complete 65 items of IRIS Q (in Bahasa). The study discussed the impact of school science and out of school experiences, future aspirations and current state of gender equity on young people decision in choosing STEM education and career.

Keywords: Interest, school experience, out of school experience, gender equity, STEM education

1. INTRODUCTION
The Interest and Recruitment in Science (IRIS) research project is developed by key European universities as consortium supported by the European Commission’s 7th Framework Program (FP7) – Science in Society. As part of international research project, FPMIPA UPI conducted preliminary Indonesian IRIS study in which this paper reports key findings from a national-wide research involving first year science, technology and mathematics (hereafter called STEM) college students, both private and public university in Indonesia. As IRIS international partner, we have privilege to utilize resources provided by IRIS consortium, including key references and publication as well as standardized instruments.

IRIS study is exploring recruitment and retention patterns in STEM education and career. This study addresses the challenge that few young people, women in particular, choose education and career in STEM. In recent years, the potential of women participation to STEM may enhance gender equity that would enrich the ways of thinking and working within this area. Accordingly, IRIS study explores factors influencing young people in choosing STEM education and career, particularly ones related to school experiences and youth culture via higher education STEM curricula and recruitment efforts. Therefore, IRIS aims to improve our understanding regarding recruitment, retention and gender equity patterns in higher STEM education.

Indonesian IRIS studies two important themes related to the level young people participation to STEM higher education and specific attention is given to gender differences pattern. First, their motivation and aspiration to STEM courses elaborated through the following questions: 1) how important were school experiences in choosing your course?; 2) how important were people around you in choosing your course?; 3) how important were media and outreach activities in choosing your course?; and 4) how do you come to choose your course?. Second, specific issues deal with their experiences, expectations, gender equity and priorities: 1) to what extent do you value your experiences as a student so far?; 2) has your everyday life as a student been as expected, or do you consider to leave STEM course?; 3) to what extent do you perceive that you are in with the chosen course?; 4) what are your priorities for future?; 5) what is your view regarding a course where one gender is over-represented?; and 6) what do you suggest for high school students who are interested
to take STEM course? In this paper, we report the first theme that relate mostly to school and out school experience and their priorities for future.

Such questions are constructed into IRIS questionnaire to scrutinize interrelationship between school and out school experience, including STEM curriculum and pedagogies. Specific attention is given to elucidate preferences in terms of learning condition for young men and women and STEM curriculum structure that meets their interest. Hence, we stimulate a discussion on how to implement fruitful teaching-learning strategies in STEM programs

1.1. Literature Review

IRIS study is based on various theoretical frameworks that relate to young people’s educational choice. Those are the expectancy-value model of achievement-related choices, sociological theories about youth and their identities in late modern societies and feminist perspectives. In addition, lessons learned from successful STEM recruitment are also discussed.

1.1.1. Expectancy-value model

Expectancy-value model (Eccles & Wigfield, 2002) provides framework for scrutinizing factors that influence girls’ educational and career choices proposes by predicting their expectations for success (perceptions of ability and task difficulty) and of task values (interest, attainment, utility, and relative cost). Positive affirmation to both expectations and value is determining their long and short-term goals and their estimates of the difficulty of the subject. Such perception is influenced by their past experiences (attributions), perceptions of others’ expectations, such as parents and peers, and their perceptions of the gender stereotypes of the subject.

Expectancy of success relies on perceptions of ability represented by statements like “Am I clever enough?” and “What are my chances of getting good grade?”. Mostly girls tend to have lower expectancy of success in science course and career that are dominated by males. For example, female students would like to choose biology, rather than physics, if they have sense of ability to succeed in that subject. Hence, if fewer numbers of girls pursuing science classes and careers, it reflects a lower sense of science ability. One of possible explanations is their perception of difficulty that inherently held among girls about science courses. In addition, expectations for success and task-values are influenced by goals and self-identity. In particular, gender-typed roles define relations of activities and gender roles: Most girls sense that science is masculine activity and it does not relate to feminine identity. Such perception contributes to science stereotyping that could be enhanced by peer group attitude and parents influence, particularly father. Meanwhile, task-values might be best represented by science classroom experience: is it interested (intrinsic), is it useful (utility), is it important (attainment), and is it worth enough (relative cost).

First, interest value can be seen by statement like “Am I really interested?”, “Will I find it meaningful?”, or “Do I enjoy working science experiment?”. In this regard, generally all students want to realize their own potential, do something interesting, meaningful and fulfilling. However, girls have different interest than boys, particularly in the context of science application (e.g. technical vs. humanity aspects of science). In addition, girls have different criteria for learning and understanding. Girls: look for knowledge in context; emphasize social element of subject.

Second, attainment value deals with such question as how important is to succeed with science education. It can be represented by the following reflection: “Am I science person, does it represents my identity?” or “Is it important for me personally to attain a science degree?”. Such questions can be sensed whether make students feel happy and proud, self efficacy to overcome challenges and do creative work and conform with their identity. It is a question of “Who am I?” in which students tend to analyze science subject and its stereotype in society. Girls, in particular, identify themselves as attractive, socially competent, creative, and not very intellectual and motivated which opposite with the image of school science.

Third, utility value relates to what kinds of values (other than in science itself) do students seek in career? It is reflected by these questioning: “Will I get opportunities to study abroad?”, “Will it give me opportunities for leadership positions?”, or “Will it give me job allowing for a good and comfortable life?”. Such questions relates to pursuing future life. Boys tend to seek job that give them high pay and status, meanwhile girls aspire ‘people-oriented’ and idealistic work.

Four, relative-cost deals how much resources that students should invest to do their best in science and how they are measured. It is decision made about spending time, energy, effort and
struggle to survive in science course and career. Most girls perceive a higher cost of taking science than boys. For example, many girls are afraid of choosing heavy subject and want something easier because they perceive themselves as not clever enough.

1.1.2. Youth culture and their identities in late modern societies

Young people have their own ways of life, a kind of subculture that might come into play in their educational choices. Such culture may be described in terms of their priorities and identity which influence their point of view towards their aspirations. They may gauge their surrounding that might contribute much to their self development and identity (Schreiner & Sjøberg, 2007). One of key identities is a freedom to choose their own values. In this regards, there exist differences between boys and girls subculture. As described earlier, young people view that math and science have masculine identity, a socially constructed belief that represent boys’ culture, not girls’. In addition, their culture often defends their priorities and aspirations against ordinary images of science brought by their family and larger society. They have their own view about how to be involved in the assigned activities that should be suitable with their image of who they want to be. In this case, if the image of science is not representing their identity, they will not pursue in science courses and career.

1.1.3. Feminist perspectives

Girls and women remain substantially under-represented in mathematics, science, and technology in school, university and in the workplace. It is widely recognized and yet is disdained. There are many explanations to such situations, including bias of selection process, sense of being minority and ignorance, bias in textbooks and academic discourse, and lack of female role models.

There are many ways to elucidate gender inequity issues in STEM education and career. It is based on how we define it. Feminist theorists offer several perspectives, ranging from both equalizing and segregating girls and boys, and structural as well as post-structural stances (Thompson, 2003). Socialization theory proposes equal treatment of women and men. Gender difference theory interrogates male-domination culture as to promote feminine culture. Structural approaches examine power arrangements, whereas deconstructive approaches advocate changes in cultural practices.

1.1.4. Success Factors for STM Recruitment

We conclude from Eccles’ expectancy-value model and sociological study of youth in late modern society that girls differ from boys in all elements. Feminist theories provide perspective related to gender equality and equity. It raises key challenges regarding how school and university deal with goal-directed recruitment efforts and career guidance. In turn, it may change STEM curriculum contents and contexts as well as its teaching-learning strategies in order to attract more students, particularly women.

In dealing with interest patterns with content of STEM curricula, we should consider the context in which the curricular topics are delivered. Previous studies have shown that girls prefer to pursue application and social aspects of STEM, for example environmental issues. It implies that girls tend to value context and relational orientation in which the content is presented. Therefore, it is worth considered to include the nature of science and socio-scientific issues into STEM curricula. Such orientation requires changes in terms of teaching-learning approaches. One of key ideas come into surface is the socio-cultural learning theory and the importance of language and social interaction for learning (Mortimer and Scott, 2003) as to challenge the old style "transmissive" teaching. In addition, new approaches are to promote active participation, collaborative learning and problem-based learning that may enrich classroom interaction.

2. RESEARCH METHOD

Indonesian IRIS study employed online survey method. We have developed IRIS Questionnaire in Bahasa (called IRIS Q Ina) based on standardized IRIS Q instrument. In doing so, we did several phases of translations and back translations. Then, IRIS Q Ina was posted in IRIS website and we invited students, via their emails, to participate.

IRIS Q has three important features. First, questions related to respondents’ personal information: social economic status, gender, university and department. Second, Likert-scale items (1-5 ratings) provide respondents to choose their preferences, from ‘not important’ to ‘very important’. Third, open-ended questions provide more spaces for respondents to explain their decisions or suggestions.
Our target population is first year students of higher education STEM departments grouped as: 1) Natural and Physical Science; 2) Information Technology; 3) Engineering; 4) Agriculture and Environmental Science; 5) Medicine; and 6) others. The students came from both public and private universities across the nation, including those who take non-education department in teacher education institutions. Overall, the study invited 62 public and 5 private universities, from Aceh to Papua. However, in fact mostly students’ email data collected mainly from universities located in Java, Sumatera and Sulawesi.

Initially, we collected 3917 email addresses and invited them three times every week started from 11-31 May 2012. Until that time, participation rate was below our expectation (we targeted to have 1000-1500 respondents filling in the questionnaire). We decided to send back invitation in (10-21 September 2012) until the webpage was closed (21 December 2012). At the end of December the data was exported and we have 545 respondents (14% response rate). To make sure data integrity, we checked data by excluding those who we thought not our main targets and those who made incomplete responses. We then had 448 real data.

Data were analyzed both quantitatively (using SPSS 16) and qualitatively (interpretative) (Lyons et al., 2012). In general, our analysis focused on: 1) overall cohort; 2) comparison between male and female respondents; and 3) comparisons among departments or study programs. Rating rate of Likert-like items is presented in the form of bar chart. Because there are five points scale in each item, it is assumed that, for example, point that close to ‘Very Important’ is regarded as having degree of importance, and vice versa. To explore cross-variables responses such as gender, mean rate was used as a concise visual data. However, to avoid assumption of measurement at interval level (point 3, no label) in such Likert-like scale, we gauged mean differences by employing such reduction technique as factor analysis. Hence, rating in each item was analyzed by crossstab non-parametric measurement and contingency test of Chi-square.

Because of sample size and numbers of test conducted, significance level used was p<0.001 as to explain the result of overall cohort in order to avoid fallacy of significance claim. For comparison within and between smaller subset of respondents from departments that dominated by males or females, the result that reaches at the level of p<0.005 is considered as strongly suggestive towards relations of relevant variables Therefore, one of implication from traditional approach to such data analysis is the numbers of associations at 0.001 probability level that was not considered in this report.

In addition to limiting significance level, we only report meaningful data that have huge range of differences. Therefore, Cramer’s V (based on Cohen’s criteria) was used to gauge Effect Size as to determine level or meaning of its significance. We will not discuss significance that has small effect because it is meaningless. However, it is worth noted here that small effect size does not mean that its differences is not important. If we found meaningful significance, Adjusted Standardized Residuals (ASR) was used to measure sources of differences detected by significance relations of chi square. ASR values that more than +3.30 or less than -3.30 (at probability level of 99.9%) mean that every cell value is significantly different towards its expected values if there is no association among variables. ASR values (in + or - directions) reflect the range of differences between observed and expected measurement, and only those with absolute values were reported.

3. RESULT AND DISCUSSION
In this IRIS study report, we pay attention to seek various aspects school and out of school experiences that might support or inhibit young people participation to STEM higher education. In addition, the study also measures gender differences in such aspects.

3.1. How important were each of the following school experiences in choosing your course?
School experiences give specific image of STEM education that may influence young people choice regarding future education and career. Figure 1 shows percentage breakdown of ratings on how important were school experiences influence respondents in choosing their STEM courses. It can be stated that overall “interest in subject” is the most important in which around 87% of the cohort rating it as important and very important and about 2% of students believe interest to have been of little or no importance in their decisions. Regarding items related to science pedagogy, lesson that both showing “practical application” (85%) and “relevance to daily life” (80%) are the most important. On the other hand, “field study/excursion” and “experiments/lab work” were not considered to be influential, with around 30% of respondents rating each of these activities as very important.
In general, “students’ interest in subject” is the key factor influencing their decisions to choose STEM education and career. This finding is not new, though, as educators we need to know how to motivate students to engage in meaningful science learning and to develop activities, both in and out of class, that engage students to apply and to relate science into daily life. In this case, providing experiment or lab work is not enough, students seem to seek fruitful learning, rather than doing prescriptive activities. In addition, it is likely that field study and excursions will attract more females to STEM courses. About 60% within female respondents regarded this item as important. We would argue that it is not the way why students have low motivation entering and engaging in school science, rather it is the way how we show them the good image of both science and scientist. Field study/excursion is likely perceived by female respondents as giving them opportunity about how scientists work in real world. In this case, field study or excursion and other outreach programs can be undertaken in two directions: girl only program or mixed program. The activity itself should consider the balance in the participation (boys and girls students) and presentation (of male and female scientists). Moreover, school-industry linkage should be maintained in order to make field study or excursion into realization. Therefore, school and industry can work on collaboratively from preparation to evaluation. Specific attention in developing such program is to
provide opportunities and challenges, for girls in particular, regarding studying and working in science.

3.2. How important were the following persons in choosing your course?

The question asked students to rate the importance of key influential persons surrounding them. Figure 2 shows the percentage breakdown of ratings on these items. It is likely that students considered their parents, both mother (79%) and father (78) as equally the most important. Meanwhile, teacher is ranked the third in which they rated this item around 63% followed by siblings 52% as important. However, students were less likely to rate friends as important (45%). It is interesting to note that students considered school counselor and career advisor as having little importance that guided them to choose STEM courses; only 15% regarded as very important. It seems that school counselor and career advisor had little influence on students’ decision making.

Table 2 summarizes mean ratings of male and female respondents on these items. Based on Chi-square tests, there were three items identified as having associations with sex differences. First, significantly more males than expected rated ‘father or step father’ as at midpoint of five-scale rating (neutral) and the effect size was medium. Second, significantly more males than expected rated ‘siblings’ as at midpoint of five-scale rating (neutral) and the effect size was small. Third, significantly more females than expected rated ‘career advisor’ as important and the effect size was medium.

In addition to school-experience, influential others also contributed to the way students make their decision of choosing STEM courses. In this regard, family support is important that parents, both father and mother, and interestingly siblings. Moreover, our finding on this aspect reveals that family factor is more influential than school factor as represented by teacher and career advisor. Both categories have different association as perceived by male and female respondents. Boys are influenced strongly from home, a challenge that gives rise to improve classroom practice on the part of science teacher in order to make aligning support. However, to increase girls’ interest it is likely that the role of school career advisor needs to be emphasized. School counselors should realize the very nature of their works of understanding and promoting children development in respect to gender equality and equity and children’s future priorities and aspirations.

\[
\chi^2(4) = 0.002 < 0.05 = \alpha; p<0.001; \text{Cramer’s } V= 0.194; \text{ ASR } = 3.2.
\]

\[
\chi^2(4) = 0.045 < 0.05 = \alpha; p<0.001; \text{Cramer’s } V= 0.148; \text{ ASR } = 2.1.
\]

\[
\chi^2(4) = 0.028 < 0.05 = \alpha; p<0.001; \text{Cramer’s } V= 0.156; \text{ ASR } = 2.7.
\]
Table 2. Mean ratings of male and female respondents on items relating to the question: “How important were the following persons in choosing your course?”

<table>
<thead>
<tr>
<th>How important were the following persons in choosing your course?</th>
<th>Females</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother or step-mother</td>
<td>4.16</td>
<td>4.38</td>
</tr>
<tr>
<td>Father or step-father</td>
<td>4.08</td>
<td>4.41</td>
</tr>
<tr>
<td>Good teachers</td>
<td>3.64</td>
<td>3.83</td>
</tr>
<tr>
<td>Friends (including boyfriend/girlfriend)</td>
<td>3.26</td>
<td>3.3</td>
</tr>
<tr>
<td>Siblings or other relatives</td>
<td>3.34</td>
<td>3.6</td>
</tr>
<tr>
<td>Careers advisors in school</td>
<td>3.14</td>
<td>3.44</td>
</tr>
</tbody>
</table>

3.3. How important were each of the following in choosing your course?

IRIs study also concern about how important were media and out of school activities influence students’ choices (Figure 3). It is likely that science competition was the most important than others (63%). Science festival (62%) and popular science television channels (61%) were regarded more important after science competition. Popular science book and magazine was rated 58%, meanwhile science museum (47%) and science fiction books or movies (49%) were rated less than science book and magazine (58%). Interestingly, computer games item was rated as the least important and it seems this item has to do with gender difference.
Most respondents valued such science competition as science olympiad that had influenced them to continue their study. Such a view is reasonable due to government is promoting many science competition events even from the earlier stage of children’ schooling. In this case, government attempts to promote science through Olympiad has worked quite well. However, as educators we should be aware of two coin sided of science olympiad. It might be good for those are talented in science while it might also give ‘hard’ image for science to pursue science for all agenda.

As our measure has shown that question regarding media and outreach activity are rated lower than influential persons and school experience. Accordingly, we would argue that government, school and society should utilize resources such as library and museum and ICT. It is clear that boys have spent time for computer games, although its impact to influence students’ interest to science is questionable. So far, private television channels have reached broader audiences and it is likely be nicely incorporated if school, media corporations, private sectors and government can work together to promote fruitful image of science by using available resources such as school library.

3.4. How important are the following factors to your future?

In addition to school-related experiences, our study also asked students to rate the importance of a range of items regarding their priorities for the future. Figure 4 shows the percentage
breakdown of students rating pertaining to their future aspirations and priorities. It is likely that almost 98% of respondents considered “developing myself” and “using my talents and abilities” as the most important one. The two items represent personal priorities along with ‘doing something I am interested in’ (94%). On the other hand, there are items representing social oriented priorities: working with something that important for society, helping other people, and contributing to sustainable development and protection of the environment. Each item was rated respectively around 94%, 96% and 91%. It is interesting to note that while both personal and social priorities were rated at higher level (more than 90%), items related to such financial considerations as job security, earning high income and starting to make money sooner were rated almost below 90%. The least important was starting to make money (84%).

Table 4 shows mean rating of male and female on items concerning their future priorities. It is likely that male and female had different aspirations regarding the importance of both financial and societal benefits according to the result of Chi square tests. First, it showed that significantly more females than expected rated ‘getting a secure job’ as very important, with medium effect size. Second, it was significantly more females than expected rated ‘helping other people’ as very important with medium effect size.

Table 4. Mean ratings of male and female respondents on items relating to the question: “How important are the following factors to your future?”

<table>
<thead>
<tr>
<th>How important are the following factors to your future</th>
<th>Females</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting a secure job</td>
<td>4.17</td>
<td>4.55</td>
</tr>
<tr>
<td>Opportunities to earn a high income</td>
<td>4.32</td>
<td>4.57</td>
</tr>
<tr>
<td>Starting to make money as soon as possible</td>
<td>4.19</td>
<td>4.41</td>
</tr>
<tr>
<td>Working with something that is important for society</td>
<td>4.57</td>
<td>4.72</td>
</tr>
</tbody>
</table>

\[ \chi^2 (4) = 0.008 < 0.05 = \alpha; p<0.001; \text{Cramer’s V}= 0.176; \text{ASR} = 3.6. \]

\[ \chi^2 (3) = 0.013 < 0.05 = \alpha; p<0.001; \text{Cramer’s V}= 0.155; \text{ASR} = 2.6. \]
Helping other people & 4.6 & 4.77 \\
Contributing to sustainable development and protection of the environment & 4.49 & 4.6 \\
Doing something I am interested in & 4.64 & 4.69 \\
Using my talents and abilities & 4.76 & 4.73 \\
Developing myself & 4.76 & 4.73 \\

It is interesting to note that students still have an idealistic view of their future and it is positive one. The interrelationship of personal and social benefits represents both their aspirations for a balance contribution and their critical voice to current environmental and societal issues. However, in particular girls tended to seek at the same time a secured job that gives them chance to help other people. This implies that to attract more females to male-occupied jobs the profession should make sure both job security and kind of contribution the profession should give to help people. It is the reason why so many females are aspired to work in the health sectors such as nurse or physician.

4. CONCLUDING REMARKS

Our study highlights key important features. As literature has suggested, this study is concerned with the crucial role of identity in educational choice. As Henriksen puts it “In order to choose a STEM education, a student must be able to see her/himself as a ‘STEM person’”. Basically, males and females have different perception and orientation, different features of choices. In this regard, parents, teachers and the whole society should be aware of these differences to foster gender equity. More specifically, parents and teachers, including career advisor, should aware of the important role they can play in young people’s identity work and educational choice process.

Our understanding towards educational choices may help us to better support young men and particularly women with variety of approaches. It includes developing school science curricula and supporting science teachers that foster interest both for female and male students; and engages education and industry sectors to work closely through strategic partnership.

First, it is promising to develop and support outreach program of which a network of school-university-industry can work together to educate young people about working condition of science careers and role model of scientists, particularly for girls. Second, such linkage also may engage in establishing comprehensive (both online and offline) resources particularly for school career advisors, parents and students in order to have useful, reliable and updated advise for STEM courses and careers. Third, curriculum developers, teacher trainers and educational leaders should encourage teachers to develop strategies that incorporate science into daily life and practical applications. At the same time, our study suggests that teachers’ influence and impact should be enhanced because students relied much on persons within their family circles than powerful and inspiring teachers in making decision about choosing STEM courses and career. At bottom line level, science teachers should improve their teaching practice. On the other hand, school and parents should work closely in supporting in and out of schools activities that would productively engage teachers-students-scientist in a collaborative learning.

References

GENDER DIFFERENCES AND JUNIOR HIGH SCHOOL STUDENTS CONCEPTUAL MASTERY BY USING VIRTUAL LABORATORY MEDIA ON OPTIC TOPICS

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ABSTRACT

Based on previous research, virtual laboratory or multimedia interactive can improve students conceptual mastery and boys students has outperformed in physics subject than girls, boys also outperformed than girls in multimedia interface. So, this research is done to investigate gender differences and junior high school students conceptual mastery by using virtual laboratory media on optic topics. Based on the purpose of this research, the method that is used in this research is quasi experiment with the subject are two classes, VIII A (Boys class) and VIII B (Girls class) in Pribadi Bilingual Boarding School Bandung and the research design is matching pretest-posttest comparison group design. The research instrument that is used is item test for conceptual mastery, interest in physics questionnaire, and virtual laboratory learning media which is developed by the researcher. To develop virtual laboratory learning media, storyboard of media should be developed then, it should be judged. After that, virtual laboratory can be made by using macromedia flash. Data processing was done by independent sample t-test using Microsoft Office Excel 2010 and SPSS 18. The result of this research shows $t_{computation} > t_{table}$, $t_{computation} = 3.348 > 2.020$ that there are significant differences conceptual mastery improvement between boys class and girls class by using virtual laboratory in optic topics. The level cognitive between girls class and boys class are different and interest in physics also has differences between boys class and girls class. For whole result, boys has outperformed in conceptual mastery and level cognitive than girls class. Also boys have more interest in physics than girls class.

Keywords: gender differences, conceptual mastery, virtual laboratory

1. INTRODUCTION

Science deals with how to find out about the systematic nature, so science is not just the acquisition of knowledge in the form of facts, concepts, or principles, but also a process of discovery. It allows learners to develop an understanding of a wide range of natural phenomena, science concepts and principles that are useful and can be applied in everyday life (Badan Nasional Standar Pendidikan, 2006). In reality and implementation, that expectation is not happened. Because, science in implementation is delivered on by one way direction means that teacher give science material only lecturing. This statement is in a line with the result of preliminary observation in the school that
becomes experiment schools. The students learn science especially physics only by lecturing and they rare to do experiment activity because of lack the equipment. This is strengthening by the data taken from interview with physics teacher. Actually, if the experiment activity want to take a place it will take a long times. Teacher also said that they do not know about laboratory virtual that can be easily taken from the internet or interactive CD. Because of that, there is bad impact to the conceptual mastery result of students in physics subject. This is the data from final examination in physics lesson year 2012-2013 of Pribadi Bilingual Boarding School students grade VIII. The data shown that students achievement above graduation standard, boys class has 29.4% out of 100%, while girls class got 21.7% out of 100%. It is shows that their achievement in physics lesson still low.

So, to overcome all of the obstacle that occurs in physics lesson at Pribadi Bilingual Boarding School Bandung is develops a media that provides students to get their self-learning activities, construct their understanding of physics concept by themselves, and also media that can make them easier to comprehend the physics concept, especially in optic topics that tends to cumulative and contains abstract concept. The media is virtual laboratory as multimedia interactive. Following research about virtual laboratory has already researched, which is stated that virtual laboratory or multimedia interactive can improve students conceptual mastery (Yahya et al, 2008; Hutagalung et al, 2007; Tuysuz, 2010; Herga and Dinevski, 2010; Putri et al, 2013). This research different with previous one because it uses single sex school, international curricula (Turkey), and the same treatment in each class.

2. RESEARCH METHOD

Based on the objectives of this research are to determine the differences of students conceptual mastery based on gender differences through virtual laboratory learning media in optic topic. The method is used method of Quasi experiments. In this method, the research carried out on two groups of students VIII Grade, girls class (VIII B) and boys class (VIII A). Research design is can be called matching pretest-posttest comparison group design. Research instrument that is used are item test as objective test with the cognitive value as C1 (Remembering), C2 (Understanding), C3 (Applying), C4 (Analyzing), C5 (Evaluating), 30 items after instrument analysis. Questionnaire for measuring students approval level of interest in physics, this questionnaire uses likert scale form. That consists of 5 categories of scale, Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD). Virtual laboratory learning media that is used is software which is developed by the researcher. First, storyboard should be made based on curriculum, optic topics material, and characteristic of junior high school students. Then, the storyboard is judged. After revision, virtual laboratory learning media can be made by using macromedia flash helped by animator based on the storyboard. Then, make it in one package software to apply at school for the treatment in the research.

Data analysis that is used are normality test and homogeneity test. The hypothesis test is independent sample t-test. The research problem of this research, “Is there any differences of student’s conceptual mastery improvement based on gender differences by using virtual laboratory learning media in optic topic?” Also with research questions: 1) how is the differences of conceptual mastery improvement between boys class and girls class by using virtual laboratory learning media in optic topic?; 2) how is the differences of students interest in physics lesson especially on optic topics between female and male students? The hypothesis of this research is:

H₀ : There is no differences of students conceptual mastery improvement between boys class and girls class by using virtual laboratory media on optic topic.

H₁ : There is differences of students conceptual mastery improvement between boys class and girls class by using virtual laboratory media on optic topic.

3. RESULT AND DISCUSSION

3.1. Concept Mastery

Based on analysis pretest data from item test, recapitulation of students conceptual mastery result has been provided in the table 1. below:

<table>
<thead>
<tr>
<th>Component</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys Class</td>
<td>Girls Class</td>
</tr>
<tr>
<td>N</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>Average</td>
<td>41,58824</td>
<td>40</td>
</tr>
<tr>
<td>SD</td>
<td>8,124491</td>
<td>5,510321</td>
</tr>
<tr>
<td>Max score</td>
<td>57</td>
<td>50</td>
</tr>
</tbody>
</table>
The importance of learning is that students can relate their learning with their prior knowledge. It is one of the importance in constructivism theory that learning has already had prior knowledge (Dahar, 2006). There is no learning with empty heads. Prior knowledge has relationship with what students learn now. That statement is in line with Piaget cited (Dahar, 2006) that from assimilation process, someone use a structure or their ability that has already exist to respond to the problem in their environment. Because average pretest score of boys class and girls class has no significant differences, so to investigate conceptual mastery improvement result, it is discussed in average of posttest score and it is obtained after the treatment given to the students. It means that, students in both class have already learned optic topics using virtual laboratory media. So, posttest score can figure the differences of conceptual mastery improvement of students because of pretest score are not too different. The result of average posttest score in boys class and girls class has significant differences. Boys class has higher value of average posttest score than girls class. Actually there is an improvement of conceptual mastery for both of class. Because virtual laboratory can improve conceptual mastery of students. It is strengthen by previous research result that said virtual laboratory can improve students achievement (Tuysuz, 2010). The differences of conceptual mastery improvement in girls class and boys class also because of gender differences between them. Where class with specific gender domination will have specific perception and attitude to learning process of physics lesson using virtual laboratory media.

There are several differences of boys class and girls class in conceptual mastery, here there are the level cognitive of students in each classes. Level cognitive itself based on Bloom taxonomy revised. The level cognitive of students are obtained from N-gain score of each level cognitive. This is the following table of level cognitive in boys class and girls class:

<table>
<thead>
<tr>
<th>Level Cognitive</th>
<th>N-gain Boys Class</th>
<th>N-gain Girls Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 (Remembering)</td>
<td>0,68</td>
<td>0,52</td>
</tr>
<tr>
<td>C2 (Understanding)</td>
<td>0,61</td>
<td>0,41</td>
</tr>
<tr>
<td>C3 (Applying)</td>
<td>0,35</td>
<td></td>
</tr>
<tr>
<td>C4 (Analyzing)</td>
<td>0,7</td>
<td></td>
</tr>
<tr>
<td>C5 (Evaluating)</td>
<td>0,71</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1 : \( N\text{-}G\text{ain} \) Value of Boys Class and Girls Class Level Cognitive

Diagram 4.4 above shown that, average \( N\text{-}gain \) score of boys class is the highest one. Every classes, either boys class or girls class has the improvement of conceptual mastery in each level cognitive. Based on the result of cognitive level or level of thinking from each conceptual mastery items is found that girls class has outperformed in C1 (Remembering) level, and got lower value in C4 (Analytical). While boys class has outperformed in C5 (Evaluation) and got lower value in C1 (Remembering).

C5 (Evaluation) in level of cognitive include in higher order thinking means that students can construct their cognitive ability in complex thinking. This also include in analytical level of thinking or we can said that C4. Boys has outperformed than girls in this level because the
characteristic of brain that develop in each boys and girls students. It is because left hemisphere of brain in boys developed more than girls.

From whole result, conceptual mastery in physics lesson using virtual laboratory both boys class and girls class has an improvement significantly. For level of thinking also both of classes has improvement in higher order thinking. So, it can be said that virtual laboratory is very good media to improve higher order thinking of students during a lesson. According to Chaeruman cited (Warsita, 2008) virtual laboratory media can train and develop higher order thinking means that train them to think in higher order thinking level.

3.2. Students Interest in Physics

The questionnaire of students interest in physics consists of four indicators that consider to the students interest in physics lessons. This is the following overall result of interest in physics between boys class and girls class:

![Figure 2: Percentage Result Interest in Physics Questionnaire](image)

From diagram above, it is shown that boys has higher value of approval level or agreement than girls. It can be said that boys class has more interest in physics lesson than girls. Either it uses virtual laboratory in learning physics or general opinion about physics learning in everyday lesson. To make it clear, Here there are the results of interest in physics based on indicator.

![Figure 3: Percentage Results of Interest in Physics Based on Indicator](image)

VR : Indicate interest in physics learning through virtual laboratory learning media.
LF : Indicate interest in physics learning through virtual laboratory learning media.
IO : Indicate students interest and optimistic in learning physics.
NP : Indicate students are not interested and pessimist in learning physics.

Interest in physics generally result from the questionnaire, it is obtained that boys class has more interest than girls class. Because physics consists of mathematical reasoning, logical, analytical, logical thinking, abstract things, and etc. So, the value of approval level in statement physics is a difficult and boring lesson, boys class has lower for approval value while girls class has higher approval level value. It is caused by boys tends to use his left hemisphere of brain. Left hemisphere of brain here controlled the logical thinking, abstract things, numerical arrangement, analytical thinking (Wood, 2009).

3.3. Discussion

This research has goals to compare conceptual mastery between boys class and girls class, where the conceptual mastery is learning outcomes after Junior High School students has already learned optic topic using virtual laboratory learning media. The improvement of students conceptual mastery differences in this learning because of several factor. One of the main factor that support the
result of students conceptual mastery students improvement is they learn physics lesson using virtual laboratory learning media as learning sources and communication process.

Virtual laboratory is included in learning media as communication process in learning. Based on Warsita (2008) in other terms, learning media is communication media that is used in learning contextual to reach the learning goals. This learning media also can improve conceptual mastery of students.

Based on research Sovocom Company from America, found that there is relationship between type of media with human memory to absorb and save a message, type of media with brains’ ability in memorize of message. For instance ability of memorize in audio media 10%, visual (visual text) 40%, and audiovisual 50%. While, the ability to save the message based on audio media less than 3 days is 70%, more than 3 days is 10%, media visual (visual text ) less than 3 days is 72%,more than 3 days is 20%,and audiovisual media less than 3 days is 85%, more than 3 days is 65% (Warsita, 2008). Virtual laboratory is also appropriate with physics subject that its scope comes from macroscopic until microscopic, something that cannot be seen by naked eyes. Especially in optics topics that has microscopic scope is about light rays and particle of things.

The differences of improvement of conceptual mastery of girls class and boys class is significant. Boys class also got higher value than girls class. The differences of conceptual mastery result because of gender differences between them. Actually, both boys and girls use their lobus of their brain but in different composition. Left hemisphere of brain in boys developed more than girls. Left hemisphere of brain here controlled the logical thinking, abstract things, numerical arrangement, analytical thinking (Wood, 2009). While women has better develops in her right hemisphere of brain. Right hemisphere of brain that control the intuitive, artistic, imaginative, holistic, and others task and visual include in remember (Wood, 2009).

The other reason that makes average result of improvement in conceptual mastery of physics lesson is different, virtual laboratory as the media that is used. Virtual laboratory is including in computer media. Using computer in education for learning, in this cases girls students consider that computer is used to do something useful for them. Girls in multimedia interface or computer tends to visual design of multimedia itself, while boys is tends to navigation and control the multimedia or computer itself (Passig and Levin, 2000). This statement is in a line with Turkle et. Al cited (Johnson, 2006) that boys consider the computer is something that has to be comprehended, while girls use a computer as tools to reach a goal or doing their task, and expected that computer can make them comfort. Besides that, The research said 84% of girls consider computer as a tools to reach their goals or tools to give them a freedom in creativity, while boys that agree with that, only 33% (Pease and Pease, 2008). This is in a line with observation during learning physics in this research between girls class and boys class. Boys class tends to obey the rules in the computer laboratory, always concentration to the media and has fast movement when they use virtual laboratory media. While in girls class, they tends to break the rule in computer laboratory class during a physics lesson. Most of them open the other tabs beside virtual laboratory application media, for example tumbler, twitter, etc.

Interest in physics generally result from the questionnaire, it is obtained that boys class has more interest than girls class. Also conceptual mastery result that is obtained, boys has outperformed than girls class. The result of conceptual mastery is caused by interest in physics. Actually interest is one of motivation that comes from inside the students itself (Dimyati and Mudjiono, 2009). Motivation is very important in learning process to improve learning outcomes of students during learning process especially in conceptual mastery. This statement is in a line with conceptual mastery result which is stated that there is a difference of conceptual mastery improvement between boys class and girls class with boys class has greater result than girls class. It is also proven by the correlational result between interest in physics and conceptual mastery. The results said that there is a significant relationship between both variables because the results is less than 0.005, it is 0.001. And they have strong correlation within them with the value 0.648. For coefficient determination is about 42% means that conceptual mastery of students can be explained by interest in physics, but the rest of it 58% can be explained by other factor there are genders, process of learning, multimedia interfaces, and body anatomy of their brain development. Conceptual mastery has relationship with interest in physics also proven by the result of (Lai, 2011) said that motivation is related to achievement and intrinsic motivation can predict math achievement.

4. CONCLUSIONS

Based on research result that has already discussed, comprehensive conclusion can be obtained. First, overall there is significant difference of students conceptual mastery using virtual laboratory in optic topics between boys class and girls class. Boys class outperformed than girls class...
in conceptual mastery using virtual laboratory in optic topics. Second, interest in physics result, boys class has more interest in physics than girls class. But for overall both of class has good approval level of interest in physics through virtual laboratory learning media.

References
THE READINESS AND THE ABILITY OF ELEMENTARY SCHOOL TEACHERS IN INTEGRATING SCIENCE INTO OTHER SUBJECTS ON THE IMPLEMENTATION OF 2013 CURRICULUM

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[2] STMIK Bina Mulia Palu

ABSTRACT
This study was aimed at getting description on teachers’ mindset, readiness, and ability in integrating science into other subjects on the implementation of 2013 Curriculum. Participants of this study were master and targeted teachers in Palu who participated in 2013 Curriculum training. Techniques of data collection were using documents review, observation, video recording, and interview. The result of research showed that (1) teachers were still lack of insight on how to transfer the value of soft and hard skills through the teaching of science which were integrated into other subjects that include attitude competence, skills, and knowledge; (2) teachers’ competence in comprehending integrated-thematic has not been developed; 3) the standard of process which focus on exploration, elaboration and confirmation has not been implemented through processing, inferring, and creating approach. Instead, the implementation is still on how to present, to observe, and to ask; (3) teachers were still have inadequate knowledge on how to apply authentic assessment to assess students’ attitude, skills and knowledge based on the process and result of teaching and learning.

Keywords: 2013 curriculum, science, standard of process, integrated-thematic

1. INTRODUCTION
The Development of 2013 Curriculum was conducted based on several main principles [1]. First, students’ learning outcomes’ standard are generated from needs. Second, standard of content is generated from students’ learning outcomes standard through subjects-free core competence. Third, whole subjects should contribute to form student’s attitude, skill, and knowledge. Fourth, subjects are generated from the targeted competence. Fifth, whole subjects are bounded by core competence. Sixth, coherence of learning outcomes, content, learning process, and assessment. The consistent application of these principles are essential in creating a successful implementation of 2013 Curriculum.

In order to prepare teachers in implementing the 2013 Curriculum, the Ministry of Education and Culture has conducted training for teachers who are positioned as master and targeted teachers. There are three important aspects in the training, i.e training material, the goals of training, and the use of training method. Teacher as ‘a driver’ of educational practice should be given many opportunities to continue to learn, to solve problems, and to improve their creativity from both other people and their own experiences. Therefore, it is very important during the implementation of 2013 Curriculum, teachers have better understanding of the curriculum supported by a suitable system.

In this research, teachers’ readiness and ability become significant points as a basic platform in designing programs that support the implementation of 2013 Curriculum. The research focused on the development of teachers training program to support the implementation of the curriculum.
Through this context, the system of training programs for elementary school teachers will be
developed. The system includes materials, components, and the structure of training based on
teachers’ readiness and ability. The improvement and completion process of this complementary
training system are based on data of teachers’ readiness and ability. The data could be obtained
through survey and field study (observation) related to implementation of the curriculum, eitherby
a teacher who are master teachers or teachers who had received training by master teacher. This
paper focuses on describing the results of preliminary study that has been carried out.

2. RESEARCH METHOD
The research applied descriptive approach with the main aspects of study were the readiness
and ability of teachers in integrating science into overall structure of teaching and learning in the
thematic framework.

Research data were obtained through documents analysis, observation, and interview. The
purpose of documents review was to recognize ideal condition that should be referred or followed by
all stakeholders, mainly trainers and teachers in implementing the curriculum. The process was also
an effort to strengthen the researchers’ insight in conducting analysis of observation and interview
results. The reviewed documents were publicly tested materials, socialization materials, training
handout, and teacher’s and student’s books. The observation was conducted during master teachers’
training in Makassar, targeted teachers’ training at LPMP Sulawesi Tengah and the teaching and
learning activities conducted by targeted teachers in their schools in Palu. The interview was
conducted to know teachers’ perception on the implementation process of 2013 Curriculum.

3. RESULT AND ANALYSIS
3.1. General Description of Preparation of 2013 Curriculum Implementation
The development of 2013 Curriculum was based on the ideas of nation’s future challenges
that characterized by sciences century, knowledge-based society and perception of society, the
development of knowledge and pedagogic, the future competence, and the trend of negative
phenomena. In order to support the curriculum implementation, training for teachers was conducted.
This training was aimed to prepare the teachers of in the first, fourth, seventh, and tenth grade
to implement the curriculum in 2013/2014 Academic Calendar.
The teachers training in 2013 Curriculum implementation was began by
the preparation activities (students’ and teachers’ book, and
handout of teachers training), teachers training,
monitoring, supervision, and evaluation of implementation. The involvement of the first and fourth
grade teachers was initial step of 2013 Curriculum implementation in elementary school. Their
involvement was appointed by Ministry of Education and Culture by considering the limitation of
time and funding. The number of teachers from Sulawesi Tengah who participated in the training is
described in Table 2.

<table>
<thead>
<tr>
<th>No.</th>
<th>Grade/Subject</th>
<th>School</th>
<th>Masterteacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>IV</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Sport and Health Education</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Culture, Art and Skill</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total 12</td>
</tr>
</tbody>
</table>

A day after the training of master teachers in Makassar, the following training was also held for
the targeted teachers organized by LPMP Palu for 4 days. The number of participants is listed in Table 3.

<table>
<thead>
<tr>
<th>No.</th>
<th>Grade/ Subject</th>
<th>School</th>
<th>Tageted Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.2. Description of Lesson Plan Development and the Implementation of Science Integration into Other Subjects in Thematic Teaching

Observation results in some schools are presented in the followings:

3.2.1. SDN 10 Palu

At SDN 10 Palu, lesson plan and schedule of theme and subtheme for each month were designed by teachers’ working-group. In the implementation of the lesson plan, there was no integration of science with other subjects based on chosen theme. The teaching, the use of media and student’s worksheet were still partial based on the subjects. Scientific approach was not understood well by the teacher. The scientific approach in teaching in elementary school for each theme or subject should include exploration of information through observing, asking, experimenting, analysing and presenting data, and followed by analyzing, reasoning, then concluding and creating. Authentic assessment was still not implemented by teachers. May be, it was not yet having meaning for teachers to determine the best manner in order to all students could achieve goal of teaching, although in different time unit.

By referring to result of teacher’s and student’s book review, it could be seen that the teachers have not understood the student’s learning outcome, core competence, and basic competence that suitable to the theme, so that students’ needs based on their psychological conditions were not optimum in the learning process.

3.2.2. SDN 03 Palu

We observed on first and fourth grade teachers as targeted teachers that have participated in the training at LPMP. The targeted teachers have showed the ability in designing lesson plan based on student’s learning outcome, basic competence, and indicator that have coherence with theme. However, the scientific approach has not been seen in learning process. The teachers tend to follow the their old habits when explained each material based on the sequential of theme. Authentic assessment has not been conducted by teachers to assess knowledge, attitude and skill aspects.

3.2.3. SDN 06 Lolu

The teaching activity at SDN 06 Lolu Palu has already used LCD projector, but only limited in displaying lesson plan text given to students. The development of theme has not met the considered criteria of integrative-thematic. The criteria was still based on the teacher’s or student’s book. They have not integrated several subjects by considering students’ condition. Teachers have not considered students psychological level of development. Another constrain in implementing 2013 Curriculum at the school is the number of students of each class. There 47 students in each class. Grouping technique by teacher was also ineffective.

3.2.4. SD Swasta Karunadipa

Before the implementation of 2013 Curriculum, SD Karundipa applied subject-based teaching for IV, V, and VI grade. Even for lower classes, there were some meetings conducted by applying subject-based teaching. Until early of September 2013, teacher has still taught theme 1, sub theme 2 of 4 sub themes. The development of teaching themes seem very slow. It should include 4 themes at the semester. The slowness was caused by the materials that included in the themes were too much.
3.3. The Analysis of Effectiveness

The initial design of 2013 Curriculum training implementation should engage lecturers as representative of higher educational institution and LPMP as partner of teachers in implementing the curriculum. However, the implementation of training was only followed by master teacher candidates and representative of LPMP. The researchers conducted observation of training activity began from Makassar (for East Indonesia Region) until the implementation of the curriculum at school or classroom in Palu. To support the observation data, we interviewed some master teachers, national trainers and targeted teachers as the main actor of the successful implementation of the curriculum. Based on documents review, it could be explained that one of characteristics of 2013 Curriculum that should be understood by teacher as participant of training was equilibrium between knowledge, attitude, and skill in building soft skill and hard skill that included in learning outcome at each educational level, as described in Figure 1.

Based on documents review, it could be explained that one of characteristics of 2013 Curriculum that should be understood by teacher as participant of training was equilibrium between knowledge, attitude, and skill in building soft skill and hard skill that included in learning outcome at each educational level, as described in Figure 1.

![Figure 1: The portion of attitude, knowledge and skills](image)

For learners in the lower educational level, portion of learning to build hard skill is lower than portion of learning to build soft skill. It means teachers in the elementary school level need to emphasize on soft skill. Portion of attitude and behavior development is stressed to build national character of learners. They should have good behavior but we may not avoid the knowledge aspect that could be developed from many learning sources.

From the observation and interview on master and targeted teachers, it was obtained description of teachers’ insight. It could be stated that the understanding of teachers on the equilibrium between soft and hard skill was relatively low. The challenges faced by teachers in the implementation is in how to conduct teaching and learning activity based on thematic-integrated approach that is consistent with student’s learning outcome, core competence, basic competence, and indicator as main goals of educational processes in the 2013 Curriculum framework.

In the conceptual level, thematic teaching is begun by constructing themes for one year. Based on the themes, teacher should analyze all learning standard of outcomes that are generated to core competence and basic competence, and should construct indicator of each subjects in the each grade. After that, teacher should construct the relationship between the indicator and the theme. From the mapping of the relationship, teacher should make network of basic competence and indicator from each constructed theme. After the forming of all themes net for during one year, teacher constructs thematic syllabi and lesson plan.

Based on the observation, the selection and the determination of developed theme at elementary schools are described in several points below:
a. The constructed theme was still based on book and not integrated for many subjects. In this context, science integration into other subjects or otherwise could not be seen.
b. The meaning of theme was not analyzed carefully for students to learn.
c. The level of psychological development of students has not been considered yet.
d. The development of themes in text books does not meet most of students’ need.
e. The chosen themes have not fully considered authentic phenomena during the teaching and learning process.
f. Teachers are lack of creativity to choose media and learning sources.

4. CONCLUSIONS

Based on the findings presented above, the following conclusion is formulated:

a. The teachers are still lack of understanding on how to integrate soft skills and hard skills into the teaching of science.
b. Teaching management and competence development have not been developed through integrative-thematic.
c. The standard of process focusing on exploration, elaboration, and confirmation has not been implemented through analyzing, inferring, and creating approach. It is still carried out only by presenting, observing and asking.

Authentic assessment which is used to assess attitude competence, skills and knowledge on the basis of process and result is not well implemented by the teachers. Teachers are still lack of comprehensive understanding of what authentic assessment is.

References

CONSTRUCTING STUDENTS’ CAPABILITY FOR 21ST CENTURY THROUGH SCIENTIFIC APPROACH

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ABSTRACT

Previous studies prove that students’ goal in learning science has not met the basic competencies as directed in the curriculum. One cause of the failure is caused by a lack of inaccuracy teachers in selecting and applying appropriate learning strategies with learning objectives to be achieved. To achieve the goal of learning science, Curriculum 2013 has directed the implementation of a scientific approach in all subjects. The importance of implementing scientific approach to learning because scientific approach is able to provide facilities to the students personally in doing scientific work. They are: 1. Observing various phenomena that exist around the students, asking about things that are related to the observed phenomena, 2. Questioning about various reasons and possibilities in connection with observations and questions/problems arise, try to look for and find solutions to the problems faced (observations based learning), and build a network through collaboration with other students (collaborative learning). Several studies have attempted to optimize the result competence of students through scientific approaches such as project-based learning, problem based learning, inquiry and discovery stated that the 21st century student competencies which include productive, innovative, creative and affective can be accommodated.

Keywords: students’ capability 21st century scientific approach

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1. INTRODUCTION

There are some researches concerning the outcome of the students in elementary school, junior high school, and senior high school or even in the university level. The result shows that the outcomes of the students do not meet the basic competency yet as directed in the curriculum. The reasons are very complex. The following are the previous research related to the fail of reaching the goal of learning in the school.

The results showed that the conditions for learning biology high school students in North Minahasa district in general have not shown the results to an improved understanding of the concept of optimal, higher order thinking skills, and process skills. Survey data show that : 1) there are 9 (42.86 %) teachers who are teacher centered learning, the teacher is only expressed as a product and biology students memorize information, 2) students studying biology at a low cognitive, 3) students are not accustomed to develop the potential of thinking, 4) learning less attention to affective and psychomotor domains, 5) an evaluation of the product—oriented leaning that emphasize the cognitive domain and less judging process, and 6) applied learning strategies teacher leads to less higher order thinking skills.

Kawuwung (2011a) also reported the results of the survey in North Minahasa regency. Data showed that teachers who are not familiar with cooperative learning strategies as many as 6 (28.57 %) teachers who do not give an answer as much as 2 (9.52 %) teachers. Teachers who are not familiar with cooperative learning strategies open as many as 13 (61.90 %) teachers. Teachers who do not understand the concept of understanding as much as 7 (33.33 %) and as many as 12 (57.14 %) teachers gave no response. Teachers who do not understand the higher order thinking skills by 5
In addition, other studies indicate that the learning undertaken by teachers in the classroom is still largely centered on the teacher (teacher-centered) 63.64 %, while the student-centered learning (student-centered) 36.36 %. The survey results relating to Reciprocal Teaching learning strategies shows that 17.65 % of teachers know this strategy and 82.35 % do not know, while learning strategies Think Pair Share 36.37 % 63.63 % teachers know and do not know the teachers (Efendi, 2011).

Based on the results of this survey, it indicates that the quality of teachers in managing the learning is low and needs to be improved to achieve mastery of learning outcomes and competencies specified other. Teachers simply move information from the students themselves, without involving students in the process to obtain the information. The criteria for mastery of learning outcomes specified in the curriculum is individualized and classical, meaning students who earn a grade of 75 in one class as much as 85 % (Hutabarat, 2005; Wulandari and Muchlis, 2011).

Beside the above circumstances, another survey of learning activities conducted on high school teachers in Sidoarjo also showed that the ability of teachers to empower metacognitive skills possessed by the students are still lacking, the results of the survey show that there are 11.37 % of teachers who have developed the skills metacognition, while another 88.63 % have never empower students to use the skills of metacognition in learning activities in the classroom. Most of the teachers who have not applied metacognition skills because they do not understand the steps in empowering metacognition skills, and have not realized that metacognition skills can affect student learning processes and outcomes (Effendi, 2011). Metacognition skills can be achieved, if teachers develop learning strategies that engage students actively in the process of obtaining information and knowledge gained.

Yowono (2012) states that the use of learning strategies in the classroom has a great potential to increase metacognition skills and student learning outcomes. Another opinion was also expressed by Nindiasari (2004) which states that learning with metacognition skills approach need to develop students' ability to improve cognitive learning outcomes. Susantini (2004) states that metacognition through students to become independent learners, cultivate an attitude of honest, brave to admit mistakes, and can significantly improve learning outcomes.

2. NEW CURRICULUM

Curriculum in Indonesia has been changed several times. Nowadays, the curriculum will be changed with an integrative thematic concept that will be implemented to elementary school, junior high, high school, and vocational school. The curriculum named the new curriculum 2013. It appears as a respond to need of education for tomorrow. This new curriculum 2013 is the next step of the previous competence-based curriculum in 2004 and KTSP in 2006. This new curriculum 2013 covers attitude competence, knowledge, and skills all at once.

The new curriculum is designed to enable students to be creative—not to achieve a good intelligence. This aim is stated by the government considering several thoughts from previous curriculum, Bloom’s theory Kartwol’s theory and Dyers’ theory. This last theory states that:

a. 2/3 creative capability is required through education and the rest, 1/3 is from genetic.

b. In contrast, 1/3 intelligence is required through education and the rest, 2/3 is from genetic.

c. The creative capability is required through:

1) Observing:
   a) Collecting the data/information from facts.
   b) Studying the characteristic of the data.
   c) Collecting the information from various scientific sources, namely: book, journal, magazine, newspaper, and internet.

2) Questioning:
   a) Proposing fact-based questions or problems
   b) Criticizing the materials
   c) Inquiring things happen

3) Experimenting:
   a) Designing an experiment.
   b) Implementing theory to practice
   c) Measuring the variables
   d) Testing the hypothesis

4) Associating:
   a) Seeing the relations of variables or measures
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3. PROBLEM-BASED LEARNING

Problem-based learning (PBL) is an instructional method that encourages learners to apply critical thinking, problem-solving skills, and content knowledge to real-world problems and issues. Instruction is more student-centered and less teacher directed than in traditional classrooms. Students assume considerable responsibility for their own learning by locating much of the information they need to solve the problems at hand (Levin, 2001:1).

In the process, the students found the opposite problem of a real event that assembled in the form of descriptions, video footage or real events in the real form. Students learn to look for more focused information and determine their own way of learning (learning strategies) to obtain information. Incorporation of lessons with the issue of a problem in everyday life is able to assist students in making appropriate solutions to these problems. Students are required to take a decision among several alternative solutions are found. Problem-based learning is a learning model that refers to the problem. Before the students learn the material, they are given a problem. Problem has been that students find what they need to learn new knowledge before they can solve the problem (Hymark, 2003).

Problem-based learning is one strategy that emphasizes the learning activity of students in using all the senses and imagination to absorb and understand the concepts being studied. Learning is expected to be a positive influence on the development of critical and creative thinking of students, so they are much more work than just to hear and receive information. As a result, students can apply academic knowledge and skills in a variety of environmental conditions and outside the school in order to solve the problem.

In the problem-based approach, complex, real-world problems are used to motivate students to identify and research the concepts and principles they need to know to work through those problems. Students work in small learning teams, bringing together collective skill at acquiring, communicating, and integrating information. Problem-based instruction addresses directly many of the recommended and desirable outcomes of an undergraduate education: specifically, the ability to do the following:

a. Think critically and be able to analyze and solve complex, real-world problems
b. Find, evaluate, and use appropriate learning resources
c. Work cooperatively in teams and small groups
d. Demonstrate versatile and effective communication skills, both verbal and written
e. Use content knowledge and intellectual skills acquired at the university to become continual learners

4. PROJECT-BASED LEARNING

Project—based learning is an innovative learning model, which emphasizes contextual learning through complex activities (CORD, 2001; Thomas, Mergendoller & Michaelon, 1999; Moss & Van Duzer, 1998). This project—based learning is one kind of learning strategies that enhance the students in order to achieve high order thinking skill. However, this learning strategy is recognized for a few teachers. This is relates to Boss statement below.

Traditional project-based learning is still a relatively new idea for most teachers. It's not the kind of instruction most of us ever had a chance to experience as students. Bringing digital-age technologies into the picture makes it even less familiar. For teachers who have never observed technology-rich, project-based learning in action, it may be hard to even imagine what a 21st-century project looks like (Boss, 2007: 14). The focus is on learning the concepts and core principles of a discipline of study, involving learners in problem-solving and investigative tasks meaningful activity to another, giving learners the opportunity to work autonomously to construct their own knowledge,
and actualize it into the real product (Thomas, 2000; Buck Institute for Education, 2001 in Nurhadi, 2003).

Project-based learning—powered by contemporary technologies—is a strategy certain to turn tradition classroom upside down. Then students learn by engaging in real-world projects, nearly every aspect of their experience changes. The teacher's role shifts. He or she is no longer the content expert, doling out information in bite-sized pieces. Student behavior also changes. Instead of following the teacher's lead, learners pursue their own questions to create their own meaning (Boss, 2007: 11).

Project-based learning provides many of the same benefits as problem-based learning. Projects combined with web delivery of the final project can be enticing and rewarding way to disseminate project outcomes to the remainder of the class near the end of the semester. Students are eager to create their own web documents with multimedia elements; of course, some are less skilled than others, and the collaborative aspect of a web-based group project builds on the strengths and diminishes weaknesses of the individuals involved. In SCEN103, students research a current topic of scientific or technological relevance to the course using the same methods of finding and evaluating resources and synthesizing contributions from multiple individuals into a coherent whole as they execute in solving PBL problems. This aspect of the course has been well received by students (see Ref. 6 for an archive of student projects) (Barbara, 2001: 113).

5. INQUIRY/DISCOVERY LEARNING

Discovery process not only enlivens lessons based on or driven by laboratory investigations, but also builds deeper understandings of science content. This instructional approach offers a framework for structuring lessons so that students can and will become more deeply engaged and take greater interest in their learning.

References

Halimah, Umu. 2012. The Implementation of Inquiry Strategy With Lesson Study Based to Improve the Learning Motivation and Biology Achievement of Ten Graders SMAN 1 Kepanjen Malang. Graduate program on biology teaching. State University of Malang.
THE EFFECT OF USING PROBLEM-BASED LEARNING MODEL TO STUDENTS’ CONCEPT MASTERY AND CRITICAL THINKING SKILLS IN SPECIATION CONCEPT

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ABSTRACT
The implementation of a learning method will greatly affect the ability of students to master the concepts and thinking skills. Speciation concept is abstract that requires a method which can facilitate students in understanding the concepts of speciation and motivate students to be actively engaged in learning. Problem-based Learning (PBL) is expected to improve students’ concept mastery and critical thinking skills in learning speciation concept. The subjects of this study were the students of Biology Department of Universitas Kuningan. The aim of the study was to find out the effect of using the problem-based learning model to students’ concept mastery and critical thinking skills in speciation concept. The writer used the experimental method in the form of quasi-experimental research. The study used one experimental class and one control class. The research design used in this research was The Matching-only Pretest-Posttest Control Group Design. The dependent variables were students’ concept mastery and critical thinking skills. The t-test result of concept mastery showed the significance $0.036 < 0.05$ and t-test for students’ critical thinking showed the significance $0.000 < 0.05$, it can be concluded that there was found the differences of concept mastery and critical thinking skills in experimental and control classes. The Gain index of concept mastery is 0.392 in the medium category and The Gain index of critical thinking is 0.463 in the medium category. Of the overall student responses can be concluded that almost all students responded positively to the use of problem-based learning model (PBL) on the concept of speciation.

Keywords:
- concept mastery
- critical thinking ability
- problem-based learning
- speciation concept

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1. INTRODUCTION
The implementation of a learning method will greatly affect the ability of students to master the concepts and thinking skills. Speciation concept is abstract that requires a method which can facilitate students in understanding the concepts of speciation and motivate students to be actively engaged in learning. In the classroom learning process, teachers do not only have to know the knowledge but also they have to consider the aspects of learning holistically to support the realization of the students’ potential development. Accordingly, it is stated in the PERMENDIKNAS (Peraturan Menteri Pendidikan Nasional) No. 41 year 2007 about standard process of education stated that the process of learning in each unit of primary and secondary education should be interactive, inspiring, fun, challenging and motivating the students to actively participate and provide enough space for innovation, creativity and independence based on talents, interests and physical and psychological development of students.

The way of teaching application will greatly affect the ability of students to educate themselves. The use of appropriate learning models can encourage the students’ interest to subject of teaching. It also can motivate students in doing the assignment and facilitate students to understand the lesson that allow students achieve better learning outcomes.
Evolution lecture material contains many concepts that are abstract (it cannot be observed directly without any aids), one of which is the concept of speciation. For example, the concept of speciation is to discuss the process of species formation that includes mechanisms of speciation pre-reproduction and post-reproduction, this concept is difficult to study directly because of higher level thinking skills needed to understand the things that are abstract. These conditions can cause difficulties for students to understand the concepts and can eventually lead to students’ misperceptions. Therefore, the evolution concept delivery need to be considered to use learning model which can trigger the students’ motivation to be actively engaged in the learning process. One alternative learning model that enables the development of thinking skills of students in solving the problem is Problem Based Learning (PBM).

Problem-based learning does not only expect students to listen, take notes, and then memorize the subject matter, but through PBM students are expected to actively think, communicates, search and process data which eventually they can conclude it. Learning activities are geared to resolve the problem. PBM puts the problem as a keyword from the learning process.

2. RESEARCH METHOD

The method used in this study is quasi-experimental type experimental method (quasi-experimental research). Independent variable is the problem-based learning, while the independent variable is the mastery of concepts and critical thinking of students. Design used in this study is the Matching-only pretest-posttest control group design, with design as follows:

Table 1: Research Design The Matching-only Pretest-Posttest Control Group Design

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>M</th>
<th>O</th>
<th>X</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>M</td>
<td>O</td>
<td>C</td>
<td>O</td>
</tr>
</tbody>
</table>

2.1. Population and Sample

2.1.1. Population

The populations of the study were the students of Biology Department of Faculty of Teacher Training and Education in Kuningan University (UNIKU).

2.1.2. Sample

The samples in this study were students in six semesters in Biology Program, FKIP UNIKU. Two classes 3B and 3C were chosen about 65 students. Data collection Sampling used is random cluster sampling.

2.2. Research instrument

The instrument used in this study is designed to analyze the effect of learning Speciation using Problem Based Learning model to students’ concept mastery and critical thinking skills in the form of multiple choice test questions with five options of level choice C3-C6 choice, open-ended essay questions and student responses questionnaire to problem-based learning.

2.3. Data Analysis Techniques

a. Normality Test
b. Homogeneity Test
c. Hypothesis Testing
d. t-test (initial test and final test) with a gain index formula:

\[
\langle g \rangle = \frac{\text{posttestscore} - \text{pretestscore}}{\text{max imumscore} - \text{pretestscore}}
\]

the result was interpreted using index gain \(\langle g \rangle\) by Meltzer classification (2002) as follows:

Table 2: Gain Criterion

<table>
<thead>
<tr>
<th>Gain Index</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>( g &gt; 0.7 )</td>
<td>High</td>
</tr>
<tr>
<td>( 0.3 &lt; g &lt; 0.7 )</td>
<td>Medium</td>
</tr>
<tr>
<td>( g \leq 0.3 )</td>
<td>Low</td>
</tr>
</tbody>
</table>
e. Data analysis of students’ responses questionnaire

The data obtained were presented by calculating the relative frequency using the formula:

\[ p = \frac{f}{n} \times 100\% \]

Description:
- \( p \): Frequency percentages are being sought.
- \( f \): number of cases (the number of frequencies or number of people)
- \( n \): Percentage of questionnaire

3. RESULT AND DISCUSSION

Results of this study analyzed some of the data obtained, recapitulated and presented, further elaborated to answer the research questions. Data resulting from this research include: (1) scores of pre test and post test of concept mastery on the concept of speciation experimental class and the control class, (2) critical thinking scores at the beginning and end of the study in the experimental class and the control class, (3) student responses questionnaire to the problem-based learning. The results of the normality test data pre test, post-test and N gain of concept mastery in experimental class and the control shown in Table 4.1.

Table 4.1: Normality Test Results Pre test, Post test and N-Gain Score of Concept Mastery in Experimental and Control Classes

<table>
<thead>
<tr>
<th>Data</th>
<th>Class</th>
<th>N</th>
<th>Concept Mastery Test</th>
<th>P-value</th>
<th>( \alpha )</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre tests</td>
<td>Experiment</td>
<td>30</td>
<td></td>
<td>0.114</td>
<td>0.05</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>35</td>
<td></td>
<td>0.200</td>
<td>0.05</td>
<td>Normal</td>
</tr>
<tr>
<td>Post test</td>
<td>Experiment</td>
<td>30</td>
<td></td>
<td>0.200</td>
<td>0.05</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>35</td>
<td></td>
<td>0.200</td>
<td>0.05</td>
<td>Normal</td>
</tr>
<tr>
<td>N-Gain</td>
<td>Experiment</td>
<td>30</td>
<td></td>
<td>0.392</td>
<td>0.05</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>35</td>
<td></td>
<td>0.190</td>
<td>0.05</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Test results of data normality with Kolmogorov-Smirnov test showed that the data pre, post test and N-Gain for the experimental class and control class has a P-value greater than \( \alpha = 0.05 \) level. Ho is accepted which means that the data came from a normally distributed population. Thus, the data pre-test scores, post-test scores and N-gain for the experimental class and the control class derived from a normally distributed population.

Test results of Levene’s test of homogeneity of data pre-test, post-test and N-Gain concept mastery using a significance level of \( \alpha = 0.05 \), and P-value is obtained as shown in Table 4.2.

Table 4.2: Test Results of Homogeneity Pre test, Post test and N-Gain Score Concept Mastery in Experimental and Control Classes

<table>
<thead>
<tr>
<th>Data</th>
<th>Class</th>
<th>N</th>
<th>Concept Mastery Test</th>
<th>P-value</th>
<th>( \alpha )</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre tests</td>
<td>Experiment</td>
<td>30</td>
<td></td>
<td>0.837</td>
<td>0.05</td>
<td>homogeneous</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>35</td>
<td></td>
<td>0.620</td>
<td>0.05</td>
<td>homogeneous</td>
</tr>
<tr>
<td>Post test</td>
<td>Experiment</td>
<td>30</td>
<td></td>
<td>0.604</td>
<td>0.05</td>
<td>homogeneous</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>35</td>
<td></td>
<td>0.362</td>
<td>0.05</td>
<td>homogeneous</td>
</tr>
<tr>
<td>N-Gain</td>
<td>Experiment</td>
<td>30</td>
<td></td>
<td>0.392</td>
<td>0.05</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>35</td>
<td></td>
<td>0.190</td>
<td>0.05</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Based on table 4.2 noted that the concept of student mastery of the experimental class and the control class at significance level \( \alpha = 0.05 \) level meet the criteria of P-value \( > \alpha = 0.05 \) level, this means that the variance of the data pre test, post-test and N-gain experiment class and control class is homogeneous. The results of calculations of data normality test pre test, post test and N-gain students critical thinking skills of shown in Table 4.3.
Table 4.3: Normality Test Results Pre test, Post test and N-Gain Score of Critical Thinking in Experiment and Control Classes

<table>
<thead>
<tr>
<th>Data</th>
<th>Class</th>
<th>N</th>
<th>Critical Thinking Skills Test</th>
<th>P-value</th>
<th>A</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre tests</td>
<td>Experiment</td>
<td>30</td>
<td></td>
<td>0.200</td>
<td>0.05</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>35</td>
<td></td>
<td>0.039</td>
<td>0.05</td>
<td>Abnormal</td>
</tr>
<tr>
<td>Post test</td>
<td>Experiment</td>
<td>30</td>
<td></td>
<td>0.265</td>
<td>0.05</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Kontrol</td>
<td>35</td>
<td></td>
<td>0.112</td>
<td>0.05</td>
<td>Normal</td>
</tr>
<tr>
<td>N-Gain</td>
<td>Experiment</td>
<td>30</td>
<td></td>
<td>0.470</td>
<td>0.05</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Kontrol</td>
<td>35</td>
<td></td>
<td>0.300</td>
<td>0.05</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Test results of data normality with Kolmogorov-Smirnov resulted that pre-test scores of control class was not derived from a normally distributed population because P-value 0.039 is less than α = 0.05, while the experimental class pretest scores derived from a normally distributed population with a P-value 0.200 is greater than α = 0.05 level. Similarly, for the post-test scores of control and experiment class has P-value greater than α = 0.05 level so that the data came from a normally distributed population. Test results of Levene's test of homogeneity of data pre-test, post test on students' critical thinking skills using a significance level of α = 0.05, and P-value is obtained as shown in Table 4.4.

Table 4.4: Test Results Homogeneity Pre test, Post test Score of Critical Thinking Skills

<table>
<thead>
<tr>
<th>Data</th>
<th>N</th>
<th>Critical Thinking Skills</th>
<th>P-value</th>
<th>A</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre test</td>
<td>30</td>
<td></td>
<td>0.110</td>
<td>0.05</td>
<td>Homogeneous</td>
</tr>
<tr>
<td>Post test</td>
<td>30</td>
<td></td>
<td>0.210</td>
<td>0.05</td>
<td>Homogeneous</td>
</tr>
</tbody>
</table>

According to the table 4.4 noted that the scores of pre test and post test of students' critical thinking skills at the significance level α = 0.05 level criteria P-value ≥ α = 0.05 level, this means that the variance of the data pre-test and post-test is homogeneous. Results of student concept mastery of control and experiments are presented in Figure 4.5.

Based on Figure 4.5 is known that the result of the control class pre test on concept mastery higher than the grade in the experiment class, the pre test average for control class was 22 and 20 for experiment class. For the average of post-test in experimental class was higher than the control class, that was 28, while the average score of post test of the control class was 26. Similarly, for the value of N-Gain of concept mastery, experimental class had a higher percentage than the control class that was 37% or 0.37, while the control class has N-Gain value by 19% or 0.19. From Figure 4.5 also appears both the experimental group and the control group increased student' concept mastery. However, an increase in N-Gain in the experimental group with the control group on the concept of speciation significantly different. From the analysis of N-Gain on the concept that overall speciation obtained experimental group students who received PBL models had N-Gain higher than students in the control group who received model of learning problem solving. This suggests that speciation
concept mastery, students who received the learning with PBL models higher than the students who received learning model of problem solving. The Analysis results of students' critical thinking skills are presented in Figure 4.6.

Based on Figure 4.6 is known that the average of pre-test scores of students’ thinking skills in experimental class was 22 and control class was 21 had an average that almost similar. After learning, the scores achieved in experimental class was 35 and 30 for control class. Similarly, for an average score of N-gain of critical thinking skills 47% for experimental class and control class 30%, or 0.30 both were in the medium category. The improvement of concept mastery in the experimental group is better than the control group with N-Gain 0.18.

Difference of the improvement of concept mastery in each cognitive level between experimental group and control group can be explained that in the experimental group experienced a significant increase due to using a model student-centered learning in the problem-based learning model with more learning activities enable students where the concepts learned and discovered by students through investigation, so that learning becomes more meaningful. This is similar to what is proposed by Piaget (Arends, 2008: 46) that learning should involve various common situations where children experimenting or trying out different things to see what happens, manipulate objects, symbols, ask questions and seek the answer itself, reconcile what it finds at a time with what he found at another time, comparing its findings with the findings of other children.

PBL is also based on the thought of Brunner (Arends, 2008: 48), in particular the idea of scaffolding is a process in which learners are helped to overcome certain problems that are beyond the capacity of its development with the help of professors or people who are more capable. PBL also provides ample opportunity for students to develop thinking, problem solving, and intellectual skills, learn to play as an adult with real experiences or situations that are tailored, and become self-sufficient student (Delisle, 1997:12).

Because the data obtained were normally distributed and homogeneous then the hypothesis test conducted with parametric statistical test t sample Independent Test. Concept mastery t-test result showed significance 0.036 <α (α = 0.05 level), so it can be concluded that there are significant differences of concept mastery between the control and experimental classes. The result of t-test indicates the significance of critical thinking 0.00 <α (α = 0.05 level), so it can be concluded that there are a significant differences in critical thinking skills between the experimental class and the control class. Thus the use of PBL models can improve concept mastery and critical thinking skills of students. So the results of this study reinforce the theory put forward by John Dewey (Arends, 2008: 46) which states that PBL makes students think, solve problems, and become autonomous learners.

4. CONCLUSIONS

Based on the research that has been done suggests that problem-based learning (PBL) affect the students concept mastery and critical thinking skills of to the concept of speciation. Hypothesis test results show that after learning using PBL models, students’ concept mastery and critical thinking increased and showed significantly different results with learning using conventional learning models in this case is problem solving. So the results of this study reinforce the theory put forward by John Dewey (Arends, 2008: 46) which states that PBL makes students think, solve problems, and become
autonomous learners. Of the overall student responses can be concluded that almost all students responded positively to the use of problem-based learning model (PBL) on the concept of speciation.

References
IDENTIFICATION OF STUDENTS’ DIFFICULTIES IN BILINGUAL CLASS OF BIOLOGY

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ABSTRACT
The study entitled “Identification of Students’ Difficulties in Bilingual Class of Biology” is a descriptive study (case study). This research is motivated by the importance of the analysis of the students’ difficulties in biology lesson. This study aims to identify the students’ difficulties in bilingual class of biology. Sample of this study were students and teachers of biology in grade 10th. Techniques of data collection are using direct observation, questionnaires and interviews. The results showed that the students' motivation in biology lessons is good categories (53%) and students’ interest in biology lessons is good categories (49.6%). Students and teachers revealed that learning in bilingual class of biology not yet effective (61% of students, 83% of teachers). However, students and teacher agree that learning of biology use English or bilingual (61% of students, 67% of teachers). Students’ difficulties in bilingual class of biology are more difficult to understand the biology term in English, difficult to understand how the teacher explained biology term in English, and less accustomed to follow in biology lessons in English. Teachers’ difficulties in bilingual class of biology are limited English speaking, understanding the biology matter in English, and there is no link to be able to connect to overseas.

Keywords: difficulties biology bilingualclass

1. INTRODUCTION
Nowadays the science and technology are developing and the demands of improving the quality of education. The government, through the Directorate of Secondary Education and Directorate of High Education (Directorate of Primary and Secondary Education) Ministry of Education to implement Mathematics and Science learning in English. Bilingual class has a standard in learning process which includes the number of students in the classroom, curriculum, assessment, methodology, teaching materials, media, and learning models. English is used as the language of instruction in general subjects the learning process in school, such as mathematics, science (physics, biology, chemistry), social sciences (history, geography, economics), and art. The curriculum used for bilingual class is applicable national curriculum, also can do the addition, expansion, and deepening of the curriculum in accordance with international developments. Since the 2000s, some universities in Vietnam started using English as major language in their courses. English is an obligatory subject since grade 3. Recently, some high schools in Vietnam started teaching subjects in English as supplement to regular classes (Nguyen, 2013).
Implementation of bilingual class is certainly encountered obstacles such empirical facts that have been revealed through the print media and has become the public opinion that the readiness of bilingual class in Indonesia is still questionable given bilingual class program is still relatively new. Readiness include: (a) instructional materials, (b) learning support materials; (c) of teachers especially in the use of English and (d) supporter the school system including student recruitment patterns that affect the readiness of students participating in learning bilingual class, raising concerns on learning outcomes and understanding of the subject matter. Successful implementation of these programs can often be seen on the effectiveness of the learning process (Handayani, 2007). Based on the above, the authors are interested to write a case study (field study) entitled “Identification of Students’ Difficulties in Bilingual Class of Biology”.

2. RESEARCH METHOD

This research is a descriptive study (case study). Subject of this study are student and teacher of biology at the bilingual class in SMAN “X” Bandung. Techniques of data collection are direct observation, questionnaires and interviews. Direct observation to SMAN “X” Bandung on the first day of the case study. After look around the school and talk with the schoolas part of he curriculum and teacher of biology, itis also an observer at the time asking for permission to conduct research. Questionnaire which was distributed on the identification of student difficulties in bilingual class of biology. The questionnaire aims to identify the students’ motivation, students’ interest, and effectiveness of biology lesson in bilingual class. Interviews were conducted with the biology teacher to know the different kinds of difficulties in biology learning in bilingual class. Interview questions consisted of five questions that feedback of biology teacher on the effectiveness of biology learning in bilingual class, agree or not when biology learning using bilingual, barriers to biology learning in bilingual class, how to overcome barriers to biology learning in bilingual class, advantages and disadvantages of biology learning in bilingual class.

3. RESULT AND ANALYSIS

Research data obtained include the number and percentage from questionnaire answers of identification of student difficulties in bilingual class of biology at SMAN “X” Bandung. The number and percentage of data presented in tables and graphs.

a. Students’ Motivation in Biology lesson

Below are presented the data of questionnaire answers on the students' motivation in biology lesson at SMAN “X” Bandung.

<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The first time I learned biology lesson, I believe that it is easy for me.</td>
<td>Strongly disagree</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 %</td>
</tr>
<tr>
<td>2.</td>
<td>Content of biology lesson delivered by bilingual would be beneficial for me.</td>
<td>0 %</td>
</tr>
<tr>
<td>3.</td>
<td>I am confident that I will succeed in biology lessons.</td>
<td>3 %</td>
</tr>
<tr>
<td>4.</td>
<td>I will successful or unsuccessful in biology lesson, it depends on me.</td>
<td>0 %</td>
</tr>
<tr>
<td>5.</td>
<td>To achieve my goal, it is important for me to succeed in biology lesson.</td>
<td>0 %</td>
</tr>
</tbody>
</table>
Data of questionnaire response indicate that the students' motivation in biology lesson at SMAN “X” Bandung is very high. The first time students learn biology lesson, students believe that biology lesson easily. This is because biology is a subject closely related to daily life. In addition, students also found the biology content was delivered by bilingual would be beneficial especially if it will continue to study abroad. Students are sure to succeed in biology lessons and realize that successful or unsuccessful in biology lesson, it depends on the student. In addition, students also realized that in order to achieve goals, it is important for students to succeed in a general biology lesson because they wanted to study medicine.

b. Students' Interest in Biology Lesson

Below are presented the data of questionnaire answers on the students’ interest in biology lesson at SMAN “X” Bandung.

<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Biology in bilingual learning interesting for me.</td>
<td>0 %</td>
<td>45 %</td>
<td>32 %</td>
<td>26 %</td>
</tr>
<tr>
<td>2.</td>
<td>I was excited when participating in biology learning.</td>
<td>0 %</td>
<td>39 %</td>
<td>42 %</td>
<td>19 %</td>
</tr>
<tr>
<td>3.</td>
<td>I am very pleased on biology learning so I want to know more on this subject.</td>
<td>0 %</td>
<td>26 %</td>
<td>58 %</td>
<td>19 %</td>
</tr>
<tr>
<td>4.</td>
<td>On the biology learning, there are things that stimulate my curiosity.</td>
<td>0 %</td>
<td>16 %</td>
<td>55 %</td>
<td>29 %</td>
</tr>
<tr>
<td>5.</td>
<td>Content of biology learning according to my interests.</td>
<td>0 %</td>
<td>39 %</td>
<td>48 %</td>
<td>13 %</td>
</tr>
</tbody>
</table>
Data of questionnaire response indicate that the students' interest in biology lesson at SMAN “X” Bandung is very high. This is demonstrated by the students were excited when participating in biology learning and very pleased on biology learning that want to know more on the subject of biology. In addition, the biology learning there are things that can stimulate the curiosity of students and biology learning content according to students' interests. However, students do not feel interested in biology with a bilingual learning. The cause of which the teacher is not clear in explaining the biology subject in bilingual.

c. Student’s Responses on Biology Learning in Bilingual Class
Below are presented the data of questionnaire answers on the student’s responses on biology learning in bilingual class at SMAN “X” Bandung.

Table 3 Student’s Responses on Biology Learning in Bilingual Class

<table>
<thead>
<tr>
<th>Number</th>
<th>Question</th>
<th>Answer</th>
<th>Do not know</th>
<th>Not yet effective</th>
<th>Quite effective</th>
<th>Been effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Do you think biology learning in bilingual class has been effective?</td>
<td></td>
<td>10 %</td>
<td>61 %</td>
<td>16 %</td>
<td>13 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number</th>
<th>Question</th>
<th>Answer</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Do you agree in biology learning using bilingual?</td>
<td></td>
<td>23 %</td>
<td>13 %</td>
<td>61 %</td>
<td>3 %</td>
</tr>
</tbody>
</table>
Data on students' responses to questionnaires on learning biology in bilingual class at SMAN "X" Bandung shows that in student assess biology learning in bilingual class not yet effective. Contributing factor such as the teacher does not explain all biology subject in English, but only some of the concepts described or written in English. But, students agree that biology learning in the classroom using bilingual. Reason such students in order to increase knowledge, able to compete with the international community, and to continue their study abroad.

d. Teacher’s Responses on Biology Learning in Bilingual Class

Below are presented the data of questionnaire answers on the teacher’s responses on biology learning in bilingual class at SMAN “X” Bandung.

Table 4. Teacher’s Responses on Biology Learning in Bilingual Class

<table>
<thead>
<tr>
<th>Number</th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Do you think biology learning in bilingual class has been effective?</td>
<td>Do not know: 0 %, Not yet effective: 83 %, Quite effective: 17 %, Been effective: 0 %</td>
</tr>
<tr>
<td>2.</td>
<td>Do you agree in biology learning using bilingual?</td>
<td>Strongly disagree: 0 %, Disagree: 16 %, Agree: 67 %, Strongly disagree: 17 %</td>
</tr>
</tbody>
</table>

Figure 4. Teacher’s Responses on Biology Learning in Bilingual Class

Data of interviews responses from teachers about teaching biology in bilingual class at SMAN “X” Bandung show that teachers assess biology learning in bilingual class not yet effective. The cause of which delivery in bilingual learning has not been effective is the use of internet technology is not maximized, references in English share still lacking, a combination of national and international curriculum unclear and complicated administrative systems. But, teachers agree that biology learning in the classroom using bilingual. The reason teachers in order to increase competitiveness among students, increase learning resources (from overseas publishers), has a global perspective, and students can continue on to study abroad.

e. Difficulties on Biology Learning in Bilingual Class

Below are presented the data of questionnaire answers about difficulties on biology learning in bilingual class at SMAN “X” Bandung.

Table 5. Difficulties on Biology Learning in Bilingual Class

<table>
<thead>
<tr>
<th>Student</th>
<th>Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. More difficult to understand the biology term because should interpret it in English.</td>
<td>1. Limitations in English.</td>
</tr>
<tr>
<td>2. Difficult to understand the pronunciation teacher.</td>
<td>2. Not master the English correctly.</td>
</tr>
<tr>
<td>3. Difficult to capture and understand the meaning of the teacher.</td>
<td>3. There is concern students making fun of the teacher because the teacher is not fluent in English.</td>
</tr>
<tr>
<td>4. Do not understand of the biology specific terms in English.</td>
<td>4. There is concern students do not understand the concept of biology in English.</td>
</tr>
<tr>
<td>5. Difficult to understand how the teacher explained in English.</td>
<td>5. Interaction with students is limited due to the limited vocabulary mastery.</td>
</tr>
<tr>
<td></td>
<td>6. Understanding of</td>
</tr>
</tbody>
</table>
Based on data from the questionnaire responses and interviews from student and biology teacher indicate that the difficulty in biology learning in bilingual class is the use of English. Teachers have not implemented the biology learning using English effectively so that students understand the biology concepts is difficult because it must interpret the English term. Pronunciation of teachers is difficult to understand, it is difficult to capture and understand the intention of teachers. Difficult to understand how the teacher explained in English and sometimes there vocabulary that is not understood. In addition, there are also students who are not familiar with the biology learning using English so they do not understand the specific terms of biology in English. Make a feeling of lazy and the disruption friends while biology learning in English.

Ways to overcome barriers of biology learning in bilingual class, teachers are not fully explain biology terms in English, but coupled with Indonesian. Biology learning using bilingual has advantages and disadvantages. The drawback is students do not understand the biology concept harder because they are not familiar with the term in English, while the advantage of them when students are given problems with foreign curriculum, they can do it more easily.

Nguyen (2013) state that develop intensive courses and/or professional development workshops led by content specialists to train teachers to teach their subjects in English. Students should be more aware of the paths in bilingual education that best fit their ability and desire. Findings from research Cimer (2012) state the main reasons for learning difficulties were the nature of the topic, teachers’ style learning, students’ learning and studying habits, students’ negative feelings and attitudes towards the topic and a lack of resources. To overcome these difficulties and make their biology learning more effective, the participants suggested such strategies as teaching biology through the use of visual materials, teaching through practical work, reducing the content of the biology curriculum, using various study techniques, teaching biology through connecting the topics with daily life, making biology learning interesting, and increasing the number of biology questions in the university entrance examinations.

McLaughlin (1992) state that as more and more children enter schools from families in which English is not the language of the home, teachers face the daunting challenge of instructing children who have limited skills in the English language. It is becoming increasingly obvious that this experience is not limited to teachers in certain schools or certain parts of the country. All teachers need to know something about how children learn a second language. Intuitive assumptions are often mistaken, and children can be harmed if teachers have unrealistic expectations and an inaccurate understanding of the process of second language learning and its relationship to acquiring other academic skills and knowledge. As any adult who has tried to learn another language can verify, second language acquisition can be a frustrating and difficult experience. This is no less the case for children, although there is a widespread belief that children are facile second language learners. This is one of a number of myths that this paper intends to debunk.

The field of bilingual special education is a dynamic field of education supported by a strong research base, with established successful models, and with an increasing body of publications. It has played a key role in providing research based knowledge and procedures to assist educators, administrators, and policy makers in making informed decisions regarding: evaluation and placement, program design and delivery, curriculum and instruction, and professional development that specifically addresses the needs of culturally and linguistically diverse students with special needs (Baca & De Valenzuela, 1994). Bilingual education for majority language students is effective in promoting functional proficiency in a second, and even third, language at no cost to the participating students’ native language development or academic achievement. Bilingual education in languages with distinct typologies and orthographic conventions can be effective in achieving a school’s linguistic and academic objectives, although there may be limits on how far both languages can be used for academic instruction (Genesee, 2004).
Facing the rapidly increasing non-native English speaking students in public schools, all teachers are challenged by an urgent need for developing ways to make their instruction responsive to these students' needs. This article reports on a year long study on three biology teachers' language integrated biology teaching to non-native English speaking students. Using extensive classroom observations and interviews, the study provides portraits of these three teachers' working with multilingual, multicultural, and multilevel students. The findings suggest that subject matter area teachers should and can extend their teaching competencies to be sensitive to these students' language and cultural needs and to integrate their instruction for the second language development with their curricular objectives (Dong, 2002).

Research from Prokop et al. (2007) state that in general, girls had more positive attitudes towards biology, especially when learning botany. Gender differences were found in all three aspects explored. Interest toward biology decreased in older students. Moreover, significant differences in attitudes between students reporting biology as their favourite subject indicate that such simple categorisation can be used in further studies. Non-linear distribution of attitudes can be explained as the effect of a different curriculum in each grade. However, other possible explanations such as effects of different educational methods or interaction of biology with other courses used in each grade cannot be dismissed. Students' attitudes toward science significantly alter their achievement in science. There is a significant interaction of students' interest in relation with grade and gender. One of the findings of the study is that, students' attitude toward biology teacher is strongly affected by teacher identity. This can be taken as a hint for future research. That effect of teacher should be included as a parameter to be considered for the studies related to student attitude.

Nesrin (2003) state that to provide meaningful learning, teachers should relate the subject matters to everyday life and connect subject matters to each other since concepts in biology do not exist in isolation. Furthermore teachers should consider students' prior knowledge upon which they should build new coming information. Therefore teachers should be competent on both knowledge of subject matter and knowledge of teaching strategies for the subject matter. Accordingly education in the universities should be improved in the way that beginning teachers feel confident, especially on designing experiment.

4. CONCLUSION

Results of identifying the students' difficulties in biology learning in bilingual class at SMAN “X” Bandung show that students have difficulties in understanding the biology concepts presented in English. Student difficulties in bilingual class of biology are more difficult to understand the biology term in English, difficult to understand how the teacher explained the biology term in English, and less accustomed to follow in biology lessons in English. Teachers' difficulties in bilingual class of biology are limited in English speaking, understanding the biology matter in English, and there is no link to be able to connect to overseas.

ACKNOWLEDGEMENT

1. Students in bilingual class at SMAN 3 Bandung
2. Biology teacher in bilingual class at SMAN 3 Bandung

REFERENCES


THE EFFECT OF PHET SIMULATION MEDIA ON IMPROVEMENT OF STUDENTS’ ACHIEVEMENT IN THE CONCEPT OF LIGHT REFRACTION

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Article Info

ABSTRACT

This study aims to examine the effect of PhET (Physics Education Technology) simulation in the concept of light refraction to develop students’ achievement and determine which cognitive domain more influenced by PhET simulation. The type of this study is quasi experimental method. Matching pretest-posttest comparison group were utilized as research design in this study. The population were all students in grade 8th of Junior High School Students in Cimahi. This study used two classes as experimental group and control group. Random sampling technique is adopted to determined the sample of this study. Experimental group was given treatment by using PhET simulation in the learning process, meanwhile control group was given treatment by PowerPoint presentation in the learning process. The comparison of normalized gain between experiment class (0.74) and control class (0.56) shows that PhET simulation is more effective in increasing students’ achievement in the concept of light refraction. PhET simulation is more influence in analyzing aspect (C4). Based on the result of questionnaires about the use of PhET simulation in learning process, it can be concluded that students enjoy in the use of PhET simulation in learning process.

Keywords:
PhET simulation
PowerPoint Presentation
Learning Achievement
Cognitive Domain
Light Refraction

1. INTRODUCTION

Globalization occurs rapidly and quickly. These developments have an impact on various aspects of human life, not least in the education aspect. In education, this development affects on learning process in the schools. According to Gagne and Briggs (1979) “Learning process as a system that aims to assist students in learning or gain information, it contains a series of events which have been designed, structured to influence and support the students’ learning processes”. The learning process involves two component mutually bound to each others, the teacher as a facilitator and students as an object of the lesson. Rustaman (Sadida, 2011) stated that “Learning process is an activity between teacher-student interaction and mutual communication that takes place in educational situations to achieve learning objectives”. In order for the process of interaction goes well then it takes the media to distribute information provided by the teacher to the student. Therefore, media is including one of the most important components in learning process.

In education, globalization affects on learning process in the schools. It also affects to the technology development in the instructional media which is used in the learning process. However, nowadays still many teacher deliver the content of their learning via “chalk-and-talk” method or which is used to conventional teaching method, they do not use media appropriately whereas technologies are available for them to make change in their learning. Commonly, teacher controls the instructional process, the content is delivered in the class and the teacher tends to emphasize factual knowledge. In other words, “Teacher delivers the content and the students only listen the information...
from the teacher. Thus, the learning model tends students become passive in their learning process” (Orlich, 2010: 243). Kaushik and Agarwal (2012) stated that the conventional teaching method in classroom has limited effectiveness in the learning process. Some limitations which may prevail in traditional teaching method are: (1) Teaching in classroom using chalk and talk is “one way flow” of information. (2) Teachers often continuously talk for an hour without knowing students response and feedback. (3) The material presented is only based on lecturer notes and textbooks. (4) Teaching and learning are concentrated on “plug and play” method rather than practical aspects, (5) The handwriting of the lecturer do not depicts the objective of the subject. (6) There is insufficient interaction with students in classroom. (7) More emphasis on theory without any practical in real situation. (8) It is more about memorizing, not understanding.

Physics is one of the sciences subjects in middle school. Physics study about natural phenomenon that occur daily life and understand the concepts. The concepts is very important and one that should be noted how the concept was understood by learners. However, because there are many teachers who use the traditional teaching method, the concepts expected to be understood by students are not conveyed properly by the form of the lecture. It is because a lot of physics concepts are abstract and complex, so it should be supported by practical activities. However, not all schools have successfully equipped scientific laboratory facilities and there is an absence of equipment that can perform experiments generally only available to show symptoms of the macro. As in optical materials with subtitles, refraction of light, refraction from air to water can only show that the refraction of the light near the normal line, while notable to indicate that far refraction line near from the normal line (incident and refracted angle are difficult to determine). Another problem is the efficiency of the time, doing experimental in the laboratory takes a long time because before doing the experimental teachers must prepare the equipment beforehand, and there are many students who are not able to get equipment due to equipment shortage. So, the concept cannot be reached by the students. It makes students get low achievement in physics subject.

In response to this problem, it is necessary to attempt improvement and innovation in the learning process. One innovation that can solve problems in science learning is teacher needs to make improvements their teaching strategies such as use of computer to deliver material. The other thing, teacher should place their position as a designer and organizer of learning so that students have the opportunity to understand and interpret science through learning activities. In addition, teachers can make learning and teaching more attractive by using interactive learning media to attract students’ motivation in learning science especially in physics. Hence, the role of media is important to make learning process become more life and students more curious in science subject. By choosing the appropriate media will make learning process effectively. An effective learning is a learning process that is not only focused on learner outcomes, but how effective learning process is able to provide a good understanding, intelligence, perseverance, opportunity and quality which can give change behavior and apply it in their lives.

One kind of media that developed because of the development technology is simulation. Simulations give students the opportunity to observe a real world experience and interact with it. According to Michael (Liao and Chen, 2007) simulation can afford learners numerous advantages such as simulations can (1) provide the students with the opportunity to engage in activities that may otherwise be unattainable, (2) enhance academic performance and the learning achievement levels of students, and (3) be equally as effective as real-life hands-on laboratory experiences. PhET is an interactive computer simulation for teaching and learning physics, chemistry, math, and other sciences. The simulations are animated, interactive, and game-like environments where students learn through exploration.

According to Purwanto (2013) stated that the students’ learning achievement whose PhET simulation media better than students’ learning achievement using laboratory equipment in the concept of Electricity and Magnetism. Another study also state the implementation PhET simulation and simple KIT to teach psychomotor skills of students on the subject of optical can to complete psychomotor learning outcomes of students (Prihatiningtyas, 2013). And also based on research results’ Prihatiningtyas (2013) by using the PhET simulation students responded was positive. Another research result state that by using PhET simulation can improve students’ achievement, class that use a synergistic learning with virtual lab PhET media is better which the posttest value is 82. When is compared with students who use learning tools that are synergistic with real lab, the posttest value is only to be 75.

Actually PhET simulation can be carried in several concepts because this media can explain abstract concept become real to the students, so that students can master the concept to be achieved in learning process. In these simulations, students can make connections between real-life phenomena and the underlying science, and seek to make the visual and conceptual models of expert physicists accessible to students. In this research, the author takes the concept of light refraction because
characteristic of light refraction is one of abstract concept in physics and one of phenomenon that occur in daily life.

Based on the background that have been explained on above, the research problem this paper is “How is PhET simulation can improve students’ achievement in the concept of light refraction compare with conventional teaching?”

To make detailed, the research questions of this paper can be described as:
1. How PhET simulation improve students’ achievement in learning concept of light refraction rather than PowerPoint Presentation?
2. How one cognitive ability that is most influence by using PhET simulation as teaching media?
3. How are the students’ response to the use of PhET simulation as media in their learning process?

2. RESEARCH METHOD
2.1. Research Design
This research uses quantitative approach, based on research objectives that want to be achieved then research method that chosen by researcher is quasi-experimental. In this research determines the differences of learning achievement of students when using simulation and using PowerPoint presentation as media in the learning process. In conducted quasi-experimental it used two group, there are experimental group and control group.

The research design in this paper is Matching Pretest-Posttest Control Group. Research designs of this research uses two group, there are experimental group and control group. Experimental group is given the treatment by using PhET simulation as media in learning process, otherwise for control group is given the treatment by using PowerPoint presentation as media in the learning process.

In this design, pretest is given to both of groups then experimental group given the treatment by using PhET simulation for three meeting. Meanwhile control group given the treatment by using PowerPoint presentation. After both of group was given the treatment, then they give posttest. Test instrument that used for posttest is same as instrument in the pretest.

2.2. Subject
This research was conducted at one of Junior High School in Cimahi. This research was conducted in the second semester in 2012/2013 academic year. This research was conducted for two weeks at least 4 meetings in May. Population in this research is all of students in 8th grade. Sample is the representative of population. In this research, researcher used two groups from population as the sample of study. Sample is chosen by random sampling technique. Class of VIIIA is chosen as control group and class of VIIIB is chosen as experimental group.

3. RESULT AND DISCUSSION
In this subchapter will show finding and result of study after conduct the research with comparing two groups which used experimental group is using PhET simulation as media in learning process and control group is using PowerPoint Presentation as media in learning process. Result and finding that will be presented, as follow as: 1) improvement of students’ achievement in learning concept of light refraction, 2) students’ cognitive ability which is most influence by using PhET simulation in learning concept of light refraction, and 3) students’ response to the use of PhET simulation as media in their learning process.

3.1. PhET simulation improves students’ achievement in learning concept of light refraction
Figure 2 shows comparison of N-gain between control and experimental group. N-gain indicates students’ improvement in learning concept of light refraction. N-Gain control group is 0.58 and it is medium category. For experimental group is 0.74 and it is categorized in high category. The result is indeed illustrated that there are highly significantly improvement of students’ achievement.

According to the result, indicates that PhET simulation has positive effect in improving student’s achievement. The result of this study is in line with the result of one research that it generally indicates that simulation increase the academic successes of the students (Mustafa, 2011). The difference improvement between the experimental class and the control class because of both groups get different treatment. Experimental group was treated by PhET simulation in learning process, while the control group by using PowerPoint presentation. It can be concluded that students’ achievement in experimental group greater than control group. Because in experimental group, students can recall their prior knowledge and can explore their finding through simulation and relate it to the concept. According to Michael (Liao and Chen, 2007), simulation can afford learners numerous advantages such as simulations can (1) provide the students with the opportunity to engage in activities that may otherwise be unattainable, (2) enhance academic performance and the learning achievement levels of students and (3) be equally as effective as real-life hands-on laboratory experiences. Simulation gives students the opportunity to observe a real world experience and interact with it. So, they obtain greater score of learning achievement than control group. Meanwhile in control group student only got the concept by using PowerPoint Presentation, so students only learned by listening teachers’ explanation. Because of refraction light is abstract concept, students got difficulties to mastering the concept if only learned by lecturing.

In control group, students cannot explore their knowledge to understand the concept, they only remember the concept from teachers’ explanation and they write it on their worksheet or book. But in experimental group they get direct experience by play simulation to explore their knowledge about light refraction. So, students find the concept by themselves, students is not only remember the concept but also understand the concept. In using simulation, students not only understand the concept, but they get skill to observing some phenomena. By observing the phenomena students will know how the phenomena occurred and how to solve the problems. With that experience student easier to remember, they save the process of simulation in their brain then link it with the concept. Thus, the simulation make students easy to mastering the concept then improve students’ achievement.

3.2. Improvement of Students’ Achievement in Cognitive Domain

The improvement of students’ achievement in cognitive domain is identified from six cognitive domains based on Blooms’ Taxonomy Revised where this cognitive domain spread out into test items. Cognitive domains which measured in this study are Remembering (C1), Understanding (C2), Applying (C3), Analyzing (C4), Evaluating (C5), and Creating (C6).
According to the Figure 3 it shows comparison between experimental group and control group in distribution for each cognitive domain that measured in this study based on their average of N-gain. According to the graph, it is seen that from six cognitive domains, there are two cognitive domains that is not significant. However, there is four cognitive domains that have significant influence in students’ achievement.

There are two cognitive domains which is not significant, they are not significant because the value of normalized gain in control group is greater than experimental group, they are applying ability and evaluating ability. It means that PhET simulation that used in experimental group do not influence in the improvement of students’ achievement in this cognitive domains. In the applying ability, the value of N-Gain both of group is slightly decrease. The value of N-Gain control group is 0.77, while experimental group is 0.74. Even the difference of normalized gain is not too different, but the value of N-Gain control group is greater than experimental group. In the evaluating ability the value of N-gain between experimental group and control group is highly different. N-Gain of experimental group is 0.14, it is categorized as low. Meanwhile N-Gain of control group is categorized as medium, the value of N-Gain control group is 0.635.

Remembering ability, understanding ability, analyzing ability and creating ability get the significant value of N-Gain according to the graph above. Those cognitive domain is called significant because of the value of N-Gain in experimental group is greater than control group. Based on the table 4.2, the value of N-Gain in those cognitive domain are greater in the experimental group. In the graph seen that analyzing ability is the most significant in the value of N-Gain, means that the PhET simulation most influences in the analyzing ability.

This phenomenon is similar with reserach conducted by Efe (2010) that students who were taught with the help of simulation made statically significant improvement in theirs test score on all six levels of Bloom Taxonomy. Unfortunately in this study, PhET simulation gets significant influence in four cognitive domains and two cognitive that do not influenced by PhET simulation. Based on the result can be seen that PhET simulation most influence in analyzing ability of cognitive domain. In this cognitive domain have highly significant result of normalized gain. It can be happen because when they play PhET simulation, they analyze how the process that occured in the simulation. So, simulation not only improve in the achievement but also improve students ability especially in analyse ability.

After determined the improvement of students’ achievement based on cognitive domain, then test item that used in pretest and posttest is classified into three sub content of light refraction concept. There are Laws’ of Refraction, Convergent Lens and Divergent Lens.

To analyze the improvement of students’ achievement in the sub content of light refraction concept, it can be seen in the value of normalized gain in each sub content. According to the table
above, the value of N-Gain for each sub content is interpreted into line diagram. It is shown in the Figure 4.

Figure 4: Line Diagram of Comparison Average of N-gain Between Control and Experimental Group in Sub Content of Light Refraction Concept

Figure 4, shows the comparison between experimental group and control group in the improvement of students’ achievement in sub content of light refraction concept. Those data is compared of N-gain from both of group. In sub content Laws’ of Light Refraction the value of normalized gain in experimental group greater than control group. The value of normalized gain experimental group is 0.867 and control group is 0.732. Normalized gain (N-Gain) in both of class include high categorized.

In Convergent Lens concept the value of normalized gain of experimental group gets higher value than control group. Experimental group gets 0.74 and control group gets 0.55. The last concept in light refractiont is about Divergent Lens. Based on the graph it can be seen that the value of normalized gain (N-gain) in control is lower than experimental group. Experimental group gets 0.65 and control group gets 0.30.

3.3. Questionnaire Analyze

This questionnaire is used to know how students’ response is after use of simulation in the learning process. This questionnaire is given to 27 students in experimental class in the last meeting. There is fifteen questions. Each item statement is calculated from the score total, then percentage it.

<table>
<thead>
<tr>
<th>No</th>
<th>Indicator</th>
<th>Answer (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SA</td>
</tr>
<tr>
<td>1</td>
<td>Object or picture in the simulation can be changed</td>
<td>81.5</td>
</tr>
<tr>
<td>2</td>
<td>I can operate the buttons in the simulation easily</td>
<td>70.4</td>
</tr>
<tr>
<td>3</td>
<td>I can measure the distance of object, image, height of object and image by using ruler that provides in simulation easily.</td>
<td>0.0</td>
</tr>
<tr>
<td>4</td>
<td>I can see the path of light when formed an image clearly</td>
<td>74.1</td>
</tr>
<tr>
<td>5</td>
<td>The image that formed in simulation can be seen clearly</td>
<td>77.8</td>
</tr>
</tbody>
</table>
### Understandability

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>SA</th>
<th>SD</th>
<th>D</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Simulation can clarify the abstract concept become more real and easy to understand</td>
<td>22.2</td>
<td>77.8</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>7</td>
<td>Simulation gives the simple way to recall the concept of light refraction</td>
<td>66.7</td>
<td>18.5</td>
<td>14.8</td>
<td>0.0</td>
</tr>
<tr>
<td>8</td>
<td>Simulation that shown in the computer can help me to understand and analyses the phenomena in refraction concept</td>
<td>81.5</td>
<td>7.4</td>
<td>11.1</td>
<td>0.0</td>
</tr>
<tr>
<td>9</td>
<td>Simulation can help me to know the key terms in the concept of light refraction</td>
<td>7.4</td>
<td>59.3</td>
<td>22.2</td>
<td>11.1</td>
</tr>
<tr>
<td>10</td>
<td>After learning by using simulation as media, I can construct the equation that taught in the concept of light refraction.</td>
<td>85.2</td>
<td>14.8</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

### Enjoyable

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>SA</th>
<th>SD</th>
<th>D</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Learning environment by using simulation is fun and enjoy so I am really curious to learn physics</td>
<td>66.7</td>
<td>33.3</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>12</td>
<td>By playing simulation, my motivation and curiosity in learning physics is increasing</td>
<td>88.9</td>
<td>11.1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>13</td>
<td>In use of simulation still need teacher’s explanation</td>
<td>25.9</td>
<td>37.0</td>
<td>37.0</td>
<td>0.0</td>
</tr>
<tr>
<td>14</td>
<td>Learn by using simulation can make good interaction between students and teacher</td>
<td>25.9</td>
<td>33.3</td>
<td>0.0</td>
<td>40.7</td>
</tr>
<tr>
<td>15</td>
<td>Learn by using simulation can make me more active in the learning process</td>
<td>77.8</td>
<td>14.8</td>
<td>0.0</td>
<td>7.4</td>
</tr>
</tbody>
</table>

Note:
SA: Strongly Agree  D: Disagree
A: Agree  SD: Strongly Disagree
N: Neutral

Based on the result of questionnaire above, it is divided into three categories, first is usability of the simulation, second is understandability about the concept by use of simulation and third is enjoyable when using simulation in learning process. The students’ response calculates in percentage. In the first categorize, statement number 1 gets the highest value of strongly agree (81.48 %). Meanwhile in the second categorize, statement number 10 gets highest value of strongly agree is about 85.18 %. In the last categorized, statement number 12 gets the highest value of strongly agree is about 88.89 %. Compare with three categorized, it can be seen that the enjoyable categorized gets the highest value of students’ response at least 24 students strongly agree if simulation can increase their motivation and curiosity in learning physics.

### CONCLUSIONS

Based on the result and discussion of the data that have been occurred in one of Junior High School in Cimahi at grade 8th about the effect of PhET simulation as media in the learning process in the concept of light refraction can be conclude that:

4.1. The use of PhET simulation in learning process is more effective to enhance students’ understanding of the concept about light refraction than use PowerPoint presentation to deliver the material. Thus, PhET simulation improves students’ achievement in the experimental group. It based on the data obtained in this research, that average of N-Gain in experimental group is 0.74 and control group is 0.58.

4.2. PhET simulation can improve students’ achievement in the concept of light refraction. It can be seen in each cognitive domain that measured in this study is increasing. Based on the result that C4 got the highly significant result of N-gain is 0.85. PhET simulation is most influence in C4 (analyzing ability). Meanwhile, in the sub content of light refraction concept Divergent Lens gets highly significant of N-Gain.

4.3. Students’ respond about using simulation in learning process is positive. Based on the questionnaire that has been delivered in the experimental class and get the data that using PhET simulation in learning process make students easy to understand the concept.

### References


ANALYSIS OF INSTRUCTIONAL INSTRUMENTS: FINDING DIFFICULTIES AND SOLUTIONS IN TEACHING HOW TO USE MONOCULAR MICROSCOPE FOR JUNIOR HIGH SCHOOL (Case Study in SMPN 1 Lembang, Class 7C)

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Article Info

ABSTRACT
Naturally science is based on empirism aspect which includes experiment and observation. Scientist used to do experiment in order to gain scientific product. It is expected by applying experiment and observation in science instruction, student will gain concept by himself so he will get meaningful learning. The usage of microscope as observation equipment in Biology Laboratory Work becomes the vital thing, since direct observation of original object such as cell, bacteria, and other microorganism is solution to make student thinking becomes concrete hence student will get meaningful learning, besides learning through microscope also include to multiple domain activity which student will experience cognitive, affective, and psychomotoric domains simultaneously. Those reasons become the big consideration why should microscope chapter get more attention. The object of this study covers 18 students (n=18) of 7 grade students in SMPN 1 Lembang. Study taken is qualitative study that is case study in which authors explore some cases appear in field, hence by those cases, authors try to overcome the problem and give solution in form of revision of instructional instrument which consist of lesson plan, student worksheet, and scoring rubric. The result of this study is expected to become an illustration for teacher professional development.

Keywords: microscope, lesson plan, student worksheet, scoring rubric, science education, science process skill, instructional instrument, revision

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1. INTRODUCTION
Naturally science consists of the collection of science products (fact, concept, principle, and theory) and the collection of science process (Komalaningsih and Akbar, 2007). Those two aspects are really important in science instruction and the interaction between both of them cannot be separated. But, scientific process in in science instruction in important to be developed because it deals with how scientist work to gain the product of science. Hence, Science curriculum in elementary school and junior high school should be focussed on science process skill. (Rustaman et al, 2005)

According to Romlah (2009), science not only deals with content, but also the procss. Science has several values, attitude and the relation between science, environment, technology, and society. The effective science instruction should also concern with the nature how student learn, and the nature of the content. The nature of science including content, process, attitude, value, those things should be contained in science.
Rustaman (2003) stated that science based on empirism, which is the knowledge exploration which based on experimentation and observation. The scientist does some experiments to gain scientific products. With the application of experiment and observation in science instruction, it is expected for student to find the concept by himself so that he gets the meaningful learning.

Observation is a kind of science process skill which use certain human senses, such as visual sense, sensory, kinesthetic, taste, and smell senses in order to find the relevant facts (Rustaman, et al, 2005). Hence, all of human senses can be developed through observation

By doing observation, someone will able to predict about the probability based on experience or relevant facts (Rustaman, 2003). According to Bryce, observation is the basic skill in science instruction. Hence, observation becomes the important activity in science instruction because it able to support the other skills in science process skill. Observation not only use all of the senses.

The relevant facts frequently can not be observed by special senses because of those limitations. The usage of observation equipment becomes the necessity to enlarge the observation or to increase the quality of gained fact (Rustaman, 2003). Such as a little objects (microscopic) can be observed by using microscope, whether it is by using monocular, binocular, or electron microscope.

The usage of microscope as the observation equipment in biology laboratory work activity becomes the important thing. The direct observation of original object such as cell, bacteria, or unicellular is a solution to make student understanding become concrete hence student will experience the meaningful learning (Trisnayanti, 2010). Besides, the skill in using microscope will involve three domains simultaneously which are cognitive, affective, and psychomotor (Sukardi, 2007). Cognitive domain includes the knowledge of using microscope, and also the usage procedure. The affective domain, including the attitude shown during the activity, while psychomotor including the student ability in using parts of body hence it shows the good performance.

In this research, the measurement of microscope usage in junior high school can not be held by ordinary assessment, but it has to measure student difficulties in using microscope, because the difficulties in junior high school level will influence the other topics which involve microscope as the equipment. Student difficulties should be identified by an effective measurement, not only student difficulties but also the effectiveness of class session should be identified by the appropriate measurement, hence when students facing the difficulties, all systems in the instructional process including student worksheet, teacher performance, lesson plan, facility, class management, and other instructional instruments will be revised to create the appropriate atmosphere which support student understanding.

1.1. Statement of Problem

According to background, statement of problem in this research is stated as the following statements:

1.1.1. By research instrument, what problems found in the class about microscope usage?
1.1.2. How are the appropriate instructional instrument based on students problem in the class about microscope usage?

1.2. Limitation of Research

In accordance to background and also the statement of problem, to make the research is more effective, the author limitate the research as follow:

1.2.1. The instructional instruments that will be revised so they will become appropriate instrument for students are lesson plan, rubric scoring of student performance, and student worksheet.

1.3. Literature Review

1.3.1. The Importance of Assessment

In order to guide student learning, teachers must have command of the subjects that is going to teach. Teacher must know which concepts and skills are central to a discipline, and which are peripheral; they must know how the discipline has evolved into the 21st century, incorporating such issues as global awareness and cultural diversity, as appropriate. Accomplished teachers understand the internal relationships within the discipline they teach, knowing which concepts and skills are prerequisite to the understanding of others. They are also aware of typical student misconceptions in the discipline and work to dispel them. But knowledge of the content is not sufficient; in advancing student understanding, teachers are familiar with the particularly pedagogical approaches best suited to each discipline.

Secondary education is critical to improving the quality of life in developing nations. This education sector plays a pivotal role in promoting rapid economic growth by preparing learners to enter the world of work or to pursue further education and training (including teacher training), and
by preparing young people and at-risk-youth to participate more fully in their own socio-development and the development of society (Bregman and Stallmeister, 2001; Bhuwane, 2001). However, despite the key role of secondary education systems, minimal attention has been paid to this sector in the past few years; instead, greater emphases have been placed on the primary and higher education levels of the system (Lewin and Cai lods, 2001). Secondary schools face greater challenges than primary schools, given the need for learners at the secondary level to move beyond standard academic content to the acquisition of relevant competencies and skills that would better prepare them to function in society. The real challenge is to incorporate relevant knowledge, skills, and experience into the learning and teaching process in a manner that will address the country’s specific growth and development needs.

Assessment is defined as “the process of obtaining information that is used to make educational decisions about students, to give feedback to the student about his or her progress, strengths and weaknesses, to judge instructional effectiveness and curricular adequacy and to inform policy” (AFT, NCME, NEA, 1990: 1). This process usually involves a range of different qualitative and quantitative techniques which involves making expectations explicit and public; setting appropriate criteria and high standards for learning quality; systematically gathering, analyzing, and interpreting evidence to determine how well performance matches those expectations and standards, and using the resulting information to document, explain, and improve performance.

Assessment is a tool to improve learning, to monitor and credential students, and to evaluate some aspects of the education system itself. Assessment plays many roles in education and a single assessment can serve multiple, but quite distinct, roles. Other assessments provide information that can be used by the learner, teacher, or parents to track learner progress or diagnose strengths and weaknesses. Assessments can determine whether learners obtain certificates or other qualifications that enable them to attain their goals.

According to Po and Pham (Mulyana, 2005), the purposes of doing assessment are: a) to diagnose the strengths and weakness of students in learning; b) monitor the development of students; c) determine the level of students’ ability; d) determine the effectively of instruction; e) influence public’s perception about effectively of instruction; f) evaluate teachers’ performances in class; and g) clarify the learning objectives that planned by teacher. in the other words, assessment can be used in the process of learning as well as after learning process has been done and propose feedback for both teacher and students.

Three critical functions of assessment are: Select, Monitor, and Hold Accountable. One of the most important functions is to determine which learners are allowed to proceed to the next level of schooling. Assessment results, along with other measurement data, are also used to track the functioning of different components of the system, and can be used to hold accountable the individuals responsible for those components.

Although assessment is often seen as a tool to measure the progress of individual students, it also allows individuals, communities, and countries to track the quality of schools and educational systems. It is to provide information, which is usually used to support a decision of some sort. By a currently accepted definition, “Validity is an integrated evaluative judgment of the degree to which empirical evidence and theoretical rationales support the adequacy and appropriateness of inferences and actions based on test scores or other modes of assessment” (Messick, 1989: 13).

Assessment is an important thing to do on learning process. According to Baxter (Suwandi, 2010), the reason why it is important to do assessment in learning are: 1) help in comparing one student with another; 2) help to identify student’s achievement in fulfilling certain standard; 3) help in the students’ learning activities; and 4) learning program can be defined as well as control as it is supposed to be.

1.3.2. Appropriate Assessment Instruments

It is important to clarify some of the fundamental principles and issues which need to be applied to the design of any assessment strategies for any module or program.

The most common type of assessment is school-based. These assessments are usually devised and administered by class teachers, although some are the work of the school principal or other instructional staff. Typically, they are aligned with the delivered curriculum and may employ a broader array of media (e.g., oral presentations) and address a greater range of topics than is the case with centralized standardized assessments. They have a decided advantage over centralized assessments in that the results are immediately available to the teacher (and, presumably, the learners) and can influence the course of instruction.

There are some principles on making assessment instruments:
1. Reliability: If a particular assessment were totally reliable, assessors acting independently using the same criteria and mark scheme would come to exactly the same judgment about a given piece of work. In the interests of quality assurance, standards and fairness, whilst recognizing that complete objectivity is impossible to achieve, when it comes to summative assessment it is a goal worth aiming for.

2. Validity

3. Relevance and transferability: There is much evidence that human beings do not find it easy to transfer skills from one context to another, and there is in fact a debate as to whether transferability is in itself a separate skill which needs to be taught and learnt. Whatever the outcome of that, the transfer of skills is certainly more likely to be successful when the contexts in which they are developed and used are similar.

4. Criterion versus norm referenced assessment: In criterion-referenced assessment, particular abilities, skills or behaviors are each specified as a criterion which must be reached. The driving test is the classic example of a criterion-referenced test. Norm-referenced assessment makes judgments on how well the individual did in relation to others who took the test.

5. Writing and using assessment criteria: Assessment criteria describe how well a student has to be able to achieve the learning outcome, either in order to pass (in a simple pass/fail system) or in order to be awarded a particular grade; essentially they describe standards.

One of the assessment tools that work best in class activity is rubric. Rubric is a multi-purpose scoring guide for assessing student products and performances. This tool works in a number of different ways to advance student learning, and has great potential in particular for non-traditional, first generation, and minority students. In addition, rubrics improve teaching, contribute to sound assessment, and are an important source of information for program improvement.

There are three steps in designing a rubric:

1. Identifying Performance Criteria. The first step in developing a rubric is to identify the criteria that define the performance. Three to six criteria seem to work best. It is not so many that it overwhelms the memory and meaningful distinctions in the performance can’t be made. Important consideration is that the performance to be assessed should be observable and measurable.

2. Setting Performance Levels. The second step in the process is to decide how many levels of performance are appropriate for the assessment. Typically, rubrics have from three to six rating levels. What drives the choice of the number of levels is the purpose for the assessment. The fewer the levels of performance for the rater to consider, the greater the reliability and efficiency in scoring the performance. The more levels, the lower the reliability in scoring and the more time it will take for raters to make the decision. If, however, the primary purpose of the assessment is formative, or to give feedback to learners to support them in improving their performance, then more performance levels (and more performance criteria) give the learner more specific information about the features of the performance that need attention.

3. Creating Performance Descriptions. The third step in the process is to write a description. Purpose to provide enough information to guide the creation and scoring of the project, but not so much that it overwhelms the reader or the performer. Parallel structure across descriptions for each criterion (e.g., delivery) is important. The more parallel the descriptions are in form and content, the more dependable and efficient the scoring will be.

As rubrics contribute to student learning and program improvement in a number of ways, some benefits of rubric are:

1. Rubrics make the learning target more clear. If students know what the learning target is, they are better able to hit it (Stiggins, 2001).

2. Rubrics guide instructional design and delivery. When teachers have carefully articulated their expectations for student learning in the form of a rubric, they are better able to keep the key learning targets front and center as they choose instructional approaches and design learning environments that enable students to achieve these outcomes (Arter & McTigue, 2001).

3. Rubrics make the assessment process more accurate and fair. By referring to a common rubric in reviewing each student product or performance, a teacher is more likely to be consistent in his or her judgments.
4. Rubrics provide students with a tool for self-assessment and peer feedback. When students have the assessment criteria in hand as they are completing a task, they are better able to critique their own performances (Hafner & Hafner, 2004).

5. Rubrics have the potential to advance the learning of students of color, first generation students, and those from non-traditional settings. An often unrecognized benefit of rubrics is that they can make learning expectations or assumptions about the tasks themselves more explicit (Andrade & Ying, 2005). In academic environments we often operate on unstated cultural assumptions about the expectations for student performance and behavior and presume that all students share those same understandings. However, research by Lisa Delpit (1988) and Shirley Heath (1983)

1.3.3. Students’ Difficulties in Class Activity

Difficulties that faces by students in class can be defined by the present of condition which obstruct someone to achieve certain purposes and objectives. According to the Board of the Association for Children and Adult with Learning Disabilities (ACALD), as what Lovitt (1989) stated that learning disability is a condition that assume to be caused by neurologist factor that selectively can be interfere the development, integration, verbal and/or non-verbal ability, which may affected to the real disabilities to the people who has average intelligence until superior, which has quite sensory system and quite learning chance as well.

Learning disability can be defined as a condition which can be an obstacle for students to achieve the learning objectives. Students that experience learning disability will gain a result that not as good as it have to be, so need to do the remedial in order to improve their results. Besides, the result that achieve by students whom experience learning disability will not be proportional to the work that have been done, students are quite lame in doing the tasks of learning activity, show the inappropriate manner and attitude through daily class activity.

According to Burton (Mulyadi, 2010), student identified as experienced learning disability if they are showing certain failure in achieving their learning objectives, such as:

a. Student said as fail (lower group) if within a certain time limit, they cannot reach the level of success or mastery in a particular learning as what teacher already set (criterion referenced).

b. Student said as fail (under achiever) if they cannot do or achieve appropriate (based on the size of the level of ability, intelligence or talent). For example, students who have been tested and demonstrated his intelligence level is classified as very superior intelligence (IQ = 130-140), but academic achievement is mediocre or even very low (Suwatno, 2008).

c. Student said as fail (slow learner) if they cannot achieve the development tasks. For example, students who are slow in learning, so he takes a longer time than any other group of students had the same level of intellectual potential (Suwatno, 2008).

d. Student is said to fail (slow learner and immature) where it did not achieve the level of mastery required as a prerequisite for the continuation of the level of the next lesson. For example, students are not able to master the principles of the square as a requirement for studying quadratic equations.

According to Lerner (Abdurrahman, 1999: 46), assessment is a process of gathering information about a child that will be used to make judgments and decisions relating to the child. Information obtained from an assessment or assessment is used as an ingredient pertibangan in planning learning programs for children with learning difficulties. Thus, the assessment was performed for diagnosis (Abdurrahman, 1999: 47).

Assessment should focus on improving student learning, and the focus of assessment should not be limited to the classroom, but include the wide range of processes that influence learning. Because assessment is a process embedded within larger systems, so assessment should focus collective attention and create linkages and enhance coherence within and across the curriculum; and tension between assessment for improvement and assessment for accountability must be managed.
2. RESEARCH METHOD

Research methodology that is taken on this research is qualitative method that is case study. Based on Sage Encyclopedia of Qualitative research (p. 68) a case study is a research approach in which one or a few instances of a phenomenon are studied in depth. Further information regarding to study case is shown on the table below:

<table>
<thead>
<tr>
<th>Model</th>
<th>Purposes</th>
<th>Key terms</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case study</td>
<td>To portray, analyse, and interpret the uniqueness of real individuals and situations through accessible accounts</td>
<td>Individuality, uniqueness</td>
<td>In-depth, detailed data from wide data source</td>
</tr>
<tr>
<td></td>
<td>To catch the complexity an to situatedness of behavio</td>
<td>In-depth analysis and portrayal</td>
<td>Participant and non participant observation</td>
</tr>
<tr>
<td></td>
<td>To contribute action and intervention</td>
<td>Subjective</td>
<td>Non-interventionist</td>
</tr>
<tr>
<td></td>
<td>To present and represent and represent reality- to give a sense of being there</td>
<td>Descriptive</td>
<td>Emphatic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analytical</td>
<td>Holistic treatment of phenomena</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Understanding</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spesific situations</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Sincerity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Complexity</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Particularity</td>
<td></td>
</tr>
</tbody>
</table>

2.1. Subject Matter Content

In adoption of content, the author adopts the curriculum standard of Indonesia that involves study of using microscope. Using microscope is chosen because this topic is the very first topic which introduces microscope in junior high school. The difficulties of student in this topic should be identified hence student’s obstacle will be overcome. Besides, student will not find other obstacles to learn other topic which involve the ability of using microscope as the prerequisite.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Science (Biology)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade/semester</td>
<td>VII/1</td>
</tr>
<tr>
<td>Topic</td>
<td>“How to use microscope”</td>
</tr>
<tr>
<td>Time allocation</td>
<td>2x40minutes</td>
</tr>
<tr>
<td>Competency standards</td>
<td>Understanding natural phenomena through observation</td>
</tr>
<tr>
<td>Basic Competency</td>
<td>Using microscope and other ancillary equipment to observe the symptoms of life</td>
</tr>
<tr>
<td>Learning Objective</td>
<td>Students are able to:</td>
</tr>
<tr>
<td></td>
<td>1. Apply procedure on the use of a light microscope monocular</td>
</tr>
<tr>
<td></td>
<td>2. Using a light microscope to observe</td>
</tr>
</tbody>
</table>
2.2. **Research Subject**

The subjects involved in this research are 7th grade students of SMPN 1 Lembang 2012/2013 period (n=18). The subjects taken are one class that is VII C.

2.3. **Data Collection Analysis**

Data collection included: (1) video recording of classroom session; (2) Photograph documentation of classroom session; (3) observational notes of instructional activities; (4) student questionnaire; (5) result of student worksheet; (6) student performance rubric;

2.4. **Instrumentation**

In this research, we used some instruments, such as; observation table, classroom observation sheet, worksheet, and rubric

a. **Observation Table.** Observation is the action or process of observing something or someone carefully or in order to gain information. In this research we gave an observation table for students. In that observation table students have to draw 2 cm ruler without microscope, prediction (before using microscope) and by using microscope.

b. **Classroom Observation Sheet.** Classroom observation, is whenever someone observes a classroom to see how it is run and how students are taught. It is done to give advice to teachers and is used to educate student teachers.

c. **Worksheet.** Worksheet is a paper listing questions or tasks for students. After doing the simple experiment, worksheet was given to students. We gave multiple choice questions. It consists of 10 questions. By giving this worksheet, we collected their opinion about the difficulties using microscope.

2.5. **Procedure**

Samples included 1 (one) class consist of 18 students of seventh grade of junior high school. Since the research taken is qualitative method, this study will provide observational sheet of instructional activity to identify whether what teacher plan is well applied in the field or not. Besides, as part of case study the author provide student questionnaire to investigate student impression and problem during class activity.

Firstly, teacher comes to laboratory to open the class by introducing students to microscope as general, teacher displays the video of bacteria that have been emphasized using microscope electron, after that teacher come to main topic about the usage of monocular microscope.

Teacher comes to the main activity in which teacher divide student into six groups. Each group consists of 3 persons. Teacher named student in each group become first student, second student, and third student. By this naming, teacher will easy to call student as the group representative. In this activity, teacher calls the first student to take monocular microscope, piece of ruler as observation object, and the tissue. After that teacher demonstrate each step of procedure, and
student will follow it. In demonstrating each step of procedure teacher will call first student and switched to the second student for the second step, and switched by third student for the third step, this method is taken due to limitation of microscope provided in laboratory. This activity is fully recorded by researcher, hence researcher will able to analyze the condition in the class.

Teacher will give the student worksheet, and student will try to finish it. After that students performance in observing through microscope will be measured by rubric scoring test, and in the last procedure students will be given questionnaire asking about their impression as well as obstacle during class activity.

Data of whole class activity will be analyzed hence the problem of students during the class can be found. After that, in analysis the researcher will analyze what appropriate solution for student then the solution itself will become the main source to revise the lesson plan, student performance rubric, and student worksheet. The whole procedure of research can be illustrated by diagram below:

3. RESULT AND ANALYSIS

Here were the experiment activity, that has been done in SMP Negeri 1 Lembang. There were only 9 microscopes in the laboratory. The amount was still lack compared to the amount of students. This fundamental skill in science that should be done by students was done in a group in figure 4.
This was the condition when the assistance did apperception. The assistances explained about how the food that had been falling down will be contaminated by bacteria and microbes and to observe it by using specific types of microscope, while the teacher will demonstrate only monocular light microscope in figure 5.

In figure 6, the students are handling the microscope based on what teacher did previously. The group consisted about 2-4 students. The divisions was not same. Each number of students has his/her own job in doing experiments steps. It would be explain detail on lesson plan. After they placed it on the table, they should clean the microscope and find the good light.
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Figure 7. The students were handling microscope as the teacher did.

This was the activity when students observed the view of ruler under microscope. They were surprised, that the shape was really different with they saw by naked eyes and their prediction.

Figure 8. The students observed the ruler under microscopic view tried to answer the questions from the test by doing discussion and searched from source.

Figure 9. The students did students worksheet by discussion and search from the source.
The worksheet has finished filled by the students. By most of students have also difficulties in doing it. Worksheet could be found in attachment.

![Worksheet Image]

Figure 10. The worksheet that was filled by students.

There were some problems that found in science school experiment implementation, the problems consisted about students difficulties of how to use microscope technically, how to know the parts of microscope, and how to do students worksheet, and will it can be seen on diagram below (Figure 11)

![Diagram Image]

Figure 11. Diagram of difficulties in knowing parts of microscope

In using microscope technically, mostly the students felt fun when using it, and when handled it in appropriate way, but 61% of the students were hard to memorize the parts of microscope because it had odd names. Based on figure 12, 56% of them had difficulties also in findings light to observe the object, since it depended on the light in laboratory. Most of students had less confidence to draw the result of observation (the students did not draw what they had observed because they were afraid to be wrong). Then the questions in student worksheet were not complete filled (60% of whole worksheets) because it might be the questions were too difficult, or limitation of time. The class management also did not give the chances to students to experience whole sequences
in using microscope due to limitation of microscope availability.

![Figure 12. Difficulties in finding light to observe object](image)

The other problem comes from miss understanding about the concept. Students guess that microscope use to look for a small object, like bacteria. Some of them found to have intention to see bacteria on the observational object. Then some students were too exciting to observe object under microscope and forget about the right way on treating microscope such as how to release preparation object on the stage of microscope.

Next the problem that contains in rubric, consists of:

1. Some of the missing indicator that needed to be observed, which are: first way of handling microscope (cleaning part).
2. Not a really clear optional scoring. The optional scoring are provided in a little different of each options but it give impact to the different range of scoring. So technically, the students are still doing not really a lower attitude but it seems like that.
3. Scoring was applied to the representative of group members only. Which is not really appropriate to be stated as the conditional scoring measurement
The result of students performance can be seen in the diagram below:

### Figure 13. Diagram of Table Analysis

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Task</th>
<th>Score</th>
<th>Students condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students are able to bring the microscope in the right way</td>
<td>Bring the microscope in the right way and put it on the table!</td>
<td>7/7 = 100%</td>
<td>One hand hold the hand of microscope while the others handle the foot of microscope</td>
</tr>
<tr>
<td>Students are able to start/end the observation in a right way</td>
<td>Use the appropriate magnifying objective lens to observe the object! Move the objective lens to the right magnifying setting!</td>
<td>7/7 = 100%</td>
<td>The objective lens placed right in the hole of table of microscope</td>
</tr>
<tr>
<td>Students are able to placed / moved out the observational object in a right way</td>
<td>Place the observational object in the microscope’s table by using the right way!</td>
<td>5/7 = 100%</td>
<td>Object placed right in the hole of microscope’s table, and clipped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2/7 = 75%</td>
<td>Moved the objective lens further from the microscope’s table, hole of microscope’s table, and clipped by using the microscope’s clip</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2/7 = 100%</td>
<td>Moved the objective lens further from object’s table and the observational object moved slowly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3/7 = 75%</td>
<td>Move the objective lens further from object’s table and the observational object moved in hurry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2/7 = 50%</td>
<td>Not move the objective lens further from object’s table and the observational object moved slowly</td>
</tr>
<tr>
<td>Students are able to observe the object by using the clear focus, brightness and contrast (skill in using macrometer/micro meter as well as microscope’s mirror)</td>
<td>Observe the observational object till it can be seen clearer with good contrast!</td>
<td>3/7 = 100%</td>
<td>Object can be seen clear/ focus with good brightness and contrast</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3/7 = 75%</td>
<td>Object can be seen clear/ focus with lack brightness and contrast</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/7 = 50%</td>
<td>Object not really can be seen clear/ focus with good brightness and contrast</td>
</tr>
</tbody>
</table>
3.1. Analysis:

a. Indicator 1, task 1
   All of the students gain higher point. It is because in the first task, teacher were fully guided the students in doing task. Firstly teacher explained about the way to do it, the after that students were following teacher’s instruction. And this explanation as well as instruction are holding for a long time as when it is repeated for several times, students were still able to do it in a right way.

b. Indicator 2, task 1
   Almost same condition with Indicator 1 task 1

c. Indicator 3, task 1
   Five from 7 observed students gain higher point. They were following teacher’s instruction. While 2 from 7 observed students gain 3 point on it. some of them missed in placing the observational object on right position, while actually it’s still on the observational table but just placed a little far from the hole. It may caused because they still don’t know yet how it would be if they put it on a position like that so they were just put it like that.

d. Indicator 3, task 2
   Students in condition of 50% were gaining a lower score because they used to forget the right way in moving out observational object. As they think it’s already can be moved out, they move it without remembering the consideration to move further the objective lens first.

e. Indicator 4, task 1
   As it is the measurement of using microscope’s skill, some of the students are quite good on it while the others still not yet. But it is normal because that was they’re first time in handling microscope.

f. Indicator 5, task 1
   This part is more to test students’ skill in using microscope. By this indicator, it still can be seen that almost all of the observed students not yet good in using the magnifying of microscope. As they come to the lab for the first time, so it is clear that they still less of practicing the way to do it.

As the experiment of using microscope was held for the first time in the class it was still normal that students were not yet able to do all of the part in a totally right way, especially in observing under microscope. But technically, they already got the discipline in handling other methods of doing it as they followed the instruction from the teacher carefully.

In previous meeting, the teacher should explain the parts and function of microscope in showing them the real microscope (not only picture) to improve learning experience of students. The students also do not need to sit on their table, but they are should find the light freely. The teacher also should give the worksheet before they come to the laboratory, they are asked to fill the observational sheet about observing the object with naked eyes and their prediction how is the picture of the object under microscope. The availibility of microscope also should be equal with the sum of students. To overcome miss understanding, in apperception learning sequence the teacher should give an appropriate explanation relates to the concept that will be learned by students. And give the chance to the students to fill the worksheet and doing the test, good class management is very important. And when the students have difficulties in magnifying the microscope, the teacher reexplain and help the
students. In this instructional process, the teacher used Bandura learning theory that the teacher acted as a model and students follow what the teacher did. This is good for 7th grade students, because they have been ready yet to do inquiry process, because the concept is still basic they need to be guided by the teacher means guided inquiry in this case by doing demonstration and step by step instruction.

In Bandura learning theory there are some phases, such as: Attention, retention, reproduction and motivation. Attention means the students were attracted by what teachers did in experiment. Retention means the students were able to internalize what they had gotten from watching what teacher did. Reproduction means the students did exactly same with what the teacher did. And motivation means the students were being motivated to observe the other things beside the object that the teacher provided, but this phase are allowed for next week after experiment. The students were free to bring everything that they want to observe.

4. CONCLUSIONS

The result of revision of instructional instrument such as lesson plan, worksheet, and rubric about how to use microscope in appropriate way has been done in appendix A. The revision is made based on what the difficulties those are faced by students and how to make the effectiveness of teaching method adopting Bandura learning theory to overcome those learning difficulties.

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IMPROVING SCIENCE TEACHING QUALITY IN REMOTE AREAS THROUGH INTRODUCTION OF INQUIRY-BASED LEARNING MODEL: A CASE IN KUTAI KARTANEGARA

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ABSTRACT

Indonesia has vast areas with few remote villages that have very limited access to transportation and communication. Limited access is directly proportional to the limited opportunity for schools there, including the science teachers, to get the latest information as well as enrichment programs for the improvement of the quality of the educational process. To improve the quality of learning in remote areas, SEAMEO QITEP in Science collaborate with TOTAL E & P Indonesia implementing the introduction of Inquiry-Based Learning Model in remote villages of Anggana, a subdistrict of Kutai Kartanegara regency, East Kalimantan province. The three schools as the main target of the program were SDN 014 Anggana in Tani Baru village, SDN 015 Anggana in Muara Pantuan village and SDN 016 Anggana in Sepatin village. Activities conducted in the program were seminars and workshops on inquiry-based science learning (IBSL) for elementary school teachers in the District Anggana, as well as the placement of graduates of science and science education for six months (November 2012 to April 2013), to assist teachers of three target schools in their application on IBSL. Through interviews and the results of questionnaires which distributed during and after the implementation of the program, the principals, science teachers and pupils in targeted schools stated that the inquiry model is very useful to improve the quality of science teaching in their schools. Realized that the inquiry-based learning model can be applied even in remote schools, the teachers involved in this program are also highly motivated to keep trying to use the model, after the program ends.

Keywords: IBSL, remote villages, Kutai Kartanegara

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1. INTRODUCTION

Based on United Nations HDI (Human Development Index) data in 2013 for East Asia and Pacific, Indonesia is still in the 10 lowest rank, while the other neighbouring Southeast Asia countries (Brunei, Malaysia, and Singapore) now are in the 10 highest rank. The HDI data has very close direct relationship with the education achievement data, such as TIMSS (the Third International Mathematics and Science Study) data. The achievement of Indonesia in TIMMS 2011 is also in the lowest rank compare with Malaysia, Singapore and Thailand. All of these facts indicate that Indonesia have to work harder to reach the equal of human resources quality among its nearest neighbouring countries, and one of the important effort can address to mathematics and science education.

As the country with very vast area and high population, Indonesia face huge challenges in making a sustainable development and prosperity for its citizens. The title of remote area are related with the very limited access on transportation and communication. Limited access in remote areas is directly proportional to the limited opportunity for schools there, including the science teachers, to get the latest information as well as enrichment programs for the improvement of the quality of the educational process. Therefore, education development in remote area is a critical point in Indonesia.

Education is a critical investment that determines the future of a nation. However, the role of related parties in implementation of education for children usually has still not been integrated yet. Each stakeholder e.g. teacher, lecturer, government, university’s student seems walking on their own way. It is believed that to increase quality of education support from all stakeholders are needed. Since education is not only the government’s responsibility, it is important for all of the community members play their role in education improvement effort.

Southeast Asian Ministers of Education Organization (SEAMEO) centre for Quality Improvement of Teachers and Education Personnel (QITEP) in Science is an institution dedicated to improve the quality and professional learning for science teachers. Realizing that good science education should be given since the early stage of education, the center is focus in develop and provide innovative and inquiry-based programs for science teacher since kindergarten up to higher secondary school. Inquiry refers to teaching and learning strategies that enable scientific concepts to be mastered through investigation. With experience to investigate contextual and relevant things or objects, it is much easier for the student to understand the explanation about the objects. The explanation may com from the teacher, a book, a discussion with peers, or all of these. Inquiry-based learning is one of recommended model that has been proved in increasing students’ interest on science and develop high order thinking capability.

One of the interesting and inspiring program to fostering inquiry based science learning (IBSL) in schools exemplified by La main à la pâte, an educational organization in France, is the involvement of scientists to assist science teachers in schools. This concept then adapted in the scheme of collaboration between SEAMEO QITEP in Science (SEAMEO Qis) and TOTAL E & P Indonesie (TEPI). As a company which operate its business mostly in East Kalimantan province, and has a strong commitment in improving the quality of human resources, TEPI fully supported all activities in the program.

The vision of the project is to support sustainable development in human resources quality through science education improvement involving all of complementary parties (schools, community, governmental and private institutions). The mission of the program is to facilitate exchange and collaborative project especially of three actors from those parties, and combines their positive inputs in implementation of inquiry base science education in school as follow:

- Teacher, to bring pedagogic ability in class supervision, ability in listening, etc.
- Student, to bring their curiosity about science, spontaneous questions, creativity, etc.
- Young scientist, to bring their scientific knowledge, experiment method, words mastery, and scientific argument, etc.

2. RESEARCH METHOD

2.1. Selection of Young Scientists and Targeted Schools
To begin the recruitment of fresh graduates for the program, TEPI and SEAMEO QiS have made publication of the program. Fresh graduates which were intended then sent their application letter and curriculum vitae by email. During July 2013 to September 2013, SEAMEO QiS and TEPI were selected prospective young scientists through administrative selection and interview. Based on the selection, five persons appointed as young scientists in this program are follows (in alphabetical order):

1. Fanny Adityaputri, M.Si (from Bandung Institute of Technology)
2. Khairul Anwar, S.Pd (from Mulawarman University)
3. Muhammad Jarkasih, S.Pd (from Mulawarman University)
4. Octy Viali Zahara, S.Pd (from Indonesia Education University)
5. Rahim Mustafa, S.Si, (from Mulawarman University)

TEPI determined three elementary schools as the targeted schools of the program, namely SDN 014 Tani Baru, SDN 015 Muara Pantuan and SDN 016 Sepatin. Each of the targeted elementary schools still sharing their location with junior secondary school as well, made a campus called "Sekolah Satu Atap". The three targeted schools were in the remote areas of sub-district Anggana, Kutai Kartanegara district, East Kalimantan province, which can only be reached in 2 - 3 hours trip on the water along the Sungai Mahakam. The principal of each targeted school were being the field officer who support and assist the young scientists during their teacher's companionship.

2.2. Departure Training

The selected young scientists expected to introduce inquiry-based learning model in targeted schools, assisting teachers in learning science and advocating the importance of education, especially science, in targeted schools and beyond. Therefore, before the placement they were provided by a ten days departure training which covered some mainly needed knowledges and experiences to strengthen their competence. All of young scientists followed the Departure Training which was conducted on 10 - 17 October 2012 in SEAMEO QITEP in Science (SEAMEO QiS) Secretariat, Jl. Diponegoro 12 Bandung. The aims of the training were:

- To introduce the selected young scientists to the program.
- Introducing young scientist to SEAMEO QiS and TOTAL E&P Indonesie (TEPI).
- Field orientation: recognizing the location, situation and condition of the area where the young scientists will be commissioned.
- Preparing the aspect of physical, mental, andragogy and pedagogy of the young scientists.
- Introduce the methods of inquiry in science learning
- Prepare examples of inquiry-based learning to be implemented in all grades of elementary schools.

Resource persons in this training were capable resource persons from SEAMEO QiS, TEPI, Indonesia Education University, Bandung Institute of Technology, Hiroshima University Japan, and practitioner educators in remote areas.

Beside accepted the material presentation, in the training the young scientists also did some simple inquiry-based science practices, selected the topics of lesson to be developed into inquiry-based learning and designed then verify simple inquiry-based hands-on activities to be implemented in all grades of elementary schools. To complete the experiences, the young scientists also directly practiced to implement their designs of hands-on in the teaching session in class of SDN Pajajaran (Pajajaran Elementary Schools) Bandung, followed the outbond capacity building games, and visited Head Office of TEPI, Jakarta.

2.3. Workshop on Inquiry Based Science Learning

On 1 November 2012, TOTAL E&P Indonesie collaborated with Education Office of Sub-District Anggana to conduct one day Workshop on Inquiry Based Science Learning for elementary school teachers. This workshop purposed to socialize inquiry model as a recommenced model to improve student centered approach in science learning. This event also had been the introductory session for young scientists with their role as committee and assisted the facilitators. The workshop attended by 31 participants from 13 elementary schools of sub district Anggana. TOTAL E&P Indonesie represented by Mr. Rochmat Djatmiko and Ms. Lolita Sagitari. Education office of district Kutai Kartanegara represented by Mr. Asmuransyah, S.Sos., M.Pd and Ms. Isna represented the local
Two facilitators from SEAMEO QITEP in Science were Dr. R. Indarjani (Deputy for Program) and Mr. Reza Setiawan S.Si., M.T (Head Division of Training).

In this workshop, teachers encouraged to have simple practice about Water Cycle using daily tools and materials. It was designed as an inquiry based learning experience since initiated with questions and hypothesize before exploration and discussion to confirm the conclusion. Just after the practice experiences, the term of inquiry based science learning then explained to participants, followed with interactive session about technique to make effective questions, which is one of key success point in inquiry process.

2.4. Science Teacher Companionship by Young Scientists

The companionship was conducted for six months (November 2012 - April 2013). The three target schools are in the remote villages in sub-district Anggana, KutaiKertanegara district, East Kalimantan province. The villages can only be reached through a 1-3 hour travel by boat from Anggana sub-district town, along the Mahakam River estuary. The location of the three villages are the coastal areas and scattered into small delta islands. Most of the livelihoods of the population in the three villages are fishermen and shrimp farmers.

Brief descriptions of the three remote schools are as follows:

1. SDN 014 Anggana. TaniBaru village, where the school is located about 61 km from the district town of Anggana. The village area of 71.5 km² is inhabited by about 3000 people, actually scattered around the delta region. This led to the location of public facilities including schools quite difficult to reach by some villagers. A total of 149 students studying in the six classrooms at SDN Anggana 014 with 11 teachers including the principal. SDN 014 Anggana sharing one area with SMPN (state secondary school) 4 Anggana, to share common facilities for laboratories, libraries and toilet.

2. SDN 015 Anggana. The school is located in the village of MuaraPantuan which is about 41 km from the sub-district town with a population of 5000 persons occupies an area of 513.32 km². This school has 332 students who are divided into 10 classes, with 14 teachers including the principal. Only 7 teachers with the status of civil servants, while the rest are paid from school's income.

3. SDN 016 Anggana. The Sepatin village, which SDN 016 Anggana located, is the furthest village from the town sub-district Anggana (about 79 km). This distance can only be taken during the 3 hours by seatruck drive along the edge of Makassar Strait. The 628.87 km² area of this village is inhabited by about 3,200 people, dominated by the Bugis and Banjar tribes. SDN 015 Anggana has about 200 students in nine classrooms, and sharing area with SMPN Sepatin. One major problem in this village is difficult to reach communication signals via satellite.

The general activities of young scientists in three villages were as follows:

- Program introduction
- Class observations
- Disseminate inquiry models to teachers by routine discussion in teacher meetings and formally in training form as well.
- Being teachers in class (not only in science subject) and in after school time
- Inventoryed and encouraged optimal use of science kits that have been owned by the schools for teaching and learning
- Initiated the establishing of science club in school
- Involved in any other school and community activities
- Routine monthly meeting with TOTAL E&P Indonesia

2.5. Periodic Evaluation

Evaluation has been planned to be done periodically throughout the program execution time by the TOTAL E & P Indonesia and SEAMEO QITEP in Science. TOTAL E & P Indonesia invited the young scientists and principals of assisted schools in the evaluation meeting in late November 2012 in Balikpapan. From the first evaluation meeting it was agreed that the next evaluation meeting held in January 2013. In accordance with the agreement, SEAMEO QITEP in Science conduct site evaluation visits the third and sixth months of program. Third month evaluation visits fell in January 2013, so the evaluation is done jointly with the TOTAL E & P Indonesia.
3. RESULT AND ANALYSIS
3.1. Workshop on Inquiry Based Science Learning

Based on discussion in reflection session after the workshop, teachers need more to get deeper with inquiry model. Therefore, it came an idea to make a follow up program in form of workshop or training at least one month later, supported by TOTAL E&P Indonesie and Education Office of district Kutai Kartanegara. To meet the demand on deepening inquiry base science learning from the participants of the workshop on 1 November 2012 and to extend the reach of its socialization to other districts around the location of program, TOTAL E & P Indonesia in coordination with the Education and Culture Office of Kutai Kartanegara regency held a two-day training for elementary teachers of three subdistricts: Anggana, Samboja and Muara Jawa. The training was conducted in two times and at two different places; on 2-3 April 2013 in the District Anggana, for teachers of subdistrict Anggana, and on 4-5 April 2013 in Samboja, for teachers of subdistricts Samboja and Muara Jawa. Each training followed by 30 elementary teachers selected by the Education and Culture Office of Kutai Kartanegara regency.

The young scientists acted as a facilitator, while the SEAMEO QITEP in Science provided training materials and guidance. The first day of training mainly filled with materials presentation, demonstrations, discussion and energizer games. The main topics in the training were Inquiry-Based Learning, Effective Questioning, Learning Scenario Design and the supported topic was Creative Thinking. For the three main topics the young scientists have provided evaluation form to be filled anonymously by participants, so the effectiveness of the topics for participants can be measured. On the second day the participants had the opportunity to make simulation of inquiry teaching based on their own Learning Scenario (Rencana Pelaksanaan Pembelajaran) with the other participants acted as students. Discussion and feedback from the simulation were valuable as an attempt to implement all of training materials later in the participants school based on their particular circumstances.

An evaluation form has been made to measure the effectiveness of presentation for three main topics in the teacher training for three subdistricts of Kutai Kartanegara. The result of evaluation described by Diagram 3.1, Diagram 3.2 and Diagram 3.3

3.2. Program Implementation
3.2.1. Implementation Program in SDN 014 Anggana, Tani Baru

Fanny AdityaPutri, M.Si and Muhammad Jarkasih, S.Pd, young scientists commissioned in Anggana SDN 014, TaniBaru village, implemented socialization and dissemination of inquiry-based science learning program in several stages, in accordance with the direction of the principal of SDN 014 Anggana as their mentors. In the first month they made observations of science teaching in every elementary classroom. They collected data on the needs of teachers to improve the quality of science teaching in the second month, and in the third month they started to demonstrate inquiry-based science teaching in all classes to give example for teachers. In the fourth month they began to assisting teachers in making inquiry-based lesson plan and its implementation in the classroom. The evaluation of the implementation by teachers result started to discuss in the fifth month, and they collected feedback from teachers who implement inquiry learning in the sixth month. Science learning themes that have designed and implemented by teachers and young scientists during this program were; Thematic for grades 1 to 3, Matters, Motion Objects, The Ear and Universe, Water, Resources and Forms of Energy, Light, Magnet, Simple Appliances and Electricity. The young scientists also encouraged teachers to better utilize the available science kits and made their own tools from simple materials if necessary.
Diagram 3.1. Evaluation result for Inquiry-Based Learning Topic

- The training of inquiry-based learning is beneficial for me: 98% Yes, 2% No
- I will try to implement inquiry-based learning in my commissioned class: 94% Yes, 6% No
- I realize the beneficial of inquiry in student development: 69% Yes, 28% Uncertain, 4% No
- I understand the main role of teacher in inquiry-based learning: 65% Yes, 34% Uncertain, 2% No
- The steps of inquiry-based learning are easy to be implemented: 59% Yes, 36% Uncertain, 6% No
- I understand the principal bases of inquiry-based learning: 34% Yes, 59% Uncertain, 8% No
- I have ever conducted the inquiry-based learning: 57% Yes, 32% Uncertain, 12% No

Diagram 3.2. Evaluation result for Effective Questioning Technique

- I will try to implement strategy in developing effective discussion in the learning process in the class: 90% Yes, 10% No
- I will try to implement more questioning-answer session in my class: 94% Yes, 6% No
- This topic is beneficial and can be practiced in class: 98% Yes, 2% No
- I can understand well the presentation of Effective Questioning Technique: 79% Yes, 22% No
- I can make open questions according to its function: 73% Yes, 27% No
- I could distinguish between open questions and close questions: 85% Yes, 16% No
- I used to conduct questioning-answer activities in class: 96% Yes, 4% No
Diagram 3.3. Evaluation result for Learning Scenario Design

Noted:
Number of questionnaire participants: 51 persons

Additional statements:
1. The other topics which proposed by many participants were Learning Media, Interactive Learning Model, Educative Games and Using Science Tool Kits.
2. Most of participants stated that they need deeper discussion for Learning Scenario Design.

Even the main targets in this program were science teachers, young scientists in SDN 014 Anggana also made some additional activities with students as the targets. They initiated the establishment of science club that perform a variety of additional science experiments outside of school hours learning. This activity was greeted enthusiastically by the students, only constrained by lack of transportation for the return of students after the afternoon activities. The young scientists also initiated various forms of competitions and fun games to increase motivation and preoccupation students in learning science, among other game "RangkingSatu" (Rank One), which were adapted of the show in one of the national private television.

The young scientists in SDN 014 Anggana in TaniBaru village permitted not only to get involved in elementary school, but also in secondary school activities (SMPN 04 Anggana). Not only as teacher and teacher assistant, the young scientists also mandated to select and escort the team of SMPN 04 Anggana to participate in the Biology Science Olympiad for the first time, which organized by Mulawarman University, Samarinda. The accommodation of the contingent was supported by TOTAL E&P Indonesie. Even have not won yet, this first experience was really enriched the perception about science education for teachers and students and rising the competitive motivation as well.

3.2.2. Implementation Program in SDN 015 Anggana, Muara Pantuan
The only young scientist commissioned in SDN 015 Anggana Muara Pantuan village, Khairul Anwar, S.Pd. experienced in taught all of classes in school, from the first grade to sixth grade. Because of the miss understood of this program by some teachers that the young scientist were commissioned as a substitute or additional teacher, in the first month he almost taught all alone by himself. As the principal reminded that the teachers themselves were the main subject to be improved in this program, then the young scientist began to work together with teachers in every
class. In each of class the young scientist concerned to practice inquiry models for at least one topic, then he encouraged the teachers to make their own teaching scenario with inquiry model to be implemented in class. He was also keep discussion about the implementation of inquiry-based model with teachers in personal and in the teachers meeting to make evaluation, solved the problems and got feedback on his effort. As a supporting skill for teachers, the young scientist were also gave a tutorial of using computer, especially related on internet.

Beside gave remedial and extra taught after school, the young scientist also introduced some new interesting fun game in teaching science that made student and teacher more enjoy in science learning. He also initiated the establishment of student science club. With his other skills beside teaching, the young scientist was also very involved in various extra curricular programs and community activities, such as trained students in conduct rising flag ceremony and reading the Al Qur'an.

3.2.3. Implementation Program in SDN 016 Anggana, Sepatin

In the first month, the young scientists in the SDN 016 Anggana conducted the need assessment to the teachers, to select the material in training teachers. The most requested materials by teachers were Educative Games, Interactive Learning Method and Learning Media. The result of their assessment is shown in the Diagram 3.4. The internal teacher training for the SDN 016 Sepatin teachers were conducted weekly, 1-3 hours after school time in about 4 months. It was not only attended by elementary school teachers, but also kindergarten and lower secondary school teachers in Sepatin village. They eager to implement the inquiry-based learning model, not only to teach science subjects. The young scientists also made the assessment form to measure achievement of teachers in demonstrate inquiry based teaching, filled by their colleagues while peer teaching session.

After the training series of inquiry based science, there were also a questionnaire to collected opinion and recommendation from participant teachers. Based on the questionnaire result, the training was quite success in giving new perception and spirit to implement on inquiry based learning, not only for science teachers. The result of questionnaire is shown in the Diagram 3.5.

![Diagram 3.4. The needed training topics of teachers of SDN 016 AngganaSepatin](image-url)
Diagram 3.5. The teacher of SDN 016 Anggana Sepatin’ statements on training

**Remarks:**
- **Statement 1:** I understand the principal bases of inquiry base learning
- **Statement 2:** The steps of inquiry base learning are easy to be implemented
- **Statement 3:** I understand the main role of teacher in inquiry base learning
- **Statement 4:** I realize the beneficial of inquiry in student development
- **Statement 5:** I will try to implement inquiry base learning in my commissioned class
- **Statement 6:** The training of inquiry base learning is beneficial for me

### 3.3. Periodic Evaluation

The first evaluation visit team QITEP in Science was held on 21 to 23 January 2013. Visitation to Sepatin village on 21 January 2013 coincided with the opening of the inquiry-based learning training for teachers in kindergarten, elementary, and junior high school in Sepatin, which is located at 016 Anggana SDN. The training was officially opened by the Head of the Education and Culture Office of Subdistrict Anggana. About 30 participants were attended the training, and the two young scientists commissioned on SDN 016 Anggana acted as facilitators. Tim QITEP in Science also visited the other two schools where young scientists in charge, namely the SDN 014 Anggana in Tani Baru village and SDN 015 Anggana in Muara Pantuan village. Through a review directly to the location as well as interviews with young scientists, heads of schools and teachers, QITEP in Science team got the impression that the implementation of the program were well received by the school and community in placement village location. Tim QITEP in Science also collects various forms of written reports and documentation of the program implementation by young scientists. Five young scientists who placed have adapted well and show quite satisfactory performance. The achievement that should be encouraged were in guiding teachers to make their own inquiry-based lesson plans independently and dissemination of models of inquiry to schools around the location of the placement.

An evaluation meeting conducted on 23 January 2013, at Handil II Base TOTAL E & P Indonesia, Kutai Kartanegara district. The meeting attended by representatives of TOTAL E & P Indonesia and QITEP in Science, principals of three elementary school and five young scientists involved. The meeting agreed on a plan to carry out joint training for teachers of three placement villages, consolidation and alignment model of inquiry-based science learning so it can be sustainable applied after the program ends. In practice, the target trainees increased to primary teachers from three subdistricts in Kutai Kartanegara regency (Anggana, Samboja and Muara Jawa).

The Director of QITEP in Science, Prof. Ismunandar joined in the second evaluation by QITEP in Science. The evaluation held in conjunction with the closing program, on 30 April 2013.
As QITEP in Science conducted interview and compiled supported documentations of activities, TOTAL E & P Indonesia also made questionnaires about the program aimed at teachers and principals. Those combination methods collected opinions and advice about the programs, particularly about the effectiveness of dissemination and implementation of inquiry-based science learning by young scientists to improve teachers' competence in teaching science. The final of the program was marked by a touchy farewell party conducted in SDN 014 Tani Baru, covered by several local and national mass media.

The success of implementation program in targeted schools was very depend on support of the principals in guide the young scientists and motivate the teachers to be opened for new teaching approach. The young scientists also helped by hospitality of village community so they could make adaptation relative immediately. Because of all of young scientists have opportunity to involved in all of class in their commissioned schools, they could implemented inquiry-based science learning more than three topics and encouraged teachers to applied inquiry-based science learning by themselves also for more than one topic during the semester. One semester for duration of placement seems to be ideal, because the aims of the program is to encourage teachers to implement inquiry-based learning model by themselves, not always depend on young scientists.

The most constraint to conduct joint activities between villages was the availability of transportation, especially for participants from remote coastal villages. Because of the remote coastal villages such as Tani Baru, Sepatin, Tanjung Pimping and Tanjung Berukang are not pass by public transportation, participants from those villages have to make well arrangement for their accommodation from distant days, and much more cheaper when they can depart together. Therefore, support from TOTAL E&P Indonesia for teachers’ accommodation in teacher training were very significant in helping teacher so they could came for teacher training.

The Head of Educational Office Anggana who came to opened the teacher training in Sepatin village, and observe the training in Anggana sub district was amazed with the enthusiasm of remote school teachers to improve their learning methods. He really hoped that other parties than Indonesian government and local government, such as TOTAL E&P Indonesia and SEAMEO QITEP in Science, can continue their participation supporting the schools' effort.

As it mentioned in interviews with participants, the results of the evaluation questionnaire as well as local media coverage (Kaltim Pos), these activities got a pretty good appreciation. The teachers became more knowledgeable about the inquiry learning models and eager to implement it at school. This is a very important long-term benefit from a brief activity.

4. CONCLUSIONS

Based on the inputs of experienced young scientists, besides of more tight selection for candidates of young scientists, there should be more longer time for Departure Training. It should to be more allocation time for teaching simulation, location orientation and achieving motivation and consolidation of young scientists as a team. If the program will continue in different time and location, the experienced young scientists are ready and would be very happy to be involved in Departure Training.

There should be longer time for teacher involving in the first stage of inquiry-based learning implementation at targeted schools, such as design the lesson plan and teaching scenarios together with young scientists. It would be better if team teaching between teachers and young scientists become more frequent along the program. Those efforts are expected to increase the teachers’ confidence in implementing inquiry-based learning by themself after the program has over. The educational officers' and principal's roles are very strategic to motivate and convince teachers on trying "new method" of teaching and learning, instead as their practiced over years. Therefore, it seems very important also to involve the school principals who will accompany the young scientists in a part of Departure Training, maybe in a session near of the location of placement.

A better planned, scheduled and supported teacher workshops program before, in the middle and after the program are highly recommended just like a preparation, formative and summative processes, in order to get valid data about impact and outcome of the program. Over all, the program might be very prospective to be continued, since it was well accepted and have triggered further real actions by the principals and teachers themselves in improving teaching methods. This is one of the
ultimate flagship program of SEAMEO QITEP in Science. By the program, the inquiry approach can be intensely trialled in schools. Moreover, this effort to provide remote areas in the border with training courses to improve the local teachers' competence in teaching science hopefully will helps Indonesian government to expand the quality education.

References
CURRICULUM DEVELOPMENT FOR NATURAL SCIENCE SECONDARY SCHOOL THROUGH INTEGRATION VALUE OF CHARACTER BASED ON CONTEXTUAL TEACHING AND LEARNING

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ABSTRACT
National education has aim that individual learners have the knowledge, improve technical skills, develop a strong personality and form a strong. Curriculum subjects of Natural Sciences Secondary School expects that students master the concepts and principles of science to develop the knowledge, skill, spiritual and social competences that can be applied in daily life and as a provision to pursue higher degrees. Implementation an integrated character education in science is a new thing, making implementation face many problem, both schools and teachers. This research designed to develop values of character that integrated in Natural Science Secondary School Class VII. This research development consist of three stages: (1) design and development integration model of values and character based on contextual teaching and learning, (2) validation and pilot test, (3) implementation and evaluation. The first year research (2013) has resulted teaching materials for natural science school first semester class VII in the form of lesson plan, student worksheet, learning assessment, and instructional media.

Keywords:
Character
Contextual Teaching and Learning

1. INTRODUCTION
National education aims to develop student potentials become man who is faithful and devout to god almighty, noble, healthy, knowledgeable, skilled, creative, independent, and become democratic and responsible citizens. Teachers and schools have to integrate the values of personality and character which developed into the Curriculum Education Unit, Syllabus and Lesson Plan which
already exist (Ministry of National Education, 2010). In principle, values and character development are not included as a subject, but integrated into the core competencies and/Basic Competence for each subject, self-development and school cultures.

Curriculum for Natural Science in Secondary school developed as an integrative science and oriented applicative, developing the ability to think, learn, curiosity, and the development of caring and responsible attitude towards the social environment. For implementation of 2013 curriculum the government has provided a syllabus, teacher and student handbooks, while lesson plans, worksheets, assessment are provided by teachers as curriculum implementers. The results of initial survey in 2012 to Pekanbaru city secondary school science teacher, indicated 18 of the 32 teachers (56.25%) have not implemented the character values in learning. Learning device has been used many times, syllabus, lesson plans has been copied and electronic sources (the Internet) used without any adjustment to the conditions of students and school. This will lead to curriculum objectives are not achieved. PPMP Riau (2011) finding that in content standards and process standards teachers have not been able to outline the material and develop syllabus and learning tools, have not still implement active learning and teacher centered.

Based on the above fact it is necessary to develop curriculum and learning tools include: syllabus, lesson plans, worksheets, assessment sheets, learning materials, and quality learning media in line with the policy and the development of science and technology. Science curriculum development in this study conducted by a team of science education from Department of Mathematic and Natural Science Faculty Teacher Training and Education Riau University in collaborate with Secondary school Natural Science Teacher SMPN 20 Pekanbaru City.

Science curriculum emphasizes mastery of concepts, thinking skills, understanding of the basic principles, bring up scientific attitudes and values through learning experiences that are relevant to learners. Character education integrated in the learning process is the practice of values, gained awareness of the importance of values, and internalization of values into the behavior of students daily, through a learning process that takes place both inside and outside the classroom in all subjects. Strategic integration of character education in the learning process implemented starting from the planning stage, learning activity, and evaluation phase of learning in all subjects (Ministry of National Education, 2010). On the secondary school science subjects values of character that was developed include: Religiousness, honesty, intelligence, toughness, caring, democratic, curiosity, logical thinking, critical, creative, and innovative, honesty, healthy lifestyle, self-confidence, respect for diversity, discipline, self-reliance, responsibility, love science, precision and accuracy.

Constructivism is the philosophy of contextual approach, the philosophy of learning which emphasizes that students learn not just memorize. Martin et al. (2002) states, with constructivism, students will be able to enhance critical thinking skills and problem solving. Students can improve their skills using a scientific attitude to solve various problems, and continues to absorb and process information obtained.

Contextual learning allows the learning process in which students explored the understanding and academic skills in a variety of contexts, inside or outside the classroom, in order to resolve the problems it faces both independently and in groups (Setiawan, 2008). According to Crawford (2001), contextual learning can be implemented through five main strategies: (1) (Relating) (2) (Experiencing) (3) (Applying) (4) (Cooperating) and (5) (Transferring).

According to Johnson (2002), application of contextual learning approach means making connections to discover the meaning, doing significant work, encourages students to be active, setting their own learning, working together in groups, emphasizing creative and critical thinking, managing individually, reaching higher standard, and uses authentic assessment.

Contextual learning is built on seven pillars: constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment. RANGKA contextual learning is the development of a modified contextual learning strategies REACT (Relating, Experience, Applying, Cooperating, Tranferring) by Crawford (2001). For the development of contextual learning Biological science subjects in Pekanbaru city, has developed RANGKA contextual learning, by which it is acronym of Rumuskamnasalah (state the problem), Amatimelalukereugian (observed through activities), Nyatakan (state), Gabungkan (merge), Kerjasamadankomunikasi (collaboration and
communicate), and Amalkan (practice). This model integrates the component science process and problem solving skill. RANGKA contextual learning approach was developed based on the philosophy of science learning RANGKA it is an easy to remember acronyms. Skeleton in living things serve to reinforce, strengthen and give the body shape, so that RANGKA contextual learning is expected to support and benefit the learning science especially biology so that learning becomes meaningful (Evi Suryawati, et.al 2010).

RANGKA contextual learning strategies can be used to as an alternative development for Effective Active Innovative Creative and Fun Learning on various categories of school. Produced teaching materials can be used as a reference in the development of teaching design preparation especially for the novice teacher. RANGKA strategies can be used not only limited to the topic of this study but has the potential to be developed in other topics on teaching Biology especially and science teaching in secondary school (Evi Suryawati, 2010). In this research, in line with government policy, contextual learning has been developed by integrating the values and character suit Indonesian culture.

The research was conducted with the aim of developing an inventory of character values that are integrated in the syllabus for each Core Competence and Basic Competence teaching science secondary school class VII and also designing and developing an active and contextual teaching materials (syllabus, lesson plans, evaluation sheets, teacher handbook, student worksheets, and instructional media) by integrating the values of character and culture according to the characteristics of students and schools.

2. RESEARCH METHOD

This Research and Development using survey design (Cresswell, 2005). Implemented in secondary school/junior high school for natural science subjects Class VII. Conducted jointly by the research team with involving teachers in partner schools SMP 20 Pekanbaru. The study consisted of two phases (1) the design and development of integration models and character values secondary school science subjects based contextual learning and (2) validation and testing.

The contextual learning teaching materials development procedures used were based on model proposed by Gagne et. al (2005) which composed of Analyze, Design, Develop, Implement, Evaluate (ADDIE) as in Figure 1. Primary data was collected through assessment sheets, observation, and achievement test and secondary data through documentation. Face validity and content validity assessment of teaching materials has been performed by two science teaching and learning strategy specialists and four experienced natural science teacher. Natural science achievement instruments built by researcher according to research topics that were taught, namely: Ecosystem and Measurement. Data processing was done by using descriptive and inferential analysis using t-test.
Figure 1. Teaching Materials Development

- **ANALYZE**
  - Student Characteristic
  - Character Integration

- **DESIGN**
  - Choosing Learning Strategy Planning
  - Choosing Learning Aid
  - Organizing Assessment

- **DEVELOPMENT**
  - Teaching Material Draft
  - Pilot Test I
  - Pilot Test Analysis I
  - Addition
  - Revision
  - Pilot Test II
  - Experts’ Verification
  - Pilot Test Analysis II

- **IMPLEMENTATION**
  - TEACHING MATERIALS
3. RESULT AND ANALYSIS

3.1. Teaching Materials Development

Table 1. Inventory Integration Character Value in Natural Science (Biology)

<table>
<thead>
<tr>
<th>No.</th>
<th>Topics</th>
<th>Learning Activity</th>
<th>Characters Developed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ecosystem</td>
<td>Direct observation and video show compiler components of ecosystem</td>
<td>Foster responsible behavior, Respect the opinion of friends and fosters thoughtful behavior</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pay attention to objects (biotic and abiotic) that exist around the school</td>
<td>Marvel at the complexity of God’s creation, foster curiosity, honest, careful, and conscientious in observing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Collate and classify objects found in the biotic and abiotic components of the mark (✓)</td>
<td>Foster a critical attitude, thorough, objective, honest, careful, and responsible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Answering a question by discussing with the group and make conclusions</td>
<td>Cultivate an attitude of prudent, responsible, honest, critical, value the opinions, and communicative</td>
</tr>
<tr>
<td>2.</td>
<td>Interdependence in the ecosystem</td>
<td>Pay attention to the surrounding environment and video show</td>
<td>Admire the regularity and complexity of God’s creation, critical, foster curiosity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Discuss the results of observations</td>
<td>Foster responsible behavior, Respect opinions and foster prudent behavior</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Make an example of food chains and food webs</td>
<td>Foster a critical attitude, conscientious, honest, careful, and responsible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Presenting the results of observations and make conclusions</td>
<td>Foster responsible behavior, Appreciate friends work either individually or in groups and fostering prudent behavior</td>
</tr>
<tr>
<td>No.</td>
<td>Topics</td>
<td>Learning Activity</td>
<td>Characters Developed</td>
</tr>
<tr>
<td>-----</td>
<td>--------</td>
<td>-------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>1.</td>
<td>Measurement</td>
<td>Pay attention to the surrounding environment and classificationphysical quantities toward to fisika basic and integral quantities integral</td>
<td>Discuss the results of observations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No.</th>
<th>Topics</th>
<th>Learning Activity</th>
<th>Characters Developed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Observe and experiment for determine length quantities of rule use vernier caliper dan screw micrometer screw</td>
<td>Foster responsibility, self confidence, tolerance, intelligence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observe and experiment for determine quantities of mass with O’Hauss balance and digital balance</td>
<td>Foster curiosity, honest, confidence, smart, critical, creative, innovative, concern, tolerance, and responsibility.</td>
</tr>
</tbody>
</table>

### 3.2. Student’s Basic Skills of Scientific Work Through RANGKA Contextual Learning

Basic skills of scientific work (Keterampilan Dasar Bekerja Ilmiah/KDBI) in this study consist of 8 aspect which are observation, classification, communication, responsibility, curiosity, teamwork, honesty, and discipline. The average percentage of students basics skill of scientific work for each observation between the experimental group and the control group can briefly be seen in Figure 2 below:
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Figure 2 indicates that basic skills of scientific work on the experimental class higher than the control class. In the experimental class average basic skills of scientific work is 83.49% with good category and 59.66% in the control class with less categories. In the experimental class, learning using the RANGKA contextual learning at each meeting by applying the sixth phases of the contextual learning. The use of this model allows students to learn actively and get involved in the learning process. RANGKA contextual learning is also effective against students basic skills of scientific work, this can be seen in some of the observed indicators, overall students basic skills of scientific work classified as good, it is related with the existing phases on the contextual learning. In the state the problem phase, students are expected to increase the curiosity against material taught, in the observation phase, students should explore knowledge by answering explorational question in the worksheets as a group, so it can train the observation, classification, communication, cooperation and responsibility. Further, in the state, merge and communication phases students should present the results of the discussion to train asking and answering questions, it will establish good communication between the student. In the practice phase students apply the concepts that have been held in the new situation by answering elaboration question so that students' understanding of concepts would be better.

Furthermore on the students basic skills of scientific work data conducted inferential analysis by using t-test, as in Table 3 below:

<table>
<thead>
<tr>
<th>Group</th>
<th>BSSW</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eksperimen</td>
<td>83.49 %</td>
<td>Good</td>
</tr>
<tr>
<td>Control</td>
<td>59.66 %</td>
<td>Less</td>
</tr>
</tbody>
</table>

| t-test | 3.37* |
| t_{tab} | 1.99 |

* = significant

Based on the t-test which shown in Table 3 obtained t test (3.37) > t_{tab} (1.99). This means that there are fundamental differences in the ability of the scientific work of students between experiment group and the control group.

Differences in students' basic skills of scientific work in the experimental group and the control group related to applied learning activities in the experimental group. Through learning model that is applied to experimental class provides opportunities for students to develop the abilities / skills...
they have, this is because the steps of contextual learning activities which designed in the lesson plan intensified the students to be active and motivated so that encourages students to get involved directly in the learning process. With the involvement of students in the learning process will bring some students basic skills of scientific work at the time of teaching and learning activities.

3.3. Mastery of Facts, Concepts, and Procedures

Based on the results of pre and post-test in the experimental group and the control group, it can be seen the value of students’ concept mastery. Average student concept mastery in both class are presented in Figure 3:

![Figure 3. The mean value of the pretest, post-test and N-gain for experimental and control class](image)

Based on Figure 3 it can be seen that the initial knowledge (pre-test) students between the experimental class and the control class, the value of pre-test in the experimental group, is 51.18% (less) and a control group is 51.28% (less). This value suggests that the two classes have the same ability in the cognitive.

Figure 3 also shows an increase in the average value of mastery of concepts in the experimental class, which is 80.13% (Good) higher than the control class is 73.70% (Enough). This is because the experimental class, is used Learning cycle model of learning which the students are required to actively discover their own concepts of the material being studied. Students also comes with worksheets that lead them to seek and find their own information and concepts from the book, so that the knowledge and information students learned not only obtained from teachers.

In the both class of the samples (experimental and control), average post test score higher than the average pre-test. Experimental classes increased by 28.95% while the control class is 22.42%. Results of analysis of N-gain calculations show that increasing mastery of concepts in the experimental class 0.60 and 0.40 in the control classes, both received moderate category. Use contextual learning Cycle Model in the experimental class could further enhance the students’ mastery.
of concepts. Further, on the data of mastery of concepts conducted inferential analysis by using t-test, as shown in Table 4 below:

<table>
<thead>
<tr>
<th>Group</th>
<th>Mastery of Concepts</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>80,13</td>
<td>Good</td>
</tr>
<tr>
<td>Control</td>
<td>73,70</td>
<td>Moderate</td>
</tr>
<tr>
<td>t-test</td>
<td>3.73*</td>
<td></td>
</tr>
<tr>
<td>t_{tab}</td>
<td>1.99</td>
<td></td>
</tr>
</tbody>
</table>

* = significant

Based on the results of the t-test calculation shown in Table 4 obtained 3.73 t_{test} > t_{tab} 1.99 (significant), from these results can be explained that there are differences in students' mastery of concepts between experimental and control group, students learn by applying contextual learning cycle mastery of concepts better than students who learn using conventional learning (lecture) submitted by teachers. According (Harwell, 1999) contextual learning can encourage students to have more positive attitude in learning. When students can relate the concepts they have learned to real-life situation.

The character development and spiritual values are integrated in all subjects (National Ministry of Education 2011). The implementation 2013 curriculum is an improvement from the Competency Based Curriculum. The 2013 curriculum emphasizes experience catering to the expansion of scientific process skills and attitude in order for students to understand science concepts and thinking skills through problem solving activities.

4. CONCLUSIONS

Research on contextual learning should be developed continuously. RANGKA contextual learning can be used as an alternative strategy in the Active Learning, Innovative, Creative, Effective, and Fun (Pembelajaran aktif inovatif kreatif efektif dan menyenangkan/PAIKEM) integrative with character value and basic skill of scientific work. RANGKA strategy is a student centered learning, with emphasis on learning activities that encourage students to think critically and creatively as part of the life skills students should possess. Effect of RANGKA strategy can be further extended in different situations and circumstances by science education researchers.

ACKNOWLEDGEMENT

I am heartily thankful to Directorate General of Higher Education, Ministry of National Education for the financial support through Riau University Research Institute Competitive Grant.

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IMPLEMTATION OF CHARACTER EDUCATION THROUGH THE DEVELOPING OF SCIENCE LEARNING BASED ON TRADITIONAL GAME “GOBAG SODOR”

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Faculty of Mathematics and Science Education
IKIP PGRI Semarang

ABSTRACT
This R and D study aims to develop education of student’s character through science learning based on traditional game “Gobag Sodor”. Mixed-method used to analyze data which took with some techniques (questionnaire, observation, teacher responsiveness sheet, and field note). Study subject that used was student of junior high school in Semarang. Study result show that education of student’s character was good after studying with science learning based on traditional game “gobagsodor”. It was proved from t-test result to the student’s character questionnaire that t-value was 0.00 less than t-table with α 0.5. This fact also promoted by analysis result of observation sheet, teacher responsiveness sheet, and field note. So it can be concluded that study through science learning based on traditional game “Gobag Sodor” can develop education of student’s character.

Keywords:
Character education
Science learning
Traditional game gobag sodor

1. INTRODUCTION
The need for students to learn is not only the material which presented by the teacher in the classroom, but the most basic need is the formation of character. Respect to the older, respect to others, and respect to the younger are some character indicators that embedded in a person. Character education need to be embedded in students early, in order to their understanding of knowledge can run balance with their true identity (Roshayanti, 2011).

Contemporary phenomenon that frequently appears in the media is many fights among students which triggered by little and not principled issues. It has provided an overview of the education world that character education is important to be embedded. As proposed by Rigby (2009) that the culture of bullying and fighting at school can lead mental, emotional, physical and academic disorders to the students who become victims. Culture of violence and other moral problems are very worrying and should get serious treatment from people who are concerned. Government through the Ministry of National Education (2011) has launched a program of character development through character education on various aspects of the national education system.

Character education focused on effort for applying kindness value in the form of behavior (Wynne in Zuhdi 2009). It also describethat there are two terms associated with the character, namely aspects of behavior and personality. Aspects of behavior shows how a person behaves good or bad, while aspects of personality showsthat a person said hasa good character if they have character
depend on moral norms. Lickona (1992) said that the formation of character consists of three interrelated parts, namely moral knowing, moral feeling, and moral behavior. Good character consists of knowing the good, love or want goodness (loving or desiring the good) and acting the good.

Character education has a higher meaning of moral education, because it is not only teach what is right and wrong, but also to embed habituation about good things, so learners become understand (cognitive domain) about which is good and bad, can feel good value (affective domain), and used to do (psychomotor domain) (Suroso, 2012). Rich (1997) said that there is a value, ability, and the inner engine that can be learned and taught by the teacher who called mega skills, which include: self-confidence, motivation, effort, responsibility, initiative, perseverance, caring, team work, logical thinking (common sense), problem solving skills, and concentration (focus).

Character education should not be divided, it should be integrated into the curriculum. Koesoema, A. D. (2007) said that the character is a human anthropological structure. Character education will provide social help so individual can grow in freedom to live with other people in the world. Character education can be done by the teacher in learning activities. If it has been implemented in learning activities, it will has been form a strong mental, used to develop thinking skills, so it can solve any problems.

In implementing character education at school, the government has implemented through various strategies. One of this strategies is applying character education in unit level of education. The values of character formation at school implemented through operational programs of each educational unit (National Education Ministry, 2011). Implementation of character education at school was done in every aspect of the teaching and learning activities, related to it. National Education Ministry (2011) said that character education should be integrated in the classroom and the teacher play very important role. However, the problems which faced by teachers in integrating character education in the classroom are how to develop an innovative learning method that can initiate the development of student character.

One of the learning model alternatives which can develop student’s character is applying the traditional game. This study offers an application model of traditional games such as "Gobag Sodor" in science learning. One of the reasons for selecting this topic is effort to integrate the delivery of teaching material with science learning model based on traditional games. It hope the students can enjoy learning activities, because it is done while playing without losing the essence of learning to practice thinking skills. In addition, the development of these models intended for students to maintain traditional culture that has been nearly forgotten because kids prefer choose game based on electronic which is actually less psychomotor training and character education. Next, this study will describe how learning with "Gobag Sodor" game can develop student’s character, especially science learning in Junior High School.

In research that has been done, we developed character education through science learning model based on traditional game which was implemented in the junior high school. In practice, we did the development of learning tools, character education instrument, implementation guide of character education in learning activities in the form of book and tutorial CD, until tools which required in learning. The development of this learning model can accommodate the implementation of character education which integrated in learning activities in the classroom. Finally, we hope the results of this study can be used as a guide for junior high school teachers in developing character education at school.

This study aims to develop character education which integrated with teaching material through science learning model based on traditional games, especially "Gobag Sodor" game. It also aims to make the design of development of learning science model based on traditional game and develop character education instruments based on assessment need.

The benefits of this research is a guide for teachers in implementing character education in the classroom learning activities, create fun learning, because students can learn while playing through science learning model based on traditional game, students are able to learn more about the traditional culture well so they can preserve it.

2. RESEARCH METHOD
The study design was a Research and Development (R & D) with modifications. Selection of R & D design was based on the advantages and suitability of this design to research problems. The data were analyzed using a mixed-method descriptive quantitative and qualitative. By using this method obtained a complete overview of the science learning model based on traditional games as the implementation of character education in the junior high school.

At the model tools trial testing stage used experimental designs. This design used the determination of a specific subject for the two groups, experimental and control group. Pretest and posttest given to the experimental and control group with same assessment based on education character and the same time to see the effectiveness of science learning model based on traditional games. Research treatment given to the experimental group, namely the development of science learning model based on traditional game, while the control group did not use it.

The research was conducted with several stages, namely: 1) preliminary stage, the team conducted literature studies and field observations, 2) planning stage, the team developed assessment need based on field studies, determined the effectiveness indicator of learning tools model based on traditional games, developed learning tools, 3) developing stage, the team made the design development of science learning based on traditional game Gobag Sodor; 4) testing stage, the team carried out tests to measure the effectiveness of the assessment, 5) analysing stage, the team did the processing, analysing, and interpreting data and performing the reflection and evaluation model tools based on traditional games.

Data collection was conducted in the Semarang for 10 months from February to November 2012 with Junior High School students. The instrument which used in this study include character education questionnaires, observation sheets, respondence sheets, field notes, and student worksheet.

Data analysis method was performed by using triangulation mixed-methods design (Creswell, 2008). It was analyzed simultaneously from quantitative, qualitative and combined data. Further analysis result used to understand research problems. The rationale basic of this design was the lacking of data analysis from one type of data would be supplemented by other types of data. In this case, the quantitative data provided a way to generalize, while qualitative data provided information about the context and setting.

Quantitative statistical test performed to determine character gain which developed from each treatment on field validation stage. While the qualitative descriptive analysis conducted on data questionnaires, interviews, observation sheets and learning transcripts, in the preliminary stages and implementation of learning model based on traditional game during field validation. Table 1 shows clearly the data analysis techniques that refer to research problems. Analysis process of triangulation data was performed by analyzing both types of qualitative and quantitative data separately, compared the results, and interpreted whether the data support each other or opposite each other.

3. RESULT AND ANALYSIS

The data obtained from the study result were analyzed by calculating t-test of questionnaire score before and after applying the model which would be confirmed by observation and reflection results. T-test calculation results could be seen in Table 1. Based on the data analysis was generally known that science learning model based on traditional game “GobagSodor” can develop good character students by character questionnaire data.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. dev</th>
<th>Std. Error</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gobag sodor</td>
<td>1</td>
<td>28</td>
<td>114.00</td>
<td>5.932</td>
<td>.000</td>
</tr>
<tr>
<td>value</td>
<td>2</td>
<td>28</td>
<td>135.64</td>
<td>7.996</td>
<td>.000</td>
</tr>
</tbody>
</table>

Based on the t-test data above can be seen in column sig. (2 tailed) which indicating that t-value was 0.00 was smaller than t-table with α 0.5. The data was significantly different, so the character of students before and after learning through the application of learning model based on traditional game "GobagSodor" developed significantly.
While it, based on the observation result of students percentage who behave in character known that most (over 50%) of students showed characteristic behavior during the process of learning model based on game "GobagSodor". The tendency of observation data analysis results convenient to the reflection data result of the teachers. The data of observations result in learning that use learning model based on traditional game "GobagSodor" can be seen clearly on characters aspects from the following graph.

Figure 1. Percentage of Students Character Development based on Observation Result in the Science Learning based on
<table>
<thead>
<tr>
<th>No.</th>
<th>Indikator yang di amati</th>
<th>Persentase kemunculan dalam kelompok</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Siswa melakukan kegiatan pembelajaran dengan sungguh-sungguh</td>
<td>Kelompok 1</td>
</tr>
<tr>
<td>2</td>
<td>Siswa dapat belajar secara mandiri dengan berinkuiri memecahkan masalah yang dihadapi terhadap...</td>
<td>Kelompok 2</td>
</tr>
<tr>
<td>3</td>
<td>Siswa belum menyelesaikan tugasnya jika waktunya belum habis</td>
<td>Kelompok 3</td>
</tr>
<tr>
<td>4</td>
<td>Siswa begitu antusias mencari tahu penyebab pencemaran lingkungan untuk ditemukan solusinya agar tidak...</td>
<td>Kelompok 4</td>
</tr>
<tr>
<td>5</td>
<td>Siswa menghargai pendapat teman kelompoknya yang berbeda dengan dirinya</td>
<td>Kelompok 5</td>
</tr>
<tr>
<td>6</td>
<td>Siswa membantu teman kelompoknya yang belum dapat menyelesaikan tugasnya</td>
<td>Kelompok 6</td>
</tr>
<tr>
<td>7</td>
<td>Siswa mematuhi seluruh aturan main yang sudah ditetapkan dalam penerapan model pembelajaran...</td>
<td>Kelompok 1</td>
</tr>
<tr>
<td>8</td>
<td>Siswa tidak melakukan kecurangan dalam permainan</td>
<td>Kelompok 2</td>
</tr>
<tr>
<td>9</td>
<td>Siswa mengikuti intruksi dari guru untuk setiap tahap pembelajaran dengan baik</td>
<td>Kelompok 3</td>
</tr>
<tr>
<td>10</td>
<td>siswa dapat berpikir secara komprehensif selama tahapan pembelajaran yang dilakukan</td>
<td>Kelompok 4</td>
</tr>
<tr>
<td>11</td>
<td>Dalam memecahkan permasalahan siswa dapat memberikan solusi yang logis, kritis dan kontekstual sesuai...</td>
<td>Kelompok 5</td>
</tr>
<tr>
<td>12</td>
<td>Siswa melakukan presentasi hasil pengamatan, diskusi dan pengujuan konsep dengan penuh rasa percaya diri</td>
<td>Kelompok 6</td>
</tr>
</tbody>
</table>

Figure 1. Percentage of Students Character Development based on Observation Result in the Science Learning based on Game “Gobag Sodor”
Reflection to the trial testing of science learning model based on traditional game did as an evaluation to get suggestions from the teachers as practitioners in the field who will use this model. Reflection was done through the scoring of some indicators aspects of assessment. From the results of this reflection known that the average teacher gave score 55 out of 72 total score, which means that this model was good enough to be implemented in science learning in Junior High School. Some suggestion was also presented in the form of teachers field notes who became observer as presented in Figure 2.

![Teacher Reflection Result Score to the Science Learning Model based on Traditional Games.](image)

**Figure 2.** Teacher Reflection Result Score to the Science Learning Model based on Traditional Games.

Based on field notes from the teacher (Figure 2) shown that generally teachers gave some suggestions related to the time management and student’s organization, in addition it introduced that the model need the conditioning of the game rules before its implementation. However, all teachers agreed that this model can be used as an implementation of character education in the school which was integrated with science learning.

<table>
<thead>
<tr>
<th>No</th>
<th>Observed Aspect</th>
<th>Field Note Which Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preparation stage of learning (learning tools, equipment, materials, etc)</td>
<td>The preparation stage took enough time so that it was needed preparation before the lesson begins.</td>
</tr>
<tr>
<td>2</td>
<td>Student organizing stage/gave instruction related to the stages to be conducted.</td>
<td>In organizing students need to regulate firstly so that instruction can be delivered more effective related to the duties and responsibilities of each students.</td>
</tr>
<tr>
<td>3</td>
<td>Conditioning stage for the students to make good observations.</td>
<td>Some students were still not fast enough to respond to the teacher’s instructions so it require more comprehensive conditioning before implementation.</td>
</tr>
<tr>
<td>4</td>
<td>Time management</td>
<td>There was difficulties in time management because of the limited lessons time, so it need clearer time management.</td>
</tr>
</tbody>
</table>
After analyzing the trial testing results of learning model with traditional games, it could be presented that science learning by integrating the traditional game “Gobag Sodor” offers an alternative implementation of character education at school.

In fact, trial testing results of science learning model based on traditional game could stimulate students to develop its character. Characteristics of this model provided the opportunity for all students to engage actively in learning process. The rules of traditional game could develop character of discipline, hard work, responsibility, cooperative, honest, and comply to the regulation. In addition, by answering questions in each box games, students were trained to be able to think critically and logically.

From the implementation of limited testing at school obtained the result that model design which has been developed can be applied in research, but still found some problems, such as 1) insufficient time allocated for the execution of the study because the students were too busy to follow learning with games that have been determined, 2) the using of equipment was less effective because the classroom situation was not conducive so it got out of the draft which was previously estimated, 3) control team as the controller answers to these questions could not be moderate, so the use of time become longer.

Based on that conditions, we feel necessary did an evaluation and repeated in the limited trial. Repetition was performed to obtain the result of deficiencies that occurred in the first trial can be resolved, students were enthusiastic in learning model based on traditional game, the time spent was more effective, equipment which has prepared could be used well, all of game rules in model design could be implemented well. So, these results could be used as a recommendation to be tested extensively in the second year.

4. CONCLUSIONS

In implementing character education in learning need the right guide and strategies, so the achievement of expected results could be seen clearly. Science learning model based on traditional games could be one of the options in the implementation of character education which integrated with the teaching material. Through this research has been designed instructional design models, guides, instrument, and equipment which have been tested validation and performed of small scale trials.

The results of this research was the data which showed the positive effects of learning through the application of science learning model based on traditional game “Gobag Sodor” to the student’s character. Students were very enthusiastic in learning because they felt enjoy learning which packaged with the game, without losing the essence of learning to practice thinking skills. From this research we produced guide of science learning model based on traditional games, character instrument, and learning equipment.

Based on this results, we can advise that in implementing character education in the learning activities, teachers should pay attention to the following points: 1) identify the characteristics and desires of students in learning, so we will easily apply the right strategy, 2) in applying the science learning model based on traditional game look carefully the learning syntax and guide in order to be

<table>
<thead>
<tr>
<th></th>
<th>Coaching stage in the observation and discussion.</th>
<th>The teacher precision was required in coaching so that it can be more effective.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Student conditioning stage in application of learning model based on traditional game.</td>
<td>Students were interested in learning because it was not boring, and it could train students to be able to develop its character.</td>
</tr>
<tr>
<td>7</td>
<td>Learning result presentation stage</td>
<td>It could stimulated student learning to be motivated and able to improve its performance.</td>
</tr>
</tbody>
</table>
effective, 3) make design instruments as required, 4) prepare equipment as needed, 5) prepare question card as much as possible and explore student’s thinking skills, so that the results which obtained is not only rote concept.

References
A DESCRIPTION OF THE DEVELOPMENT OF ASSESSMENT BY ELEMENTARY SCHOOL CANDIDATE TEACHERS-UNIVERSITY STUDENTS IN A CONTEXT-BASED SCIENCE LEARNING

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ABSTRACT
This paper described the development of assessment by elementary school (SD) teachers candidate-university students in a context-based science learning. The purpose of this study was to investigate to the extent of which the SD teachers-university students have developed their context-based science learning and its assessment. It also investigated the role of teacher educational institution in enhancing teacher capability and professionalism. In addition, this paper reviewed some related literatures and researches on context-based learning, authentic assessment, and teacher competency.

Keywords: Assessment, Context-based science learning.

1. INTRODUCTION
Essentially, science study directs and suggests to the teachers of science that the implementation of learning should not be oriented only to the understanding of concepts, but rather both scientific attitudes and processes as the results of learning processes should also disclosed maximally.

Republic of Indonesia Law Number 14 of 2005 on Teachers requires that the job of teacher is a professional occupation. Teachers as the instructor in a learning process must be capable of planning the goals of learning, guiding their students in achieving desired competencies, and carrying out assessment for improving the quality of learning. Accordingly, there are two crucial indications in an educational process at a classroom that are always related to both learning processes and assessment.

Context-based learning
The learning processes that teachers prepare and implement should be of high quality and beneficial for students. Teachers ought to present any contexts that their students need and know. A learning that is unconnected to a certain context with which the students are familiar will result in a bias, insignificant, and “vanished” learning. As Johnson & Elaine B (2002) suggest, the higher the
capacity of students to connect their academic learning to some context, the more the meaning they get from the learning.

Assessment

If the goal of science is for cognitive, affective, and psychomotor masteries to be implanted within the students, then objective and subjective tests are not an adequate instrument in measuring the learning achievement. Through such assessment, the skill of students in conducting their activities, either during trials or when producing a creation, is not fully disclosed.

Then, term ‘assessment’ in a learning process begins to be widely used. Moreover, the assessment used is not limited to the scope of understanding on concepts, but rather expected assessments are real or truly ones. Furthermore, as Johnson & Elaine B (2002) say, an authentic assessment invites students to use their academic knowledge in a real world context for a meaningful goal.

Authentic Assessment

Doran, R. et al. (2002) described that “authentic” is a term of assessment referring to a “real world” situation or context, generally needing varied approaches for problem solving and what are problems that make it possible for more than one solution to the problems. Assessment also frequently provides students with chances of producing diverse solutions on any problem.

In line with some other literatures, alternative assessment is occasionally called as authentic assessment, portfolio assessment, or performance assessment (Val Klenowski, 2002; Doran, R., et al.; 2002; Johnson, R. L: 2009; Vito Perrone: 1991). The use of an authentic assessment according to Meyer, C. A (1992) puts more emphasis on a context of how are responses made, whereas performance assessment pays more attention on how many are students responding to be assessed. Thus, not all performance assessments are authentic ones. In a performance assessment, students complete and demonstrate some behaviors that an assessor intends to be measured. Whereas in an authentic assessment the students not only complete and demonstrate the desired behaviors, but also actually conduct them in certain life contexts.

The form of An Authentic Assessment in Natural Sciences

Authentic assessment puts more emphasis that students can demonstrate their skills and knowledge of answering some questions. For the students to be capable of demonstrating their skills and knowledge, some problems to be solved in the course of learning are designed. The problems or assignments should be in line with the real activities or real problems of the students. The answers of the problems should make it possible for more than one right answers or rectify the answers of the problems to be more convincing. Some examples of the forms of authentic assignments are: science experiments, research project, presentation, lesson presentation, real life problem solving, and portfolio.

Related Researches

Some researchers in the field have conducted researches by asking teachers to fill out a questionnaire and develop learning schemes. The results showed that the assessment processes conducted so far were solely intended to measure the levels of concept mastery that were obtained by objective and subjective written tests as a measuring instrument. For example, a research by Nuryani et al. (1992) disclosed that the tests carried out thus far measured only the mastery of materials, and even they were carried out only on low cognitive levels.

Another research was conducted by Buldur, Serkah & Tatar, and Nilgun (2009) concerning the perception of teachers on alternative assessments and revealed that the teachers were weak in classroom management, time management, too crowded classrooms, the lack of teachers’ knowledge on contains, and the low knowledge of teachers on student skills and assessment. Whereas during an interviews the teachers acknowledged that applying performance assessment techniques and tools is highly time consuming. In addition, they complained the lack of school facilities, the lack of teachers’ knowledge on assessment techniques and tools, the complaints of students’ parents, too heavy curriculum burden, too crowded classrooms, the less interest of students, and insufficient other sources.

Such condition caused the teachers reluctant to conduct a learning that focuses on a student’s activities-based development. The learning activities conducted were usually focused on the
presentation of materials according to textbooks. This factual situation forced the students to memorize whenever they were going to take an examination. Whereas for SD level, according to Harlen, W (1993), the priority was on how to build a sense of curiosity and critical power of children on a problem.

A research by Ahmad N et al. (1998) disclosed some acknowledges of SD teachers that they had never attended any workshop or training at an elementary education level that specifically dealt with the application of assessment. The same was also investigated by Korkmaz and Kaptan, 2003; Watt, 2005, and Cheng, 2006 (in Buldur, Serkan& Tatar, and Nilgun: 2009) which disclosed that the failure of teachers in using alternative assessments was due to the lack of their knowledge on the issue. They also found out that the teachers had very limited knowledge on other assessment techniques and tools. The recommendation that Buldur, Serkan& Tatar, and Nilgun (2009) proposed based on the results of their research was that it needs to put more emphasis on the assessment system for both teachers and candidate teachers to study, plan, and implement any alternative assessment.

The Formulation of Problem

The capability of a teacher to get a professional competence should be sought as early as possible. Therefore, in order to enhance the competence of teachers, it needs to design a preparatory program since they study as a student. Professional teachers have some indications, namely, capable of planning, implementing, and assessing the learning results of students during a study. Related to the learning results, student assessment should be real or authentic according to what the students achieved and capable of digging the competence of students in other aspects in various forms of authentic assessment.

The rationale above can be expressed in a research problem formulation as follows: How is the development of assessment that students-candidate SD teachers conducted on context-based science learning?

The purpose of this research was to find out how the students of PGSD as SD teachers in designing and implementing an authentic assessment on context-based science learning. The researchers considered that this research is very beneficial to conduct particularly in order to obtain an early description on the competence of students in designing learning and its assessment that is commonly used and developed.

The questions to answer in this research were as follows:
1. What is the competence of the students-candidate SD teachers in designing context-based science learning?
2. What is the competence of the students-candidate SD teachers in designing an assessment on context-based science learning?
3. What is the role of teacher guidance institution in developing competences in assessment and learning?

2. RESEARCH METHOD

Research Designs and Sample

A research design is a procedure of collecting, analyzing, and interpreting and reporting the data of research. The research design becomes a guidance in deciding the method to be used by the researcher during conducting the research and determining the logic in making an interpretation in the end of the research (Creswell & Clark, 2007).

The research was conducted on those students of PGSD who have been working as SD teacher and attending a study in university (part of the students of advanced study and Dual Modes). Those students have been teaching in SDs around East Priangan (TasikMunicsciencelity and District, Ciamis District, and BanjarMunicsciencelity). The sample of students picked up consisted of the students who were attending a profession training program, 38 persons in total.

Form, Source, and Data collection and Processing

The data collection instruments used were questionnaire and observatory sheet of Learning Implementation Scheme (RPP). Next, the data collected was analyzed descriptively, and then analyses of questionnaire and on learning scheme were conducted by using an assessment rubric.
The data of questionnaire results was changed into a form of the percentage of respondents’ responses to the points of questions. Meanwhile, the data of learning schemes was assessed by using a rubric that the researchers have developed referring to how the students-candidate SD teachers designed their lesson and its assessment. This result was obtained from an assignment of the 38 teachers who were attending a course (dual modes class) to develop a RPP of science lesson.

The discussion of the research results was divided into two, one on the results of questionnaire and another on the results of an observation of RPP that the teachers had made.

3. RESULT AND ANALYSIS

Discussion I (on the results of questionnaire)

Responses on Learning Implementation Scheme (RPP)

The results of questionnaire processing showed that of the 38 respondents, 65.79% designed their lesson before teaching science. The majority of them said that RPP of science that they used was either developed by them or duplicated from an existing one. More than half of the respondents (63.16%) carried out a study of materials based on the curriculum in designing an RPP.

Meanwhile, on various problems in developing an RPP of science, 44.73% respondents said that they don’t really understand the concept and 34.21% said the time allocated was short. In preparing a learning process, more than 60% teachers carried out a study of science material contained in the curriculum, and of which 10 percent admitted that they didn’t carry out a study of material before a session. It should be appreciated the admission of nearly all respondents (71.06%) that stated that their RPP of science had been developed not merely to meet administrative requirement.

Concerning the connectedness of their material and daily life contexts, 55.26% admitted that in designing their RPP of science they connected a concept of science to be learnt to any event/phenomenon close to the students’ life, while 2.64% said they didn’t. The reasons for difficulty in connecting a concept of science to a specific context were the less of time (86.84%) and the lack of understanding of the concept rightly (13.16%).

It is noteworthy that in fact only 18.42% respondents who admitted understanding a context-based science learning, whereas 47.37% said that they modestly understand, and 34.21% admitted that they don’t understand a contextual-based science learning.

Responses on the Use of Assessment

From the results of the processing of questionnaire on the use of assessment it was known that majority of the teachers (63.13%) said that in designing and developing an instrument of assessing science they occasionally created it themselves or they duplicated an existing instrument. The assessment instrument that they usually developed was perceived as having represented the real competence of their students.

In using test problems, the forms most frequently used were essay and multiple choices. However, 60.53% of the respondents admitted that they occasionally used other assessment instruments besides from essay and multiple choices. Of all respondents, 60.52% said that essay or multiple choices test problems have represented the real competence of students in science. More than half respondents (60.53%) admitted to find it difficult developing an assessment instrument other than essay and multiple choices in science learning. The reasons for the difficulty were the lack of their understanding of any other assessment forms (47.37%) and the less of time to develop them (39.47%).

When the respondents were asked on an assessment in form of student portfolio, it turned out that the majority of the teachers (60.53%) admitted that they have only little knowledge on the form of assessment. In addition, nearly all of the respondents (73.68%) didn’t understand term ‘authentic assessment’ and its examples, and majority of them didn’t know the difference between the meaning of assessment and evaluation in science learning. In line with it, when asked on their understanding on alternative assessment and its example, nearly all of the respondents (78.95%) admitted that they didn’t understand and 73.68% respondents didn’t carry out alternative assessment as an assessment instrument in the science learning process that they planned and conducted.
Responses on Training and Teacher Working Group (KKG)

The frequency of the respondents in attending educational activities and training fell into categories of often (23.68%), occasionally (52.64%), and never (5.26%). Meanwhile, the forms of training most frequently attended were learning model/method/strategy (52.64%) and leadership (10.52%), whereas a learning achievement test training has ever been attended by only 5.26%.

Moreover, concerning whether there is some impact/effect of training on the competence of preparing a learning set and the method of developing a teacher assessment instrument, only 31.57% said yes, whereas 52.64% said just as usual, and 15.79% said no. However, nearly all of the respondents expressed it needs to hold trainings on the development of science learning and alternative assessment instruments in order to enhance the competence of teachers in teaching-learning processes.

Discussion II (on the results of teacher learning scheme)

Next, the 38 respondents were provided with an assignment of developing a Learning Implementation Scheme (RPP) of science course. The science RPP was then assessed by using an assessment rubric by some aspects and indicators.

From the first aspect, the goal of learning, it was disclosed that 55.26% of the respondents set the goal of learning in the development of student competence that was oriented to only concept understanding.

On the second aspect, learning steps, there were some assessment indicators. By the first indicator, that is, implementing aperception by digging the initial knowledge of student, it was found that 63.16% respondents conducted aperception to connect among some concepts. Whereas by the second indicator, that is, preparing some learning activities of students connected to a science context in the course of learning, the majority of respondents (63.79%) carried it out. By the third indicator, that is, the relevance of learning steps by using LKS, it was found that 55.27% respondents carried out some learning steps by using LKS but didn’t know clearly what is the goal of assessing it. By the fourth indicator, that is, the appropriateness of method in applying a context-based science learning, it was found that 19 of the 38 respondents listed the method just in the interest of supplying in the implementation of a context-based science learning. By the last indicator, it was found that 57.90% respondents used an environment beyond classroom as a learning medium that was brought into a classroom as an exhibitory instrument.

In the assessment of the third aspect, concept development, it was found that nearly all of the respondents (73.68%) connected the context of science to a textual science just for the sake of aperception.

In the fourth aspect, assessment development, it was found that 47.38% respondents developed an assessment according to the specified goals that was oriented to only the understanding of the concept. Moreover, it was found that 50% of the respondents developed an assessment in form of concept understanding that was limited to direct memory, such as the following questions: name, what is meant by, why, and so on. Even majority of the respondents (73.69%) didn’t develop an assessment other than a concept understanding problem test.

4. CONCLUSIONS AND RECOMMENDATION

Conclusion

Based on the research results described in the discussion above, it can be concluded as follows:

1. Majority of university students-candidate SD teachers have been capable of designing a Learning Implementation Scheme (RPP) of science although they occasionally still duplicated an existing RPP. In developing their RPP of science, most of the candidate teachers carried out a study of the scope of material based on the curriculum. The problems were the lack of right understanding on the concept and the less of time.

2. Majority of university students-candidate SD teachers have been capable of designing a context-based assessment in science learning, although they still perceived that the less of time as a cause...
of difficulty in connecting the materials of science that were learnt to any event or phenomena close to the students. The context-based science learning was still less understood by the candidate teachers. They occasionally still duplicated existing problems and stated that multiple choices and essay problems have adequately disclosed actually their student’s competence of science. Although some assessment instruments other than multiple choices and essay test problems were occasionally used by the majority of the candidate teachers, they found it difficult to develop them because they lacked of understanding on the other assessment instruments. Even most of the candidate teachers didn’t know terms ‘assessment’, ‘authentic assessment’, and ‘alternative assessment’.

3. The role of teacher development institution in providing education and training was perceived as has not yet affected significantly the capability of teachers for preparing their learning set and the method of creating its assessment instrument. Nearly all of the respondents expressed that it needs to hold a training of the development of science learning and alternative assessment instrument in order to enhance their competence in a teaching-learning process. They also hoped that various trainings be held in KKG because in KKG they often held discussions on the problems of students in their learning processes and their solution.

**Recommendation**

From the research results above, the authors recommended that candidate teachers be prepared with competence on:

1. How to design a good RPP, particularly a context-base science RPP.
2. How to design an authentic assessment so as to disclose comprehensively the competence of students.
3. Last but not the least, there should be a stage of preparation that is easy to apply by professional teachers.

**References**


THE EFFECT OF POSTER PRESENTATION TOWARDS STUDENTS’ CREATIVITY AND CONCEPT COMPREHENSION ABOUT POLLUTION CONCEPT

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ABSTRACT

This study aims to examine the effect of poster presentation towards students’ creativity and poster presentation about pollution concept. The type of this study was weak experiment with one group pretest and postest design. Population in this research was grade 10 of senior high school students at Bina Nusantara International School Serpong consists of 10 classes. The sample has taken by using random cluster sampling technique. The quantitative data of this research has gained through concept comprehension test and observational sheet, meanwhile the qualitative data gathered through rubric and questionnaire. Based on the analysis of the result, this research obtained improvement in concept comprehension with normalized gain 0.307 which was categorized into medium improvement. The correlation between students’ creativity and concept comprehension done by using coefficient correlation which the result is 9%, meaning that 9% of concept comprehension may be explained by creativity. Based on the result of questionnaires about the use of poster presentation, it may be concluded that students were enjoying the use of poster presentation.

Keywords: poster presentation, students’ creativity, concept comprehension, achievement.

1. INTRODUCTION

There are several things that hang on experiences and adding visualization in the teaching learning practice for the student in the class that can improve students soft skill. Visualize the concept of the science materials can increase students interest to science. This thing has already implemented in some schools, such as poster presentation as assessment. Visualize the concept of science is also benefit during the teaching activities.

According to American Heart Association 2004 (MacIntosh, 2007: 351) “A poster presentation consists of a visual display of research highlights on fiberboard background combined with an interpersonal question and answer period”. There are the key benefits for students because poster are student centered, encourage students to reflect on their learning during their class activity, and enable students to demonstrate their learning and to learn from other students’
experience. They are also felt to be less intimidating than standard oral presentations by enabling the flow of discussion around student experience (McNamara, et al, 2010:5).

According to Stegemann and Sutton-Brady (McNamara, et al, 2010:5) provide a useful summary of the benefits of posters as identified by the literature. Several studies have reported that students feel comfortable with the concept of poster presentations. Presentation at a poster session is an enjoyable and rewarding experience for students. Constructing a poster is an effective of developing both research skills and creative abilities. According to Huddle (McNamara, et al, 2010:5). “Poster preparation allows students to become active learners and encourages deeper learning”.

The use of poster presentation is being one of the triggers for student’s enthusiasm in learning science, because as stated by the experts they found that poster presentation is effective in visual learning. Learning science using a poster presentation is expected to enhance student’s creativity and understanding. By way of an effective teaching and educational, it is expected the students to feel comfortable while learning activities.

According to what have stated aboved, so the research problem how is the effect of poster presentation towards students’ creativity and concept comprehension about pollution?

**Research Questions.**

1. How does the creativity of students through poster presentation about pollution?
2. How does the improvement of students’ concept comprehension before and after they make a poster presentation about pollution concept?
3. How is the correlation between students’ creativity and concept comprehension?

**Poster Presentation**

According to Handron, 1994 (in Bracher, et al 1998). A poster presentation is “as an experiential learning activity that stimulates curiosity and interest, encourages exploration and integration of concepts and provides students with a novel way of demonstrating understanding”.

According to American Heart Association 2004 (MacIntosh, 2007: 351) “A poster presentation consists of a visual display of research highlights on fiberboard background combined with an interpersonal question and answer period”. According to Kress and Van Leeuwen, 2001 (in MacIntosh, et al 2007: 352) “The poster presentation is a multimodal communicative event, with writing, graphics, color, speech, and even gesture used to convey meaning.”. The fact that the content is displayed as a “visual unit,” all on a single view plan, distinguishes it from the research paper. The poster is marked by the importance of the visual features, while the learning activities without visual or abstract is not marked by the importance of the visual features. (MacIntosh, et al 2007).

According to Stegemann and Sutton-Brady (McNamara, et al 2010:5) “provide a useful summary of the benefits of posters as identified by the literature. Several studies have reported that students feel comfortable with the concept of poster presentations. Presentation at a poster session is an enjoyable and rewarding experience for students. Constructing a poster is an effective of developing both research skills and creative abilities. Poster preparation allows students to become active learners.” and Pearce and Sutton-Brady “Encourages deeper learning” (McNamara, et al 2010:5).

**Creativity**

According to Tylor (Munandar, 1992) think creatively is the ability to see, think differently, need some information that perhaps it is not necessary, and make a solution and new idea. Creative thinking is a mental process that is dynamic between divergent thinking (imaginative) and convergent thinking (factual) of continuous from time to time. While creativity is the ability to find some new links, in looking at the subject from a new perspective and create new combinations from several ideas, products, colors, textures, and other things.

The following indicators of creative and definitions of each indicator as described by Munandar (1992):

**Fluency** is sparking a lot of ideas, problem solving, or questions, or suggestions give you many ways to do things, and always think about more than one answer. Definition of the current thinking on the behavioral skills of students, among others are first is post a lot of question, second is answering regarding to the question option. Third is have an idea regarding to the problems. And the last is fluent to post an opinion.
**Flexibility** is producing ideas, answers, or questions varieties, can see the problem from the perspective of different, being able to change the approach or way of thinking. Definition of the current thinking on the behavioral skills of students is as follows are first is giving a various skill towards unusual things. Second is giving a various interpretation to some picture, story, and problems. Third is implement a concept or idea differently. Fourth is give a consideration to some situation, that have different situation given by someone else. And the fifth is if they found various types of problems, they will think differently to solve the problem.

**Originality** is able to create and produce new expression and unique, think differently to express yourself, and can make a combinations that is different with other things. Definition of originality are first is think of some problems that was never thought of by someone else. Second is asking the old ways and try to think something new. Third is chose asymmetry design to create a picture or design. Forth is having a another way of thinking. And the last is refer to synthesize than analyzes.

**Elaboration** is ability to enrich and develop an idea or product and adding or detailing the objects, idea, and situation so it can be more interesting. Meanwhile the definition of detailing skills on the student behavioral are finding the meaning of some question deeply or solve the problem with some steps and detail, develop and enrich the ideas of others, trying and testing a detail to see the final goal, have a beautiful sense so there will be dissatisfaction with blank or simple appearance, and adding some line, colors, and details with their own picture or the other picture.

According to Guilford “creativity refers to the abilities that are characteristics of creative people” (Lee, 2005:3). And according to Hulbeck (Munandar, 1992) Creative action is an imposing of one’s own whole personality on the environment in an unique and characteristic way.

2. **RESEARCH METHOD**

The type of method in this research is weak experiment. This method is chosen because using one class in making a poster presentation without control group. Based on Arikunto (2010) weak experiment method is only use one group research without any control group.

Poster presentation has already implemented in the class activities. It was advantageous for students to become active learner and to develope their communication skills. In order to implemented of poster presentation, one class of experimental group has already chosen. Class divided into several group, one group consists of 4 students. They have to discuss about pollution before they make a poster. In this activity, students should work together. After students finished their poster, they should present their poster in front of the class. Students have to explore their knowledge and creativity through poster presentation. Rubric was used to evaluate the poster.

Creativity is the ability to find some new links, in looking at the subject from a new perspective and create new combinations from several ideas, products, colors, textures, and other things. Students’ creativity were assessed through poster presentation that use observation sheet as an instrument. There will be such indicators in observation sheet for making a poster such as Fluently, Flexibility, Originality, and Elaboration.Pollution is a topic to be raised in the learning using a poster presentation. Class will divided into several group. During making a poster, students will be observed by observer by using obervation sheet.

Students’ concept comprehension in this research is a cognitive domain in pollution concept. Mastery and understand the concepts is essential in teaching and learning activities. According to Bloom’s Taxonomy cognitive domain are C1 (remember), C2 (understand), C3 (apply), C4 (analyze), C5 (evaluate), C6 (create) that are measured by using an objective test consist of 20 multiple choice question.

3. **RESULT AND ANALYSIS**

The profile of students’ creativity
The figure 1 shows the average results of the students’ creativity that obtained by observational sheet. During learning activities of making a poster presentation the higher amount of indicator presents in fluency which is 67% of students who are indicated in fluency. Based on Munandar (1992) the indicator of Fluency are students can spark their ideas, can solve a problem or questions or give a suggestion, and always think more than one answer. Meaning that they are fluent to post an opinion. The lowest amount of indicator presents is in elaboration which is 50% of students who are indicated in elaboration. Based on Munandar (1992) the indicator of Elaboration are the ability of students to enrich and develop an idea or product and adding or detailing the object. Meaning that only 50% of students can enrich and develop their idea during making a poster presentation and adding or detailing the poster. The total average of students’ creativity is 56%.

Table 1. The Results of Pretest and Posttest on Concept Comprehension

<table>
<thead>
<tr>
<th>Component</th>
<th>Pretets</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Mean</td>
<td>61.09</td>
<td>73.04</td>
</tr>
<tr>
<td>S</td>
<td>11,15</td>
<td>9,01</td>
</tr>
<tr>
<td>S'</td>
<td>124,31</td>
<td>81,18</td>
</tr>
<tr>
<td>The highest score</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>The lowest score</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Gain</td>
<td>11.96</td>
<td></td>
</tr>
<tr>
<td>N-Gain</td>
<td>0.30 (Medium)</td>
<td></td>
</tr>
<tr>
<td>Normality test</td>
<td>Sig. ≥0.05 = Normal</td>
<td></td>
</tr>
<tr>
<td>Sig.</td>
<td>0.383</td>
<td>0.263</td>
</tr>
<tr>
<td>Conclusion</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>Homogenity test</td>
<td>Sig. ≥0.05 = Homogen</td>
<td></td>
</tr>
<tr>
<td>Sig.</td>
<td>0.190</td>
<td></td>
</tr>
<tr>
<td>Conclusion</td>
<td>Homogen</td>
<td></td>
</tr>
<tr>
<td>Independent-Sample T-test</td>
<td>Sig. (2-tailed) ≥0.05 =</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H0 Accepted</td>
<td></td>
</tr>
<tr>
<td>Sig.</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Conclusion</td>
<td>H0 not accepted, H1 Accepted</td>
<td></td>
</tr>
</tbody>
</table>

Based on the table shown that mean of students’ concept comprehension in pretest is lower than posttest which is 61.09 < 73.04. This table also show the results of high score and low score of
students’ concept comprehension. In pretest, the highest score of students is 80 and the lowest score of students is 40. Meanwhile in posttest, the highest score of students is 90 and the lowest score is 60.

The result of normality test of concept comprehension in pretest is 0,383 and in posttest is 0,263. Using significant interpretation (α) 0,05 so it can be concluded that the value of significant from normality test both of pretest and posttest is higher than significant. This result shows that the distribution of pretest and posttest score is normal.

The result of homogenity test of concept comprehension in pretest and posttest is 0,190. Using significant interpretation (α) 0,05 so it can be concluded that the value of significant from homogenity test both of pretest and posttest is higher than significant. This result shows that the distribution of pretest and posttest score is homogen.

Based on the result of normality test and homogenity test is shown that the data of pretest and posttest of concept comprehension is normal and homogen, and after that is hypothesis testing. By using a software of IBM SPSS 20 for windows is obtained that the value of significant is 0,00. This data is lower than α=0,05, it can be concluded $H_0$ is not accepted, $H_1$ is accepted, means that there is a significant effect of poster presentation towards students’ concept comprehension.

Figure 2 The Improvement of Students’ Achievement.

The improvement of students’ concept comprehension can be shown by measure N-Gain from pretest and posttest. The result of N-Gain is 0,30 meaning that the improvement of students’ concept comprehension is medium. Meaning that there is an improvement of students’ concept comprehension that had an intervention of poster presentation in learning activities about pollution concept.

Table 2 The Result of the Correlation and Regresion Between Students’ Creativity and Concept Comprehension.

<table>
<thead>
<tr>
<th>Regresion</th>
<th>Correlation</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Y= 42.08+0.552X$</td>
<td>0.307</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Based on the result of correlation between students’ creativity and concept comprehension is 0.307 is done by helping of software IBM SPSS statistics 20 for windows. The result of coefficient determination is 9%, meaning that 9% of concept comprehension of students can explained by creativity and the rest of it can explained by the other thing.
Based on the figure 3 shown above, the result of coefficient determination is 9%. It means that 9% of students’ concept comprehension can be explained by creativity and 91% of students’ concept comprehension can be explained by other things.

4. CONCLUSIONS

The research about the effect of poster presentation towards students’ creativity and concept comprehension has been conducted systematically. Based on the result of the research it can be concluded that the implementation of poster presentation towards students’ creativity and concept comprehension can be seen below:

The profile of students’ creativity based on the observational sheet results which is 56% of students can explore their creativity through poster presentation. The creativity of students shows a positive impact to the result of poster presentation in term of visualization and audiolization.

The implementation of poster presentation can improve students’ concept comprehension, it can be noticed by processing the differences between pretest and posttest score. The differences score of pretest and posttest can be seen by calculate normalized gain which is 0,30 which include as medium category. There is a significant effect of poster presentation towards students’ concept comprehension.

Based on the coefficient determination can be shown that 9% of concept comprehension can be explained by creativity, meaning that the rest or 91% of concept comprehension can be explained by the other things. The respond of students towards the implementation of poster presentation shows the positive respond. Based on the indicator the majority of students like pollution concept, making a poster presentation and creativity through poster.

Recommendation

There are some recomendation based on the finding of the research that has been conducted and the consideration that implementation is still need to be improve. The recomendation and suggestion that necessary to be conveyed by the researchers are:

1. Poster presentation can be implemented as an alternative teaching strategy in other science concept in school.

2. Before designing the instrument to measure the creativity, the analysis of the indicator based on the expert has to be more spesific so it can be appropiate to concept.

3. Analizing students’ ability before making a group is should be done. Considering that heterogen of students’ ability in every group can improve students result.
References


DEVELOPMENT OF ANIMATION TOOL TO IMPROVE CRITICAL THINKING ABILITIES OF JUNIOR HIGH SCHOOL STUDENTS

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UniversitasPendidikan Indonesia

ABSTRACT
The purpose of this study is to develop student-centered animation tool that can improve concept mastery and critical thinking skills of junior high school students. Student-centered animation tool is a learning software that gives students an opportunity to design an animation related to the topic that learnt in the software. By implementing this software, it is expected that students’ abstract concept mastery and critical thinking skills can be improved. The topic that learnt in the software is matter since it contains several abstract concepts. Research methods used in this study is R&D (Borg and Gall, 1998) which consists of constructing software, field testing and validating. The software construction step started from analyzing junior high school curriculum, composing lesson plan, flow chart, storyboard and constructing the software using Flash program. The finding of this step revealed that student-centered animation tool involves several concept contained in the matter topic and it is potential to improve several ability of critical thinking. The concepts developed in the software are element, compound, mixture, atom, molecule and ion while the abilities of critical thinking skills are focus on a question, analyze arguments, ask and answer clarification and/or challenge questions, observe and judge observation reports, deduce and judge deduction, make material inferences and define terms and judge definitions using appropriate criteria.

Keywords:
Student-centered animation tool
Critical thinking abilities
Concept mastery of matter

1. INTRODUCTION
The world always change from one era to another. Several hundreds years ago, people lived in
agriculture ages afterward changed into industrial ages. The improvement of industry has changed the world into information technology (IT) ages that people are facing now. This age of information technology influence Indonesia in many aspect, such as economy, social, politics and culture. However, the influences can be both positive and negative.

Not all of the influence of IT must be adopted. Only those that give us benefits must be adopted. In economic aspect, IT can help people in Indonesia to increase their product marketing by using internet so they can sell the product to consumers that live abroad in easy and quick way. In communication aspect, IT can help people to communicate each other without spent lots of time and money. Like in economic and communication aspect, education is the one aspect that gets many benefits from IT as well. IT helps teacher to develop their class better by using IT based media so that they solve the problem of the lack of media especially in teaching abstract concept.

Although science is regarded as exact subject in school, many of its concept are abstract and difficult to understand. One of the abstract concept of science is particle of matter. Student often find difficulties in learning this concept since it involves processes in atomic and molecular level. On the other hand, students are required to mastery this concept well because they will need it as a foundation to learn the next concepts of science especially chemistry concept. The strength of chemistry explanation is in atomic and molecular level. (Hesse & Anderson, 1992; Treagust & Chittleborough, 2001). Researchers believe that chemistry lesson which focus on molecular level can help students to improve concepts mastery and principles. (Ahtee & Varjola, 1998).

To help students learn abstract concepts, several IT based learning media has been being developed. One of those is animation. Appling & Peak (2004) stated that abstract characteristic of atom and molecule can cause students’ learning difficulties but can be solved by using models. It is expected that the use of animation can be the alternative modelling of atom and molecule. Many kind of animation can be developed in the modelling. Based on researches of the use of animation in learning abstract concept, it was found that the achievement of concept mastery after attending animation based learning has not been optimum so it needs to develop one kind of animation software that allows students to design, interpret and evaluate animation. Hsin, Quintana dan Krajcik (2009) developed chemation, a software that allows students to design, interpret and evaluate molecular animation.

Based on the success of the use of chemation, The researchers intend to develop student-centered learning media that allows student to design an animation and help them to comprehend particle of matter concept. Besides that, it is expected to improve critical thinking abilities, since science can be used to improve critical thinking.

2. METHOD
To develop student centered animation tool that can improve students’ concept mastery and their critical thinking abilities, research and development (R&D) from Borg and Gall (1998) research methods has been being used. The research start from analysis curriculum of junior high school and will be ended by field testing then validating the software.

3. RESULT AND DISCUSSION
The results of the software construction step are chemistry concepts in matter topic, flowchart, storyboard, animation tool software and critical thinking abilities that students may develop.

The research began with analysis junior high school curriculum. The result of the analysis found that matter topic contained several concepts that potential to be developed in animation tool. The concepts are element, compound, mixture, molecule, atom and ion. Those concepts are developed in the software due to their suitability with criterias that have determined in order to choose the concepts would be developed in the software. The criteria of concepts selection is:

1. The concept must be abstract and needs visualization or simulation to deliver it to students.
2. The concept must be essential for developing next concept.
3. The concept must be potential to improve students’ critical thinking abilities.

Element, compound, mixture are concepts about classification of matter. Those three concepts are learnt in junior high school and they are essential as foundation for learning the next topic regarding to chemistry such as chemical reaction and stoichiometry. Atom, ion and molecule concepts are...
abstract concepts that should student master since many of chemical processes occur in microscopic level such as in atomic and molecular level and the it is very important to mastery these concept because the strength of chemistry explanation is in atomic and molecular level. (Hesse & Anderson, 1992; Treagust & Chittleborough, 2001). It is essential to involve ions concepts in the learning as well since many of compound are ionic and ionic compound consists of ions.

After analyzing curriculum, the next step within animation tool construction is constructing flowchart. Flowchart is the figure of the sequence and structure of the software.

The Figure 1 shows flowchart of the animation tool.

Based on the flowchart, the animation tool contains six vertical sequences of scenes. The scene of matter definition has three subscenes, Classification of matter has two subscenes, Element and compound has two subscenes while Mixture has two subscenes. Every subscene contains the designing of animation tool that allow students to design an animation.

After constructing flowchart, the next step is creating storyboard. Story board is the figure that depict the design of software appearance. The software involves 33 storyboard which depict the design of each software frame. Based the story board, the software contains many component of flash. The component are texts, pictures, symbols, animations and sounds.

Finally, the storyboard was interpreted into software. Based on the software that has been made, the software of animation tool potential to improve several critical thinking abilities. Those abilities are focus on a question, analyze arguments, ask and answer clarification and/or challenge questions, observe and judge observation reports, deduce and judge deduction, make material inferences and define terms and judge definitions using appropriate criteria.

![Flowchart of animation tool](image-url)
4. CONCLUSION

Based on the research, particularly in animation tool construction step it can be concluded that the animation tool involves several concepts in topic of matter which are developed into animation tool to improve critical thinking abilities of students. The concepts are element, compound, mixture, molecule, atom and ion. Those concepts are developed in animation tool in form of texts, pictures, symbols, animations and sounds. Critical thinking abilities that potential to be improved by this animation tool are, focus on a question, analyze arguments, ask and answer clarification and/or challenge questions, observe and judge observation reports, deduce and judge deduction, make material inferences and define terms and judge definitions using appropriate criteria.

REFERENCES

IMPLEMENTATION QUANTUM TEACHING TO INCREASE ACTIVITIES AND LEARNING OUTCOMES BASIC SCIENCE CONCEPTS AT PRIMARY SCHOOL TEACHER EDUCATION STATE UNIVERSITY OF PADANG

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State University of Padang

ABSTRACT
Science learning that is perceived less teacher-centered to give meaning to the students. Although there are discussions, nature occasionally done to strengthen the material explanation. Lack of ability students in exploring knowledge, discover and implement ideas that lead to students' lack of understanding of the concept. During learning that emphasizes mastery of product knowledge and psychomotor skills learners affective neglected. This study aims to improve the competence of students in learning Science. Goal achievement is done by applying the model of Quantum Teaching. Teaching Quantum models using a combination of elements of the environment (context) by way of presenting the lesson (content) to keep spending the students' interest. By students that these models have the dynamic space for teachers to design lessons using a variety of interactions structuring the content, learning context in order to deliver maximum results. This study aims to develop a learning model based Quantum Science Teaching on ecosystems and materials. This research is action research class with 4 stages: planning, implementation and action, observation and reflection. Instrument used was a questionnaire Learning Implementation Plan, hand outs, student activity sheets, teacher observation and student assessment for primary school teaching as many as 30 students who took a course Basic Concepts of Elementary School Science odd semester 2012/2013. The results of the application of Quantum models shows teaching: student learning activity increased by 22% in the second cycle after the application of Quantum Teaching. Basic Concepts of science learning outcomes of students PGSD FIP UNP increased by 12% in the second cycle after the application of Quantum Teaching.
Education is the key to unlock the door of modernization, progress and prosperity of a nation. Therefore, especially in primary education is a fundamental milestone in the mastery of science and technology as well as providing soft skills that can improve the quality of its human resources so that students are able to face the challenges of the future. To create a human resource that is expected, many efforts have been made by the government as improve curriculum, instructional workshops and seminars, training and others.

Science learning activities would not be fun if it was a teacher-centered learning. Therefore it is necessary that students creatively. Student activity will be realized when teachers use instructional strategies that can involve the whole student both physically and mentally. The passion for student learning should be maintained, because the desire to learn teacher required students to foster interest and motivation through the elements that exist in students such as intelligence, emotions and feelings. As stated Antonio (2005) that education requires educators figure "ngemong" in its treatment of students as an organism grows and need attention from time to time. Because true education is a process of transformation and moral values, not just trasmisi mere information and data. Other elements that belongs Quantum Teaching, as proposed DePorter (2005:15) in the psychological aspects of learning Quantum Teaching is of considerable concern because of the real learning context sets the stage learning in principle arrange the learning environment to be fun. Therefore, to overcome the problems described above, the researchers tried to find a model / new learning approach that uses Quantum Teaching. Model Quantum Teaching is a learning process that can sharpen students' understanding and memory, as well as making learning a fun and rewarding. This is what belongs Quantum Teaching, so that when carefully arranged to create a sense of respect, belonging, so the class will be a community of learners to learn the target with pleasure.

The main principle of Quantum Teaching is "bring their world to our world, and bring the world into our world". The intent of bringing them into our world are teacher trying to enter the world of student by influencing the thoughts and feelings associated with an event to life, so that teachers can bring students into his world (membelajarkan). Another feature of Quantum Teaching is maintaining student interest. In addition, Quantum Teaching using a combination of elements of the environment (context) and how the presentation of the lesson (content) that student interest is maintained.

The above incident is rare ideal when lecturingBasic Concepts Science students ofPrimary School Teacher Education Basic Concepts Science that will be taught in elementary school. This marked lack of creative students in learning and implementing pratikum, causing the value of the performance and learning activities are low. Generally, the value of the skills / psychomotor supported by the results of the test (cognitive). The average value Final Exam of Semester Biology Basic1st semester 2012/2013 and Final Exam of SemesterScience Basic Concepts 2nd semester of 2012/2013 is as follows (total of students is 30):

<table>
<thead>
<tr>
<th>No.</th>
<th>Value Range</th>
<th>Basic Biology</th>
<th>Science Basic Concepts</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>86 – 100</td>
<td>86, 86</td>
<td>86, 87, 87</td>
<td>Very Well</td>
</tr>
<tr>
<td>2</td>
<td>71 – 86</td>
<td>72, 74, 74, 76, 76, 76, 76, 80, 80, 82</td>
<td></td>
<td>Well</td>
</tr>
<tr>
<td>3</td>
<td>56 – 70</td>
<td>56 (6 students), 70 (2 students), 60 (3 students), 62 (3 students), 66 (3 students)</td>
<td>58 (6 students), 70 (3 students), 62 (3 students), 66 (3 students)</td>
<td>Enough</td>
</tr>
<tr>
<td>4</td>
<td>&lt; 55</td>
<td>40, 40, 45, 50, 50</td>
<td>45, 50, 50, 52</td>
<td>Less</td>
</tr>
</tbody>
</table>

Table 1. Average Value Final Exam of Semester Basic Biology and Basic Science Concepts Primary School Education Teacher student2012/2013

Fundamental studies for Basic Biology courses on Basic Concepts odd semester and the second semester of Science in 2012/2013 (Table 1) indicate that the percentage is not much different, such as: (1) Very well categories on Basic Biology: 2 students (6.67%), and Basic Science Concepts: 3 students (10%). (2) Well categories in the Basic Biology: 6 students (20%) and Basic Science...
Concepts: 8 students (26.67%), (3) Enough categories on Basic Biology: 16 (53.33%), and Basic Science Concepts: 15 students (50%), (4) Less categories on Basic Biology: 6 students (20%), and Basic Science Concepts: 4 students (13.33%). This situation is caused by lack of attention to the psychological faculty students. Generally lazy students learn the basic concepts of biology and science because many concepts are memorized and sequentially. More-over material science lessons more practice, not just theory. Besides, professors rarely give praise / rewards on students, because they are great. This assumption is in fact one of the students need to examples of how to divide their attention, how to raise the spirit and motivation of students and most importantly, how to make students feel happy and not burdened in the study.

The fact that the authors have encountered in the field reinforce that learning science is dominated by the understanding of objectivism. Understand objectivism focuses on mastery of learning outcomes product knowledge so that learning is solely aimed at remembering factual information, so that the psychomotor and affective skills learners neglected. As a complement to the preliminary findings, the researchers distributed questionnaires. Based on questionnaire data showed that 38% of students enjoys learning science without memorization. Amount 72% Science want learners are taught to experiment, and as much as 71% of students are less able to grasp the concept that common misconception. Therefore, the application of Quantum Teaching Learning Basic Concepts in Science is helpful in optimizing the activities of teachers and student learning outcomes.

Primary School Teacher Education maximum Padang State University of Padang. This happens because the main principle Quantum Teaching is “bring their world to our world, and deliver them into our world”. Quantum Teaching intent to bring their world to our world we are trying to enter the world of student teachers by influencing the thoughts and feelings associated with an event to life, so that teachers can bring students into learning. Another feature of Quantum Teaching is maintaining student interest. This is illustrated pinsip contained in Quantum Teaching, namely: (1) Everything speaking, (2) has a goal (3) experience in learning (4) admit every effort (5) if it is worth examining the worth celebrating. Quantum Teaching students in learning is also considered in the ways they prefer to learn in accordance with their respective student type. So students do not have to sit in a chair, but students can choose. With given freedom in choosing students will feel free not bound so that students do not feel pressured to be like this, Quantum Teaching teachers in learning so that the child will be partners feel free to ask, fun in learning.

Quantum is the interaction that converts light into energy (De Porter, 1999:5). These interactions alter the natural abilities and talents of students into light that will benefit themselves and others. Quantum Teaching techniques and principles are applied quantum structured and directed learning undertaken in the fun. With a pleasant state that students do not feel burdened to accept the lesson, because in learning Quantum Teaching is designed so that anyone who follows the lessons will be pleased. With the encouraging situation that all material provided by the teacher will be readily accepted by the students. Quantum Teaching in learning, students get attention when students are doing a good job. The appreciation of the teacher or of his friends will be motivated indirectly. In learning Quantum Teaching students also received recognition from the teacher so that they feel appreciated. Students will always vying to complete the tasks assigned by the teacher, because they know who can be a job well done will always receive special attention. In Quantum Learning Teaching learning material supplied by various ways such as by singing, reading poetry so as if students do not learn, when they learn with enthusiasm. Teachers in presenting the material followed with humor, so students do not feel afraid, do not feel heavy in receiving lessons. Teachers must be able to explain the material in order to simplify the formula easily learned by students, especially those often encountered in everyday life.

Science teaching activities carried out in practice, not just theory, where students are encouraged to practice in daily life. With the students practiced material will be easier to remember than just theory. Another thing in learning Quantum Teaching students also considered in the ways they prefer to learn in accordance with their respective student type. So students do not have to sit in a chair, but students can choose. With given freedom in choosing students will feel free not bound so that students do not feel pressured to be like this, Quantum Teaching teachers in learning so that the child will be partners feel free to ask the teacher. In Quantum Teaching, child talent will be
explored through a variety of ways such as by the music or the singing, the child has a talent then the child will be nurtured talent. With a child's heart will sing happy, with singing lessons children will readily accept. Similarly, the subject matter can be conveyed by way of reading poetry, with joyous singing, a live demonstration involving children that is why, Quantum teaching learning can improve learning achievement (Nilandri, 1999).

The main principle of Quantum Teaching are all aspects of human personality (DePorter in Nilandri, 1999). All aspects that include thoughts, feelings, body language, knowledge, attitudes and beliefs, and perceptions of the future. So learn to be successful when taught by linking to an event, thought or juice obtained from the home life. Learning will be successful if teachers could understand the state of their students, so that all the material, the message will be embedded in the hearts of the students. Finally with a broader understanding and deeper mastery, students can take what they learned into their world and apply it to new situations. Quantum Teaching learning design framework by DePorter (in Nilandri, 1999) are: (1) Grow, meaning a teacher in teaching students should be able to generate interest for follow the lesson, in various ways, so that the existing interest then learning will be able to run smoothly. May also what are the benefits for me. (2) Natural, meaning a teacher in teaching should be able to create a common experience that can be understood by students. Teachers in teaching provide examples of events that never see the kids everyday. (3) Rename, that is, a teacher in teaching using easy to understand words, the formula correct, clear concept, the model is easy to understand, easy strategies. (4) Demonstrate, meaning the teacher in teaching and provide opportunities for students to show what they know, that the teacher in teaching using props to demonstrate the material being taught, so students will easily remember the content of the messages conveyed by the teacher. (5) Repeat, meaning the teacher in teaching can show you an easy way to repeat material. For example, by providing a summary of which is taught earlier. (6) Celebrate, meaning a teacher in teaching give recognition to the efforts of students to complete the task and the acquisition of skills and knowledge. Class can be a house where students, not just open to feedback, but also a place to learn, recognize and support others, where they experienced the joy and satisfaction of giving and receiving, learning and growing.

Based on the above, the research problem is formulated as follows: (1) How to increase students’ learning activities after the application of Quantum Teaching? (2) How to increase student learning outcomes after the application of Quantum Teaching? This research aims to: (1) Improve students’ learning activities with the application of Quantum Teaching. (2) Improve student learning outcomes after the application of Quantum Teaching.

2. RESEARCH METHOD

The research used classroom action research that consists of several cycles, at each cycle consists of four phases: planning, action, observation, and reflection (Kemmis and Taggart, 1998). Into four stages in the action form a cycle that is one round activities streak back to the origin. Planning stages consists of: (1) Attention to the psychological aspects of learners in the context of learning sets the stage. (2) Prepare lesson plans, media, learning material, students activity sheets, and assessment. (3) Divide groups based on the ability of students to heterogeneous groups. Implementation of the action consists of several stages: initial activities, core, and closing. Quantum Teaching in practice using grafts were put in to three stages of learning as table 2.

<table>
<thead>
<tr>
<th>Learning phase</th>
<th>Time</th>
<th>Tahap Quantum Teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start up activities</td>
<td>10 minute</td>
<td>Grow</td>
</tr>
<tr>
<td>Core activities</td>
<td>60 minute</td>
<td>Natural, Naming, Demonstrate</td>
</tr>
</tbody>
</table>
Observations were made to see the progress of learners competence during action carried on. Objects observed were all teachers and students during the learning competencies using observation and assessment sheet format kompetensi. Pengamatan the learning process during an act of data collection, data associated with the indicators of success or events in the classroom environment. Forms of data collected during the observation is quantitative data of test results and qualitative data in the form of assessment of psychomotor, affective, and record student progress. Reflection is the activity of studying, and reviewing previous observations form the basis for further improvements to the learning activities. At this stage learners discussed how an existing implementation, the problems, issues, and so on to give birth to the findings and conclusions for the improvement of learning in the next cycle. At this stage the students’ progress notes and observations from the observer is the basis for the discussion and advancement of learning solutions give birth next. The data was collected through student activity and learning outcomes. Instruments used in the research were: observation sheet, interview, and tests. The data was analyzed with the percentage and compared with the validity criteria.
3. RESULT AND ANALYSIS

Prior to the implementation of research using Quantum Teaching, average the students ability to learn science of the first semester of learning science at the third class of Elementary School was still low. Students ability was still low because the students have difficulties in learning science. Based on observations at the time of the teacher to teach, demonstrate that the learning that occurs tends to be monotonous, one-way, less communicative, tends to be a lecture, students are less engaged and active. Based on the initial assessment, it is necessary a learning approach that is able to improve the situation conducive classroom, students actively engaged in learning, the two-way communication, as well as increased motivation of students to learn. Learning in question is Quantum Teaching learning methods implemented in two cycles. Based on the results of research on attachment, known to the average value of the learning outcomes of students in the second cycle after the students are actively involved in learning with Quantum Teaching method is as shown in the following table 4.

<table>
<thead>
<tr>
<th>No.</th>
<th>Minimum Mastery Criteria (75)</th>
<th>Cycle I</th>
<th>Cycle II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>Percentage</td>
</tr>
<tr>
<td>1</td>
<td>≥Minimum Mastery Criteria</td>
<td>21</td>
<td>70%</td>
</tr>
<tr>
<td>2</td>
<td>Individual Minimum Mastery Criteria</td>
<td>9</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>Classikal Minimum Mastery Criteria</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the first cycle the number of students who completed the Minimum Mastery Criteria > 75 were 21 people (70%), while in the second cycle increased to 27 (86.67%). Increase also occurred against the learning outcomes in the second cycle, as shown in the following table 5.

<table>
<thead>
<tr>
<th>No.</th>
<th>Minimum Mastery Criteria (75)</th>
<th>Cycle I</th>
<th>Cycle II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cognitive</td>
<td>Psychomotor</td>
</tr>
<tr>
<td>1</td>
<td>≥Minimum Mastery Criteria</td>
<td>76.86%</td>
<td>75.40%</td>
</tr>
<tr>
<td>2</td>
<td>Individual Minimum Mastery Criteria</td>
<td>28.76%</td>
<td>24.60%</td>
</tr>
</tbody>
</table>

Data on students' learning activities are carried out observations observer during the study summarized in table 6.

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Cycle (%)</th>
<th>Average (%)</th>
<th>Increased (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>II</td>
<td>I</td>
<td>II</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Grow</td>
<td>46</td>
<td>74</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>Natural</td>
<td>60</td>
<td>74</td>
<td>67</td>
</tr>
<tr>
<td>3</td>
<td>Naming</td>
<td>53</td>
<td>82</td>
<td>67.5</td>
</tr>
<tr>
<td>4</td>
<td>Demonstrate</td>
<td>46</td>
<td>76</td>
<td>61</td>
</tr>
<tr>
<td>5</td>
<td>Repeat</td>
<td>75</td>
<td>88</td>
<td>81.5</td>
</tr>
<tr>
<td>6</td>
<td>Celebrate</td>
<td>75</td>
<td>90</td>
<td>82.5</td>
</tr>
<tr>
<td>Average (%)</td>
<td>69.9</td>
<td>21.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From table 6 a description of learning activities of students in the second cycle can be concluded following:

1. Indicator A1: Grow
At first the teacher difficulty in growing interest and motivation of students. This causes the activity of "grow" in the first cycle to obtain a value of 46 (less category). As time goes by the meeting, the A1 activity increased in second cycle to 74 (both categories) in order to obtain an average score of 60 (category enough). Grow indicators play an important role, due to quantum learning objectives is to cultivate students who ultimately produce students who not only have the academic skills, but also have the skills (life kill) is not bounded by the walls of the classroom, but by the sky, the air, sea and earth.

2. Indicator A2. Natural

This activity is a continuation of the WIFM (What’s In It For Me). At this stage all students are involved in activities (experiments, discussion, or observation). The purpose of the activities undertaken by the students, naturally involving students. This indicator scored cycles I and II are good, with an average value of 67 (good). Quantum Teaching is the methodology used in the development of design, presentation to boost teachers 'ability to inspire students' ability to excel. In Quantum Teaching is bundled package of multi sensory, multi-intelligence, is compatible with the brain, enabling the heart (feelings) which is a recent discovery of the relationship of the heart, brain and learning.

3. Indicator A3. Frontage

The first cycle value on this indicator, including low-only 53 (enough) while the second cycle events successful enough that the first cycle. The average acquisition activities amounted to 67.5 (both categories).

4. Indicator A4. Demonstrate

This indicator plays a role in learning science, learning science is a characteristic of the object, however due to elementary school students who have not had the experience, it is only in the second cycle value is 76 (good), while the average value of 61 (both categories). This is in accordance with the opinion DePorter (2005) which states as well as any learning method that applied a teacher, everything would still be worth it when the teacher forgot how to build a good relationship with the students. According to Alim (2009) a matter that interests the student to teacher learning is to build relationships with students as human beings with a sense of love. Love between teacher and student learning needs to be shown in Elementary School.

5. Indicator A5. Repeat

Once researchers confirm the results of the analysis and presentation of the group, the findings concluded: Stage is set forth in the RPP repeat the concluding section. The reason teachers are entering this stage what is the best way for students to repeat this lesson? Could be a question, experiment, or making inferences. Repeat the activity indicator results are not much different from the first cycle to the second cycle, ie by 75 (good) and 88 (very good). Interesting because learning approach, students become happy, so that the desired outcome can be achieved (81.5, very good). This happens because the teacher is able to uncover feelings of love. The feeling of love is one of the keys to success for all teachers to build a wonderful relationship with students in order to create a fun learning environment.

6. Indicator A6. Celebrate

Celebrate indicator is an indicator of student activities and student favored. This occurs because the learning outcomes of students admitted (celebrated) so that students feel valued, taken into account. The average value of activity "celebrate" the first cycle of 75 (good), the second cycle increased to 90 (very good), so that the average acquisition value of 82.5 (very good category). This activity adhering to the slogan "Every thing that is obtained in the learning needs of students celebrated” so that students are motivated to be active. Be celebrated in the form of praise, or giving an object, with the goal of students are treated fairly.

4. CONCLUSIONS

Learning will be successful when learning is associated with a natural, events, thoughts or juice obtained from student life. Learning will be successful if teachers understand thought their students, so that all the material, the message will be embedded in the hearts of students. Student learning activities increased by 22% in the second cycle after the application of Quantum Teaching.
Basic Concepts of learning outcomes FIP science UNP PGSD students increased by 12% in the second cycle after the application of Quantum Teaching.

References
INTEGRATION OF FORMATIVE ASSESSMENT ATTRIBUTES (IFAA) IN CELL BIOLOGY LEARNING TO DEVELOP UNDERGRADUATE STUDENTS’ REASONING AND ANALYTICAL THINKING

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¹Biology Department FPMIPA Unnes; Postgraduate SPs
²Biology Education Department FPMIPA; Science Education Program SPs
Faculty of Mathematics and Science Education
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ABSTRACT
A study about facilitating higher order thinking skill for prospective teachers was carried out to develop reasoning and analytical thinking skills of biology student teachers by application of Integration of Formative Assessment Attributes (IFAA) learning model in Cell Biology. A number of 3rd semester Biology Education in Semarang State University in 2012-2013 (n=58) was involved as research subject. Subject was divided into two groups (29 students each) as experimental group 1 and experimental group 2. Cell Biology learning process in experimental group 1 was conducted by narrative model, and learning in experimental group 2 was conducted by IFAA model. Reasoning and analytical thinking of students were measured using validated instruments, among others were concept map, articles review, and 30 selected response questions. The results showed that reasoning and analytical thinking skills of students in Cell Biology conducted by IFAA model can be improved significantly. However, the findings suggest that argumentation ability in analytical thinking skills of students still needs serious improvement.

Keywords: Reasoning ability, Analytical thinking, Student teachers, Attributes of formative assessment

1. INTRODUCTION
Recent studies describe that implementation of learning process in college sciences is synonymous with provision of broad science content. Breadth of science content is needed in science learning to understand natural phenomena, but these conditions are not sufficient to ensure that students have understood the entire content studied. One of several indicators describe of understanding of science content such as the ability of learners in a variety of thinking skills, including the ability to explain, collect evidence, provide examples, observations generalize, apply concepts, making analogies, reasoning ability, and presentscientific concepts in new situations (Janssen et al., 2009; Ery et al., 2009).
Certainly, the qualification standard of college graduates is not just mastery required extensive content. The ability and skills to think and act are main factors that determine. Therefore, learning in college should take notice and implement schemes of higher order learning (Fry et al., 2009). Scheme of higher order learning emphasizes on understanding and creativity of students, such as being able to understand and construct knowledge based on facts, analyze the relationship between knowledge with other relevant knowledge, as well as being able to develop critical thinking and creativity.

Characteristical subject matter of Cell Biology has a very important role in development of understanding, reasoning ability, concepts application, analytical thinking, as well as provide insight to students about the phenomenon offline. Some factors have been identified to be the cause of students' disadvantage to develop their reasoning and analytical skills in learning Biology Cell. The research results showed that teachers tend to develop learning materials as much as possible, in hopes students will be able to understand and apply knowledge acquired (Smith et al., 2008; Gotwals & Songer, 2009). Another factor is students are not able to understand the metabolic reactions and found a link factors causes a chemical reaction occurs (Kitchen et al., 2003; Lynd-Balta, 2006; Wilson, 2006; Fencl, 2010).

This study developed Integration of Formative Assessment Attributes (IFAA) model in Cell Biology lesson to help students understand essential concepts and metabolic processes, furthermore to develop reasoning skills and analytical thinking. Formative assessment is an assessment process carried out during learning as feedback to understand student learning progress (Black & William, 1998; Tanner & Allen, 2004; Furtak & Primo, 2008). Attributes of formative assessment are learning goals and criteria for success, collaboration between teachers and students, learning progression, descriptive feedback, self-assessment and peer-assessment (McManus, 2008).

2. RESEARCH METHOD

Subject

Subject in this study was students of Biology Education Department, Semarang State University in third semester year 2012/2013 taking Cell Biology courses. Number of subject was 58 students who are divided into two groups, 29 students as experimental group-1 and 29 students as experimental group-2.

Design

Research was conducted as two group pretest-posttest design. Scheme of research design was described as follow.

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest</th>
<th>Treatment</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-1</td>
<td>O₁</td>
<td>X₁</td>
<td>O₂</td>
</tr>
<tr>
<td>Experiment-2</td>
<td>O₁</td>
<td>X₂</td>
<td>O₄</td>
</tr>
</tbody>
</table>

X₁: learning-lecture question and answer
X₂: learning model of the IFAA

Implementation of IFAA model

IFAA model in Cell Biology learning include interactive learning activities (information, discussion, question and answer), concept mapping, and review articles of research journal. Interactive learning was implemented in classical scheme. Concept mapping and review of research journal articles were done by students in groups. During learning process, student was performed three times practice test. The scheme of IFAA model in Cell Biology learning can be seen in Figure 1.
Measurement of reasoning abilities and analytical thinking

Measurement of reasoning abilities and analytical thinking carried out separately before learning as a pretest and after learning as a posttest. Questions used for measurement is 30 items, consists of 20 multiple choice questions (selected response), and 10 multiple choice questions with argumentation (constructed response). Questions to measure reasoning ability were developed based on Lawson nomenclature (Lawson et al., 2007). Three of five reasoning ability indicators was applied in this study, i.e. proportional reasoning, probability reasoning, and correlation reasoning. For analytical thinking measurement, questions was developed based on classification by Brookhart (2010). Three indicators of analytical thinking was applied are identifying the main idea, argumentation thinking, and comparative thinking. Each of reasoning ability and analytical thinking indicators was measured in five item questions.

Data analysis

The answers of students performed has been analyzed in quantitative-descriptive techniques. Quantitative technique can be identified level of students’ reasoning skills and analytical thinking. In addition, to measure signification of difference N-gain and mean of final result test of two groups experiment, t-test (SPSS 20) technique was applied. Descriptive technique can be identified students’ thinking process to answer the questions.

3. RESULT AND ANALYSIS

IFAA model implementation

Evaluation of IFAA mode implemented in Cell Biology learning focuses on three subjects in Cell Biology, i.e. Prokaryotic and Eucaryotic Cell, Plasma Membrane, Mitochondria and Chloroplasts. Aspects we have evaluated include ability of students to make concepts map, and to review international journal articles.

Figure 1. IFAA Learning models in Cell Biology

ASSESSMENT FORMATIF

ATTRIBUTES:

a. Learning goals and criteria for success
b. Collaboration
c. Self-assessment
d. Peer-assessment
e. Feedback and Learning progression

Prior knowledge Identification
(a, b, c)

Review
(b, c, d, e)

Exploration and discussion
(b, c, d)

Concept Acquisition
(b, c, d, e)

Elaboration
(b, c, d, e)

Relevance
(b, c, d, e)

1. Prior knowledge Identification
(a, b, c)

2. Exploration and discussion
(b, c, d)

3. Concept Acquisition
(b, c, d, e)

4. Elaboration
(b, c, d, e)

5. Relevance
(b, c, d, e)

6. Review
(b, c, d, e)
1. Students’ ability to create concept map
   
   Elaboration, the forth step in IFAA learning model, students should create concept map. Scoring of concept map was done by calculating the average score for each category. Scoring ranges, 1 until 4, for each category. The scoring rubric result of concept map created by student in group experiment-2 can be seen in Table 1 and Figure 2.

<table>
<thead>
<tr>
<th>Completely</th>
<th>Interrelation</th>
<th>Notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prokaryotic &amp; Eukaryotic Cell</td>
<td>2.8</td>
<td>2.1</td>
</tr>
<tr>
<td>Plasma Membrane</td>
<td>3.1</td>
<td>2.8</td>
</tr>
<tr>
<td>Mitochondria &amp; Chloroplast</td>
<td>3.8</td>
<td>3.8</td>
</tr>
</tbody>
</table>

   Figure 2. Students’ ability to create concept map

2. Students’ ability of international journal article review

   The Relevance, the fifth step in IFAA learning model, students should review article of international journal. Scoring of students’ ability of international journal article review was done by calculating mean score of group in each category. Range score for a category is 1 until 4. Results scoring students’ review of international journal articles in group experiment-2 can be seen in Table 2 and Figure 3.

<table>
<thead>
<tr>
<th>Relevance</th>
<th>Content</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prokaryotic &amp; Eukaryotic Cell</td>
<td>1.75</td>
<td>1.90</td>
</tr>
<tr>
<td>Plasma Membrane</td>
<td>3.65</td>
<td>2.80</td>
</tr>
<tr>
<td>Mitochondria &amp; Chloroplast</td>
<td>3.90</td>
<td>3.70</td>
</tr>
</tbody>
</table>

   Figure 3. Students’ ability to review international journal article
3. Students’ reasoning and analytical thinking

Measurement of students’ reasoning skills and analytical thinking in Cell Biology using a written test, pretest and posttest. Thet-test result of mean N-gain and final test scores of two group can be seen in Table 3 and 4.

Table 3. T-test result of N-gain

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean of N-gain</th>
<th>S.D.</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>29</td>
<td>0.2015</td>
<td>0.1116</td>
<td>0.01*</td>
</tr>
<tr>
<td>X2</td>
<td>29</td>
<td>0.5192</td>
<td>0.1577</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. T-test result of final test scores

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean of N-gain</th>
<th>S.D.</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>29</td>
<td>33.35</td>
<td>8.83</td>
<td>0.01*</td>
</tr>
<tr>
<td>X2</td>
<td>29</td>
<td>62.21</td>
<td>12.78</td>
<td></td>
</tr>
</tbody>
</table>

Posttest results also provide an overview of students’ reasoning and analytical thinking. Table 5 shows the percentage of students who answered correctly for an indicator.

Table 5. Percentage of students who correctly answer

<table>
<thead>
<tr>
<th>Correlation (%)</th>
<th>Probabilistic (%)</th>
<th>Proportional (%)</th>
<th>Identf. of Main Idea (%)</th>
<th>Argumentation (%)</th>
<th>Comparative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXP-1</td>
<td>47</td>
<td>34</td>
<td>39</td>
<td>41</td>
<td>12</td>
</tr>
<tr>
<td>EXP-2</td>
<td>58</td>
<td>58</td>
<td>66</td>
<td>66</td>
<td>42</td>
</tr>
</tbody>
</table>

Figure 4. Comparison of percentage correctly answer in experiment group-1 and group-2

Figure 2 indicates that ability of students to create concept map had been developed. On Prokaryotic and Eukaryotic Cells subject, shows that ability of students to create concept map still has not met the expectations. Most of students create concept map as a resume concept presented in the chart. Interrelationship between concepts in a linear only done on one line. Interrelationship between concepts students made unable give an overview of relationship between concept with other concepts.

Providing guidance and reinforcement to students increasing concept map put a positive influence on development of student abilities. This ability was developed in learning of
Mitochondria and Chloroplasts. Most of students are able to identify the essential concepts, and then students linking between concepts and gives meaning to concepts relationship.

Mapping concepts have a positive effect on development of reasoning skills (Odom & Kelly, 2001; Lawson, et al., 2007; Bao, et al., 2009). By identifying important concepts, and labelling the meaning interrelation between concepts are identified, students have been using reasoning abilities. Thinking skills of students must be trained gradually and simultaneously so that they have habits of mind and was able to take a decision based on their reasoning.

Based on Figure 3, it can be stated that the ability of average student in selecting and reviewing international journal articles end to positive development. Giving opportunities and guidance gradually could be a positive influence on student learning process. On subject of Prokaryotic and Eukaryotic Cells, students looked for articles not from sources of international journals. Most of students are not found relevant articles based on research. They reviewed relevant articles but it was not research result.

In subject of Mitochondria and Chloroplasts, students' ability in reviewing international journal article based on research was developed. The entire group of students were able to choose relevant research articles published in international journals.

Provides the opportunity for students to undertake review of international journal is one way to practice writing and communicating. Assignment forms to support the implementation of assessment, such as writing, reviewing, and communicating effectively in improving students' learning progress (Quitadamo & Kurtz, 2007; Noblit et al., 2010).

Analytically thinking skills can also be developed through a review of a book or research articles in a relevant to subject being studied. To understand an article, and provide a review of article by using knowledge they have before, and then present the results of article review, could give an opportunity to students develop their higher-order thinking skills and critical thinking (Quitadamo & Kurtz, 2007; Reynolds & Moskovitz, 2008; Noblit et al., 2010).

The result of t-test as shown in Table 4, indicates that implementation of IFAA model provides a significant influence on reasoning skills and analytical thinking of students development. Giving students the opportunity to think and analyze in learning processes of Cell Biology could impact on understanding subject material positively. Nonetheless, Table 5 and Figure 4 describes that IFAA learning model cannot develop students’ argumentation ability, an indicator of analytical thinking skills, significantly. Sure, it is anote for lecturer when applying IFAA learning model in Cell Biology.

4. CONCLUSIONS

Cell Biology learning by applying Integration of Formative Assessment Attribute (IFAA) had a positive influence to biology student teachers in developing reasoning skills and analytical thinking. Application of IFAA learning model in Cell Biology requires diligence and persistence. Lecturers should collaborate with students in achieving learning objectives. Lecturers also need to provide an opportunity for students to do a self-assessment at the end of study to determine and fix their shortcomings. However, the findings suggest that students’ argumentation ability, an indicator of analytical thinking skills, still needs serious attention.

References


MEASURING STUDENT-CENTERED LESSON’S SHIFT IN DAILY PRACTICES AS IMPACT OF TEACHER PROFESSIONAL DEVELOPMENT ON SCIENCE TEACHER

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Article Info
ABSTRACT
Continuing professional development (CPD) program experienced by teacher inevitably aimed to improve teaching and learning quality in daily practice. This persistent-recommended activity would lead teacher to improve their ability to investigate more about students’ thinking. How CPD affect significantly on daily practice improvement seems necessary to be investigated. The paper is aimed to measure impact of teacher CPD in daily practice, in terms of student-centered learning improvement. A science teacher with 7-year CPD experience is observed in his daily classroom for 7 months. Series of tens lessons were video-tape recorded, transcript, and analyzed using teacher and student-centered evaluating lesson analysis by Matsubara (2013). The paper provides not only pattern of student-centered shift during 7 months of instruction process as impact of teacher CPD, but also a recommendation on CPD program-structure suggested so that learning can be more student-centered on real classroom difficulties improvement.

1. INTRODUCTION
For every year, many universities have graduated many teachers, whom are expected to be able to develop the education problem in Indonesia. Some program such as PLPG and PPG has also published in order to develop the quality of in service teacher. The pre-service teachers are also being educated by some universities in order to get the expected output when they are graduated and become in service teacher in the future. Yet, according to PISA and TIMMS, the achievement of Indonesian students is still below average of international students.

Many experts and teacher have cooperated together in solving the problem of education quality in Indonesia. Many programs and suggestion of teaching strategies have been developed. Matsubara on 2013 proposed an idea that the teacher suppose not to be agree by all the suggestion that the expert said. Instead, the teacher should be the sources of instruction process refaction as the...
source in solving the problem and improving the quality of education itself by creating meaningful learning.

Meaningful learning is determined by the way how teacher delivered the material to the student and student doing actively during the class. The extent to which the learner processes the information to be acquired is the extent to which it is acquired (Wigginton, 1986). Wigginton stated that the learner should be the one who process the information from educational experiences. Teacher is a key to bring will carry on what kind of type learning. Improving quality and when the teachers learn from and with each other, it can be better outcomes for learners.

**Continuing Professional Development**

Continuing Professional Development (CPD) is widely acknowledged to be important in the pursuit of improvements in teaching and learning (Hargreaves, 1994; Harland and Kinder, 1997; Craft, 2000). Professional development consists of all natural learning experiences and those conscious and planned activities which are intended to be of direct or indirect benefit to the individual, group or school, which contribute, through these, to the quality of education in the classroom. It is the process by which, alone and with others, teachers review, renew and extend their commitment as change agents to the moral purpose of teaching; and by which they acquire and develop critically the knowledge, skills and emotional intelligence essential to good professional thinking, planning and practice with children, young people and colleagues throughout each phase of their teaching lives.” (Day, 1999, p.4)

Lieberman (1996) classified CPD into three types: direct teaching (such as courses, workshops and so on); learning in school (such as peer coaching, critical friendships, mentoring, action research, and task-related planning teams); and out of school learning (such as learning networks, visits to other schools, school-university partnerships and so on).

Kennedy (2005) described nine models of CPD, which are outlined below.

1. **Training** - focuses on skills, with expert delivery, and little practical focus
2. **Award Bearing** – usually in conjunction with a higher education institution, this bringstheworrying discourse on the irrelevance of academia to the fore
3. **Deficit** - this looks at addressing shortcomings in an individual teacher, it tends to beindividually tailored, but may not be good for confidence and is unsupportive of the development of a collective knowledge base within the school
4. **Cascade** – this is relatively cheap in terms of resources, but there are issues surrounding the loss of a collaborative element in the original learning
5. **Standards Based** – this assumes that there is a system of effective teaching, and is not flexible in terms of teacher learning. It can be useful for developing a common language but may be very narrow and limiting
6. **Coaching / Mentoring** – the development of a non-threatening relationship can encourage discussion, but a coach or mentor needs good communication skills
7. **Community of Practice** – these may inhibit active and creative innovation of practice, although they have the potential to work well through combining the knowledge bases of members
8. **Action Research** – This is relevant to the classroom, and enables teachers to experiment with different practices, especially if the action research is collaborative.
9. **Transformative** – the integration of several different types of the previous models with a strong awareness and control of whose agenda is being addressed

Kennedy suggested that the first four of these were essentially transmission methods, which give little opportunity for teachers to take control over their own learning. The following 3 are more transformational, giving an increasing capacity for professional autonomy, with the action research and transformative models being able to provide even more professional autonomy, and giving teachers the power to determine their own learning pathways.

Direct teaching or training, the traditional perception of CPD, is often perceived as a top down delivery model of CPD, where information on methods is passed on to teachers for them to implement. Such lecture-style teaching has proved unpopular with teachers, who tend to prefer more active and practical styles of learning (Edmonds and Lee, 2002). An awareness of less formal and traditional forms of CPD is slowly growing, with calls for teachers to become more creative in their
approaches to their own professional development, and move away from more traditional
transmission-based methods (Muijs et al, 2004).

In a smaller scale study by the National Foundation for Educational Research CPD: Teachers’ Perspectives (2000), CPD needs most frequently mentioned were the development of
knowledge in the teachers’ own subject area; the use of ICT and the Internet in the curriculum;
assessment; support for pupils with special educational needs and leadership skills. The international
research literature has consistently shown that professional development is an essential component of
successful school level change and development (Day 1999b; Hargreaves 1994).

A key factor in ensuring CPD is effective is the matching of appropriate professional
development provision to particular professional needs (Garrett, et al., 2001). This ‘fit’ between the
developmental needs of the teacher and the selected activity is critically important in ensuring that
there is a positive impact at the school and classroom level (Hopkins and Harris, 2001).

An emphasis on the purpose of CPD before any activities take place may enhance the CPD
experience, and improve both individual and school-level outcomes (Harland and Kinder, 1997;
Muijs et al, 2004). Muijs et al described an inter-relationship between teacher, pupil and school
outcomes, and suggested that CPD can meet the needs of all of these, so long as there is an awareness
of those needs throughout the CPD process. Smith (2002) suggested that evaluation should play an
integral role in CPD, and will become part of a cycle: while it provides feedback on the success of the
process, it can also help to determine further CPD needs. The use of data, both quantitative and
qualitative, is essential for teachers in terms of learning about their practice and drawing conclusions
(Knight, 2002), but it still remains easier to assess the impact of CPD on teachers than the impact of
CPD on pupil’s learning (Edmonds and Lee, 2002).

Gondall et al conduct research regarding with CPD Evaluation and produce five main result
ideas; (1) CPD leaders require targeted training for the role. Many leaders felt unprepared for the role,
both in terms of knowledge of the field. (2) Many feel that the evaluation of the impact of CPD is
important, this evaluation often does not happen due to constraints of time (on CPD leaders as well as
other members of staff), and lack of resources While time is often made for dissemination of learning
through CPD, the process often stops there, with no further investigation as to the effect of that
learning. (3) Some leaders had no financial responsibilities in relation to CPD, others had a great deal.
Some leaders were involved in planning for individuals’ CPD, others were not. This lack of clarity
about the role of CPD leader, on a national basis, left individual schools and individual CPD leaders
in the position of recreating the wheel, time and again. (4) There was no correlation between phase,
size or sector of schools which were rated as “high” in terms of the evaluation of impact of CPD.
Some small schools were able to evaluate the impact of their CPD experiences at least as effectively
as much larger schools. (5) Schools have varied understandings of both the nature and the value of
CPD. Staff at all levels pointed to not only formal courses but peer observation, delivering training to
others, and professional discussion as valuable means of CPD.

The paper is aimed to measure impact of teacher CPD in daily practice, in terms of student-
centered learning improvement. Research questions are formulated into two main questions;
1. Whether the effect of CPD can change the type of learning from teacher center to student center.
2. Whether the CPD are advisable to increase the quality of teachers in teaching learning.

2. RESEARCH METHOD

In 2012, a science teacher with 7-year CPD experience is observed in his daily classroom for
7 months. Series of tens lessons were video-tape recorded, transcripted, and analyzed using teacher
and student-centered evaluating lesson analysis by Matsubara (2013).

A lesson analysis system focuses on students’ responses in classroom discourse. Basic unit
for coding this lesson analysis is “move”. Based on Smith in 1967 and Fujii in 1983, a set of a
teachers’ question and a students’ response to the question is coded as move. Several kinds of
students’ responses in instructional process that is included into unit of move is categorized into three
main categories such as non response, teacher led response, and non led response. Those three main
categories have been developed into several specific categories that are described below.

<table>
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<tr>
<th>Description</th>
<th>Category Code</th>
<th>Interpretation</th>
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Those responses that have been categorized is given a line. Those line is connected and finally will perform a pattern. Each lesson will result a pattern. Because in this research several lessons have been analysed so several patterns might be resulted. Those patterns are analysed to see the shifting that might occur.

3. RESULT AND ANALYSIS

The transcript of instructional process will be sequenced based on its date as seen on table below, then it can be analyzed into moves and non-moves.

<table>
<thead>
<tr>
<th>Date</th>
<th>Transcript Classification</th>
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<tbody>
<tr>
<td>February 15th – March 29th</td>
<td>TR 1</td>
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<td>March 29th – April 10th</td>
<td>TR 2</td>
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<td>April 10th - April 17th</td>
<td>TR 3</td>
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<td>April 17th - April 20th</td>
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<td>April 20th – May, 1st</td>
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<td>May, 1st – May, 11th</td>
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<td>May, 11th – May, 15th</td>
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<td>May, 15th – July, 5th</td>
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<td>July, 5th – November 13th</td>
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</table>

The transcript of instructional process data will be inputted into Ms. Excel format then it will be classified into different categories based on table below. Thing that has to be underlined is the pattern making that shows the tendency whether its approach is teacher-centered or student-centered.
<table>
<thead>
<tr>
<th>Time</th>
<th>Dialogue</th>
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<tbody>
<tr>
<td>09.00 - 10.00</td>
<td>Guru bertanya, “Menggambarkan apa yang kalian tersebut?” Siswa menjawab, “Menggambarkan.”</td>
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<td>Guru merespon, “Pencemaran lingkungan. Apa lagi?” Siswa menjawab, “Pencemaran air.”</td>
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<td>11.00 - 12.00</td>
<td>Guru merespon, “Ya ya.” Siswa menjawab, “Pencemaran?”</td>
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</table>

Figure 1 Transcript result of instructional process with the topic of pollution on April, 17th 2012 in minute range from 9th into 12th minute, see that the red line pattern indicates whether its approach is teacher-centered or student-centered.
### Analysis of TR 1

In the analysis of TR 1, it is seen that the lesson conducted on both dates (February 15th and March 29th) have tendency to be student centered, although learning activity on February 15th indicates more student centered learning than on March 29th, the number of moves on February 15th is more than on March 29th.

The shifting between both cannot be seen clearly due to many fluctuate on the pattern. Both of the lessons have patterns which lied on passive, teacher led, and student centered learning. On the CPD perspective, the teacher strategy used in both lesson were closely the same. The teacher used outdoor class activity as the strategy of learning to teach in the class. The student will explore by themselves and learn from what they have done in the outdoor class activity. The questions of teacher were mostly asking about the things found in the field and what they have done.

### Analysis of TR 2

Both learning activities show the tendency of student centered learning. But, learning activity on March 29th indicates more student centered learning than on April 10th, the number moves on March 29th is more than on April 10th.

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**Figure 2 Transcript result of instructional process with the topic of pollution on April, 17th 2012 in minute range from 18th into 30th minute; see that the dot dashes indicates the non-move activity which means no questions is proposed by teacher**

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Difference with previous lesson, in April 10th the responses is in DI and DR but no response in QP. The shifting is little bit decreasing although the category still in student centered learning. It might be caused by the teacher use debate method in class; although there is group discussion but the dominance is debating that is done by students and facilitated by teacher.

Analysis of TR 3

Both learning activities show the tendency of student centered learning. But, learning activity on April 10 indicates more student centered learning than on April 17th, the number of moves on March 10th is more than on April 17th. On April 10th, the learning activity was group presentation; the students are actively asked and answer the question.

Analysis of TR 4

In 17 April 2012, the lesson has been in student centered but the level is still low. Generally, students’ responses are in responses response demonstrating information and/or knowledge. It means that they response based on their knowledge or information that has been gotten previously. Besides that, they are already brave to propose question and interact with their classmate. But, this condition is not as much as in the lesson of 20 April 2012. On April 20, the learning activity was group presentation and lecturing, during the learning activity the teacher provide slides to the students and propose some question related to the given topic. But overall, the shifting still steady because the level of lesson is in student centered learning.

Analysis of TR 5

In 1st of May 2012, the learning experience tends to teacher centered as it is shown by the pattern. The pattern tends to be in teacher led response. It means that students’ response to the teacher questions is depended on the teacher control. The responses are generally utterance, it means that they seem like doubt to answer teacher’s question. Comparing with the previous instructional process on April 20th, learning activity on April 20th indicates more student centered learning as seen based on the number of questions proposed by teachers.

Analysis of TR 6

While in May 11th of 2012, the learning experience tends to students centered. It is shown by the pattern above. The pattern tends to be in non led response. It means that students’ response to the teacher questions is not depended on the teacher control. The responses are generally direct response; it means that they use their reasoning to answer their teacher’s question. But, there is also a response that they need direct information to answer the question. In this process instruction, students are brave to propose question to their teacher and students interact each other. These responses are depending on the role of the teacher professionalism to construct an instructional process which is interactive. In this lesson teacher use class discussion so no wonder in this lesson students involve and more interactive.

By comparing this lesson from May 1st, it can be seen that there is a shifting from teacher centered to students centered. It indicates that teacher’s CPD are developed well. It might caused by a good preparation learning that is designed by the teacher. Teacher has learnt from previous teaching experience.

Analysis of TR 7

Similar with the lesson in May 15th 2012, the lesson tends to students centered learning but the responses that are generally appear are in response demonstrating information and/or knowledge.
It means that they response based on their knowledge or information that has been gotten previously. Comparing with previous lesson on May, 11th the shifting still steady because the level of lesson is in student centered learning.

Analysis of TR 8

In the analysis of TR 8, it is seen that the lesson conducted on both dates (May 15th and July 5th) have tendency to be student centered. Yet, the lesson conducted on July 5th has pupils interaction more than in May 15th. This is proved by the activity on the moves, which shows that July 5th has code QP more, while May 15th has code DR more. On the CPD perspective, the teacher strategy used in both lesson were closely the same. The teacher used lecturing in the opening, group discussion as the core activity of the lesson, and let the students interact with others. Yet, in the July 5th, the teacher seems to use lecturing more than in November 13th. Besides, if it is analyzed based on quality of teacher question, it can be seen that in July 5th, the questions have more tendency to be closed question, where students have only two options to be answered.

Analysis of TR 9

In the analysis of TR 9, it is seen that the lesson conducted on November 13 has tendency to be more student centered. This is due to the activity on the move, which shows more to pupil interaction and at least teacher led respond. Meanwhile, in the lesson conducted in July 5th the lesson has tendency to the teacher centered because the moves were mostly lied on teacher led response section. On the CPD perspective, the teacher strategy used in both lesson were closely the same. The teacher used lecturing in the opening, group discussion as the core activity of the lesson, and let the students interact with others. Yet, in the July 5th, the teacher seems to use lecturing more than in November 13th. Besides, if it is analyzed based on quality of teacher question, it can be seen that in July 5th, the questions have more tendency to be closed question, where students have only two options to be answered.

4. CONCLUSIONS

Based on shifting as seen on nine different transcript sequences starting from February 15th - November 13th, the shifting is occurred as it moves from teacher centered into student centered. The principle of using CPD in the classroom, using current teaching as a starting point from which to work, is a concept that is worthy of further investigation and consideration. The lived experience of the classroom should be at the heart of teachers’ professional development, and the principles of this project have gone some way towards achieving this.

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PROJECT-BASED LEARNING: AN EFFORT TO IMPROVE STUDENTS’ ACHIEVEMENT AND PROBLEM SOLVING SKILL ON PEOPLE AND THE PLANET CHAPTER
Binar Kasih Sejati
International Program on Science Education

ABSTRACT

An active and hands-on learning such as creating a project is touted as one of effective learning model that provides students with complex tasks based on challenging problems that involve students’ problem solving skill. This research investigated the effect of project-based learning (PjBL) as an effort to improve students’ achievement and problem solving skill on People and The Planet chapter. The method which is used in this research was weak experiment with one-group pretest-posttest design. The sample was taken purposively (n= 24 students) grade Secondary 1 in a Private International School. The quantitative data of this research was gained through objective test and essay test, while the qualitative data gathered through rubrics and questionnaire. Based on analysis of the result, this research obtained improvement in both students’ achievement and problem solving skill with normalized gain 0.46 and 0.38 respectively, those results categorized into medium improvement. The level of students’ problem solving skill is shifting, the dominant level that exists before the treatment was in the 1st level and changed into 2nd level in the end, it showed that PjBL can facilitate students to have higher level of problem solving skill. A visual organization of poster showed higher acquisition rather than knowledge aspect, it defined that most students tend to pay more attention in visual look than the concept itself. All of the results are supported with the response of students towards PjBL implementation which showed positive response in all indicators.

Keywords: Project-based learning, cognitive achievement, problem solving skill, People and The Planet

A. Introduction

Knowledge is generated through experience, connecting the ideas they encounter, such as in a classroom context, with the concrete (Piaget, 1963). This meant that knowledge and understanding come through discovery rather than repetition of facts. According to the Badan Standar Nasional Pendidikan (BSNP) year 2006 science subjects for secondary level should be developed through analytical thinking skills, inductive, and deductive reasoning to solve problems related to daily natural events. Based on those statements, it is known that science is very important to be learned by students in secondary level to solve some daily natural problems.

To solve complex problems, students are required to have both fundamental skills such as reading, writing, math, and some 21st century skills (collaborative skills, engagement and motivation, and critical thinking and problem solving skills, research gathering, time management, information synthesizing, and utilizing high technology tools). By combining those skills, students become directors of their own learning process, guided and tutored by a skilled teacher (The George Lucas Educational
Factually, a conventional learning which passively learning facts and reciting them out of context is no longer sufficient to facilitate those skills to be obtained by students. Therefore it is necessary for teachers to find an appropriate innovation of teaching strategies which bridge students in secondary level to have those skills.

Based on King et.al (2009) teaching in the middle school years (secondary level) is challenging. A project build on authentic learning tasks that engage and motivate students, middle school is an ideal time to integrate project in their learning. Projects encourage students to invent, and struggle with important and essential ideas. Through such projects, students work in a group to solve authentic and interdisciplinary issues: determine how to approach an issue, what kind of activities to perform, collecting data from various sources and analyzing/ synthesizing their findings to produce new information (Solomon, 2003).

Project-based learning is an instructional model that provides students with complex tasks based on challenging questions or problems that involve the students' problem solving, decision making, investigative skills, and reflection. Project-based learning hails from a tradition of pedagogy which asserts that students learn best by experiencing and solving real-world problems (Barron & Darling-Hammond, 2008; Thomas, 2000).

Considering that curriculum is tentative, the researcher adapts a common world’s curriculum, it is based on Cambridge Curriculum. The skill-set that assessed in Cambridge Curriculum for science are knowledge with understanding, handling information and problem solving, and experimental skills and investigations (Cambridge IGCSE, 2010). It provides some learning concepts which learn about daily real world problem in science, one of them is Living Things in Their Environment. The concepts certainly discuss about some topics that strongly focus on solving daily natural event problem in science such as; discussing positive and negative influence of humans on the environment and all of those topics are learned in People and The Planet chapter. Realizing that the use of Cambridge Curriculum is not really common in Indonesia, the researcher chose one of Private International School which use Cambridge curriculum as its reference. Compare to another research, this research analyze two variables at once they are students’ cognitive achievement and problem solving skill. Developing from those variables this research also investigates the level of problem solving skill of each student and examines the final product of the project itself. Based on the background which has already stated, the problem of this research is “How is the improvement of students’ achievement and problem-soliving skill through project-based learning?”

B. Method

The research was conducted in one of Private International School in Bandung which applied Cambridge Curriculum in the learning process. The data collection was done in April up to May 2013. Population of this research is all of students’ ability in cognitive achievement and problem solving skill that belongs to all secondary one level students in the school. The sample is all of students’ ability in cognitive
achievement and problem solving skill on people and the planet chapter and consists of 24 students. The sampling technique of this research is purposive sampling, the consideration of the sample is based on the preliminary test where the class has lower result of achievement and problem solving skill compare to another class.

The design which is used in this research is the one group pretest and post-test design. In this design there is a test to know student’s prior knowledge or pretest (O₁), treatment (X) where the Project-based Learning method applied in the teaching learning process, and after the concept given the treatment the final test will be conducted or post-test (O₂). The research method which is applied in this research is weak experimental method. This research only use one group research without any classroom control (Arikunto, 2006). Determination of the research method is considered by the sampling technique which is not taken randomly and by analyzing the interrelationship within the variables. Those variables are project-based learning as independent variable and student’s achievement and problem solving skill as dependent variables.

The research instrument which is adapted to collect the data in this research consist of: Objective test in a form of multiple choice question is used to measure students’ achievement before and after treated Project-based Learning in chapter of people and the planet, essay test is used to measure students’ problem solving skill achievement, teacher will mark the rubrics based on students’ answer and calculate it as final result, the rubrics will determine the stage of problem solving skill that students have based on each essay question given. Another instrument is rubrics form for assessing the final product of the project-based learning. The final product is in a form of poster, the poster will be analyzed based on rubrics criteria regarding to some important of component; product of knowledge and product of visual organization. The last is a questionnaire, this instrument also used for analyzing the students’ response towards implementation of project-based learning model in people and the planet chapter.

C. Result and Discussion
1. Profile of Students’ Cognitive Achievement Improvement

<table>
<thead>
<tr>
<th>No.</th>
<th>Component</th>
<th>Pretest</th>
<th>Posttest</th>
<th>G</th>
<th>&lt;g&gt;</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Participant</td>
<td>24</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>( \bar{x} )</td>
<td>43.56</td>
<td>69.31</td>
<td>25.75</td>
<td>0.46</td>
<td>Medium</td>
</tr>
<tr>
<td>3.</td>
<td>SD</td>
<td>12.92</td>
<td>8.92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Lowest Score</td>
<td>27.27</td>
<td>59.08</td>
<td>4.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Highest Score</td>
<td>68.17</td>
<td>86.35</td>
<td>40.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A learning process with project-based learning model gives certain factors which can improve the cognitive achievement of students. It can be said so because students are prosecuted to learn more actively engage into the learning, yet they are raising and solving a problem stated by their self. Project-based learning provide a physical activity to the students, the students actively involved in raising the problem, express the solution, creating the product, as well as present the final product in front of their friends. Besides, the students not only having a physical activity they also had experiencing in cognitive conflict by completing the worksheet, finding the best solutions to overcome the problem, and the responsibility of the solutions that they have made.

Here in project-based learning implementation the school fully support and give facilities which is need by students to complete the project. The Cambridge Curriculum also aligned with project-based learning steps so the students were not confused and can learn the people and the planet chapter systematically, PjBL gives space for students to discuss positive and negative influence of humans on the environment which is include as progressive learning objective of Cambridge Curriculum.

There are 5 stage of project-based learning which is implemented in this research (assign collaborative working group, present real-world problem, set parameters for completing project, teacher consultation, and final project shared with larger group). In each stage, students have different activity and experience regarding to the syntax explanation, students also have different competencies depend on the material which is given in each meeting. The learning objective that should be reached by students in each day also different, so that the cognitive achievement regarding to Bloom’s taxonomy in each syntax is varied.

### 2. Profile of Students’ Problem Solving Skill Improvement

<table>
<thead>
<tr>
<th>No.</th>
<th>Component</th>
<th>Pretest</th>
<th>Post test</th>
<th>G</th>
<th>&lt;g&gt;</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Participant</td>
<td>24</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Max Score</td>
<td>42</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>$\bar{x}$</td>
<td>21.21</td>
<td>29.21</td>
<td>8</td>
<td>0.38</td>
<td>Medium</td>
</tr>
<tr>
<td>4.</td>
<td>Lowest Score</td>
<td>14</td>
<td>22</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Highest Score</td>
<td>32</td>
<td>37</td>
<td>16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1.2 Recapitulation of Students’ Problem Solving Skill Test

The problem solving skill has seven main process, they are; identifying problem, exploring problem, set goals, look at alternatives, select best solution,
implementation, and evaluation. Each process was measured to indicate the profile of students’ problem solving skill comprehensively.

As the result the problem solving skill of students is improving it is shown by the pretest and a post-test have been given to all participant students before and after the treatment. The calculation result of the pretest is 21.21 with the range scale from 14 to 42 and the post-test average is 29.21. Score of the gain is 8, whereas the score of normalized gain is 0.38 based on Hake’s categorization it includes as medium improvement. The calculation result of gain and normalized gain indicates that the participant students have improved their problem solving ability. Students’ problem solving skill was obtained through 2 essay questions of analyzing an article and real case study about environmental problem. Based on the result, most of students in the beginning could not fulfill the questions completely but in the end of the learning most of the student are able to solve or even giving some solutions to the problem raised.

The essence of problem solving skill has been inserted during the project-based learning implementation. As mentioned by HighReach Learning Inc. (2007) that problem-solving skills need to be introduced and reinforced through a wide variety of hands-on, developmentally appropriate activities. In this research, a final product has been designed and a worksheet also provided, those activity force the students to work more hands-on.

According to the result (as shown in figure 4.3) all of the problem solving skill process meet with the improvement without any exception. With various score of normalized gain, the order of result acquisition must be considered. The rank of normalized gain acquisition from the highest to the lowest specifically is exploring problem, set goals, select best solution, look at alternative, evaluation, and identifying problem. Select best solution process was found have higher score rather than look at alternative process this is can be happened because students can only mention limited alternative, so it will only gain lower score whether they can still select the best solution which is only one solution that they think it is the most effective to overcome the problem. Another result is evaluation which is the last process of problem solving skill got higher score than implementation, here the students are able to evaluate their own program but most of them do not know how to implement in their own society.

The fluctuate result may influenced because of several factors during the learning process with project-based learning model implementation. Overall, a positive result has been produced in all problem solving skill processes. The profile of students’ problem solving skill seems improving in low until medium category. The correlation between problem solving skill and project based learning is strongly interrelation, and it supports each other. The entire learning objective also achieved by students it means that people and the planet chapter when using project-based learning model can stimuli students to have higher problem solving skill which is important in 21st century life.
3. **Leveling of Problem Solving Skill**

Figure 1.1 Graph of Shifting Level in Problem Solving Skill

In the beginning of the learning the dominant level of the students is in the first level, it is where students can think in a concrete way, limited tasks can be mastered by applying content-related, practical reasoning and use specific content-related scheme to solve problems (Reeff, 2006). Now, all the students representing each level it means the 3rd and 4th level is fulfilled. At the third level of problem-solving proficiency, student will be able to use formal operations to integrate multidimensional or ill-defined goals, and to cope with non-transparent or multiple dependent constraints. Level 4 problem solver is where the student capable of grasping a system of problem and possible solutions as a whole. Thus, the consistency of certain criteria, the dependency among multiple sequences of actions and other “meta-features” of a problem situation may be considered systematically. Also, at this stage pupil is able to explain how and why they arrived at certain solution.

4. **Poster as Group Final Product of The Project**

Figure 1.2 Graph of Group’s Result in Poster as Product
Poster includes as one of type for final product of project-based learning in science regarding to King (2009). A poster in term of products according to O’neill and Jennings (2012) consist of 2 aspect, they are; product in knowledge and product of visual and organizational. The product in term of knowledge consist of 4 criteria; completeness, fluency, elaboration, and relevancy. While the products in term of visual organization are: flexibility, originality, legibility, and proportionality.

Based on the result (as shown in figure 4.4) the visual organization aspect obtains higher accomplishment with 81.94% rather than knowledge product which gain only 68.05%. This result interprets that most of students are more interest in visual attraction, they pay more attention in the visual look rather than the content. The knowledge that should be shown in the poster was not explored deeply by the students. Most of the groups are more concern in finishing the poster appearance

The creating of the poster is already arranged in the learning process through some criteria. The criteria for completing the posters are given in the third syntax of project-based learning, it is set parameters for completing the project. The essence of poster which is existing in that syntax is opportunity to dialogue about learning. In this syntax all students have opportunity to discuss about the completion of the project.

Another consideration of creating a poster as final product is linking among variable of this research, they are students’ achievement and problem solving skill through the knowledge product. As explained before, each group consist of higher achiever and lower achiever students which means the dividing process is fair. The result of groups’ product can be seen in Table 1.3 and 1.4 as follows:

<table>
<thead>
<tr>
<th>Knowledge Achievement</th>
<th>Higher</th>
<th>Lower</th>
<th>Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poster Result</td>
<td>Figure 1.3 The Greenhouse Effect (5th) Group Poster Result</td>
<td>Figure 1.4 The Land Environment (3rd) Group Poster Result</td>
<td>Figure 1.5 The Transportation (2nd) Group Poster Result</td>
</tr>
</tbody>
</table>
Table 1.3 Groups’ Poster Result of Knowledge Aspect

<table>
<thead>
<tr>
<th>Poster Result</th>
<th>Visual Organization Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Higher</td>
</tr>
<tr>
<td>Figure 1.6 The Ozone Depletion (6th) Group Poster Result</td>
<td>![Image]</td>
</tr>
<tr>
<td>Figure 1.7 The Human Population (1st) Group Poster Result</td>
<td>![Image]</td>
</tr>
<tr>
<td>Figure 1.8 The Water Pollution (4th) Group Poster Result</td>
<td>![Image]</td>
</tr>
</tbody>
</table>

Table 1.4 Groups’ Poster Result of Visual Organization Aspect

| Teamwork Ability | 71.25% |
| Cognitive Achievement through PjBL | 73.75% |
| Problem Solving Skill | 75.42% |
| Poster as Final Product | 83.75% |

5. Students’ Response towards Implementation of Project-Based Learning Model

Figure 1.9 Graph of Students’ Response towards Project Based Learning Implementation

It is seen clearly that each indicator has different percentage score response from all participants. For teamwork ability the score is 71.25% which means that most of respondent agree that by doing a project in group they can improve their teamwork ability. On the other hand the score for indicator of cognitive achievement through project based learning gain 73.75%, for problem solving skill indicator it
gathers score as much as 75.42%, and the last indicator about the response of poster as final product most of the participants agree that the poster is good idea to be created as final product of the project and it is obtained the highest score compare to other indicators as much as 83.75%.

D. Conclusion

The implementation of project-based learning model on People and The Planet chapter can improve students’ cognitive achievement and problem solving skill, it can be noticed by processing the differences between pretest and post-test score which is gained by students that shows an improvement and obtain normalized gain as much as 0.46 which include as medium category and the improvement of students’ problem solving skill is indicated by the normalized gain (<g>) as much as 0.38 which categorized as medium as well. The leveling of problem solving skill in this research apparently encounters a shifting result. The shifted result shows when the pretest was given to students, the dominant acquisition is level 1 problem solver as much as 75% the rest are level 2 problem solver. Meanwhile, when the post-test was given to the students the dominant level is in level 2 problem solver as much as 62.5% some of the rest are still in level 1 problem solver, the other one have already reach the 3rd level of problem solving skill, and only a student that can reach the 4th level of problem solving skill. A poster was determined as final product of the project-based learning implementation. The result of the poster shows positive accomplishment, the product in term of visual organization shows higher value rather than the product of knowledge. The respond of students towards project based learning implementation shows positive respond in all indicators; teamwork ability, cognitive achievement trough PjBL, problem solving skill, and respond to poster as final product.

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THE IMPROVEMENT OF STUDENTS' PROBLEM SOLVING SKILLS IN THE CONCEPT OF SEPARATION METHOD BY USING PROBLEM BASED EXPERIMENT

SITI ASHRI SAHIDAH LISDIANI

(0902124)

ABSTRACT: This research is conducted under the needs of education to solve ineffectiveness of traditional experiment method which could not provide enough facility in developing student skill of problem solving in science instruction. This research is aimed to investigate the improvement problem solving skill in 1) domain of problem analysis, 2) domain of problem solving planning, 3) domain of conducting problem solving, and 4) domain of problem solving evaluating as the result of problem based experiment implementation. The method which is used in this research is descriptive quantitative method. Sample of research is gained by using purposive sampling which sample is students in higher achiever class of secondary 2 in one of Cambridge based International School in Bandung. According to research result, it can be concluded that the improvement of students' skill in problem understanding is categorized as low with n-gain value is 0.1. The improvement of students' skills in problem solving planning domain is classified as medium with n-gain value is 0.6. The improvement of problem solving skill in domain of conducting problem solving is medium with n-gain value is 0.5, and domain of problem solving evaluating improved in high category with value is much as 0.8.

Keyword: Problem based Experiment, Problem Solving Skills, concept of separation method.

INTRODUCTION

The needs of science education are essential to the life challenge where science education is one of important aspects in developing high quality human resources. It is emphasized that science education aims to foster students who eligible for pursuing life challenge by showing excel capacity in solving real life problem. Like other thinking skills, problem solving is quite important to be mastered by students. This competency is essentially important to have by each individual in facing daily life situation where knowledge that they have should be engaged with the problems of daily which is generally have unobvious solution. Problem solving is
also fostering better citizenship as Problem Solving Expert Group (PEG) (2010) stated that development of problem solving includes the willingness to engage with such situation in order to achieve one's potential as a constructive and reflective citizen.

Finding the method which more emphasizes to student center learning is urged to be done where development of student problem solving skill should be accelerated to answer the needs of student. Experiment Activity is proposed as one method that utilize in fostering problem solving. As Unal and Ozdemir (2013) state that experiment activity offers experience opportunity to solve problem and develop understanding. It is also emphasized that experiment activity is usually used by teacher to develop students thinking skill, which somehow, helps the students understand the various aspects of scientific investigation including problem solving skills development during the process. Experiment activity is compatible with the process of problem solving where usually it involves scientific investigation of problem.

In fact, science laboratory activity has only been emphasized on the process of conducting experiment without considering development of problem solving skill. During the implementation of experiment activity which generally uses cookbook method, Students are rarely engaged in the material. Accordingly, Kelly et al. (1994) stated that students can be successful in their laboratory class even with little understanding of what they are actually doing. This methods seems to be effective while most of the time students are be able to conduct laboratory activity successfully. As the impact, the result foster that students intend to perceive if they need to follow instruction and getting the right answer (Unal & Ozdemir, 2013), thereby defining unreachable developing of problem solving.

Based on the argumentation above, the use of novel method of experiment activity is needed considering that cookbook method fails to meet the requirement of
problem solving development. Problem based experiments is triggered to fulfill the needs of improvement in science experimental work from traditional or cookbook model. Problem based experiment is experiment activity which is redesigned using problem-based learning. Problem-based experiment is considered benefit to enhance problem solving skill and performance skill of student as the result of activities arrangement that facilitate the student to explore problem solving method related to daily problem through experiment activity.

This research is aimed to study the improvement of problem solving skills as the result of problem based experiment implementation. In this study, the implementation will be implemented to secondary level students of secondary two in the concept of separation method. Concept determination is reconsidered based on characteristic analysis of the concept where it is contextually related with daily life. This concept is compatible with the characteristic of problem based learning which the problem comes from daily activity and familiar condition that usually faced by students.

**a. Research Problem**

In line with the explanatory background that has been described, problem that rose in this research is stated in the following question:

"How is the improvement of students' problem solving skills in the concept of separation method by using problem based experiment?"

Elaborating the research problem above, the research attempts to explore the following questions:

a. How is the improvement of students' problem solving skill in domain of problem analysis, problem solving planning, and problem solving evaluating?
b. How is the improvement of students' problem solving skill in domain of problem solving planning?
c. How is the improvement of students' problem solving skills in domain of conducting problem solving?

d. How is the improvement of students' problem solving skill in domain of problem solving evaluation?

**PROBLEM BASED EXPERIMENT**

Problem based experiment is one of experimental method which is adapting students centered approach. This method is the type of laboratory activity which is adapting problem based learning approach in the implementation. Bound and Feletty (Chan & Chia, 2005) state that problem based learning in particular proposed, the problems act as the stimulus and focus for student activity and learning.

Problem based experiment is one of method which is proposed to solve some obstacles that occur during experiment activity. The obstacles occur that most of student could not develop their thinking since laboratory work is often cognitively overloading (Unal & Ozemir, 2013). This led to the condition that student not to think about the essence of topic, but following the procedure and getting right answer without exploring knowledge. As the result, Kelly and Finlayson (2007) state that students can be successful in their laboratory class even with little understanding of what they are actually doing.

Unlike the traditional lab method, problem based lab present different approach while students are given problem scenario and require to develop their own procedure and method to solve the problem instead of given th procedure in cookbook style. As Kelly and Finlayson (2007) stated that in problem based lab the problem which is typically as the center of study is in form of ill-structured, complex with no right answer.Yet, the condition leads PBL to be implemented as extended collaboration among group which leads to conceptual learning.

Gallet (1998) proposed the implementation of problem based learning in laboratory activity. The stages are including (1) formulating problem, (2) defining the
problem, (3) problem analysis, (4) present the information technically and theoretically, (5) analyse the parameter to solve the problem, (6) Elaborate the alternatives, (7) choosing the procedures and experiments, (8) conducting alternative experiments, (9) validating experiments by group, (10) Judging the best procedures, (11) reporting data from each group (12) discussion of experimental result, (13) report of discussion , (14) Determine the conclusion, (15) reconsideration of experiment results.

There are several benefits that can be fostered from the implementation of problem based experiment. PBL experiment. It indeed illustrates positive effect in improving the problem solving skills (Klegeris & Hurren, 2011). Problem based Experiment is indeed, providing the opportunity for students to explore more. Kelly and Finlayson (2007) report that students respond that they are given more chance to learn and explore the material .In PBL, students work in small collaborative groups and learn what they need to know in order to solve a problem (Hmelo-silver, 2004). This activity is also beneficial where students in both low and high level could improve their problem-solving skills (Adesoji, 2008).

**PROBLEM SOLVING SKILLS**

According to Ananiadou and M. Claro (2009), Problem solving skills and is included into information domain of 21st century skills and competency where problem solving skills involve at some point defining, searching for, evaluating, selecting, organizing, analyzing, and interpreting information. Further, PEG (2010) represents problem solving competency as an individual's capacity to engage in cognitive processing to understand and resolve problem situations where a method of solution is not immediate obvious. It includes the willingness to engage with such situation where method of solution is not immediate obvious.
In general, problem solving skills simply can be defined as the ability to identify, understand and analyze problem which is used to design unobvious solution by analyzing hypothesis, interpreting, execute, and evaluating the solution.

Further, problem solving skills can be fostered through the process of problem solving. According to O'Neil and Schater (1997), problem solving process is arranged into the following process, including: 1) exploration of alternative ideas, 2) extraction of relevant material, 3) simplification by constraining the problem into parts, and 4) organization, attending to externally provided feedback.

Problem solving component generates the context of skills to determine the direction of development of the process to foster problem solving skills. O'neil and Schater (1997) define the component of problem solving as: 1) Domain specific knowledge (content understanding), 2) Metacognition (planning, self-monitoring), 3) Domain specific problem solving strategies motivation (self-efficacy and efforts). As addition domain of problem solving skills explain the direction of specific domain as a basic how problem solving skills should be assessed. Based on Anderson et al. (2011) explain that problem solving domains of hypothesize, investigate, evaluate, integrate, and reflect are considered in the process of problem solving assessment.

Polya (1973) argue that problem solving is learnable skill by imitating and practicing it. As skill, Polya broke down problem solving skills into four phases of (a) understanding the problem, devising a plan, (b) carrying out the plan, and (c) looking. However, the use of problem solving skills relates with the implementation on particular subject or curriculum. Bransford and Stein (Nitko and Brookhart, 2007) proposed IDEAL Problem Solver as general problem solving skills. They arrange general problem solving skills into five stages of process as (a) Identify the problem, (b) Define and represents the problem, (c) Explore possible strategies, (d) Act on the strategies, and (e) Look back and evaluate the effects of activity.

Thus, problem solving skills that is used in this research is that problem solving skills which is proposed by Mettes & Pilot (1980) which emphasized on
problem solving skills in science and technology. The domain are explained as 1) Problem Analysis, 2) Problem Solving Planning, 3) Conducting Problem Solving and 3) Problem Solving Evaluating.

**METHODOLOGY**

Subject of research is 16 students of secondary 2 in high achiever class. Sampling technique of research subject is determined by using purposive sampling. Accordingly, educational research is often utilized quota/ purposive sampling in difficulty to take probability (McMillan, 2012). Yet, High Achiever Class is taken as the consideration from preliminary study where student's cognitive achievement is excelled as the effort to prevent cognitive load during the implementation.

Research method used in this research is descriptive quantitative. Descriptive quantitative method is utilized to describe the phenomena or the condition of certain variables (Arikunto, 2002).

In identifying the improvement of problem solving skills, problem solving skill test and performance test was arranged. Problem solving skill test was arranged to measure students' problem solving skill in domain of problem analysis, problem solving planning, and problem solving evaluating. On the other hand, performance test was arranged to measure students' problem solving skills in domain of conducting problem solving.

**RESULT AND DISCUSSION**

In analyzing the improvement of problem solving skill as the result of Problem based experiment, data which is obtained from both problem solving skill test and performance test were analyzed descriptively. Descriptive statistical analysis is done to identify general value of data as the initial process which is advantageous to analyze the important values of data. Those data, further, are analyzed to get Normalized gain index as the effort to know the quality of problem solving
improvement. The quality of improvement is categorized by calculating the value of Normalized Gain Index $<g>$. Furthermore, the recap of Problem Solving Skill improvement generally is represented in the following table below.

**Table 1 Improvement of Problem Solving Skills**

<table>
<thead>
<tr>
<th>Domain of Problem Solving Skills</th>
<th>Average Score (%)</th>
<th>$&lt;g&gt;$</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$S_i$/ 1st Test</td>
<td>$S_f$/ 2nd Test</td>
<td></td>
</tr>
<tr>
<td>Problem Analysis</td>
<td>81.3</td>
<td>83.6</td>
<td>0.1</td>
</tr>
<tr>
<td>Problem solving Planning</td>
<td>26.6</td>
<td>68.0</td>
<td>0.6</td>
</tr>
<tr>
<td>Conducting Problem Solving</td>
<td>88.5</td>
<td>95.1</td>
<td>0.5</td>
</tr>
<tr>
<td>Problem Solving Evaluating</td>
<td>46.1</td>
<td>86.7</td>
<td>0.8</td>
</tr>
</tbody>
</table>

The result is indeed illustrated that there are difference improvement of students' skills in each domain. Further, it is needed to identify the improvement in each domain in elaborating the result above. The elaboration is including analysis of test item in each domain which represent the improvement of domain more detail as well as identify the profile of students skill in that domain. Moreover, the elaboration of improvement in each domain also relates with criteria of implementation which was obtained from observation result and worksheet fulfillment analysis since each syntax of problem based experiment is aimed to develop specific domain of problem solving skill.

According to the result, it can be seen that there is improvement of students' problem solving skill. Thus, it indicates that the implementation of problem based experiment has positive effect in improving students' problem solving skills. The result of implementation is in line with the result of several research that they generally indicate that in the cases of problem based learning activity, PBL have positive effect in improving the problem solving skills (Klegeris et.al, 2011). The result is also establish the benefit of problem based experiment proposed by Silver
(2004) that indicates if problem based learning experiment gives sense to engage problem solving skill process where students both can learn content and thinking strategy. It is indeed validate that the implementation illustrates agreement to the statement that somehow there is some interrelation of problem based learning activity and problem solving skills.

On the other hand, reviewing that the significance of problem solving improvement are generally in medium level, it is established that there is certain ineffective activity which resist high improvement of students skill. It is proved that the improvement between each domain of problem solving skills is different with each other which means that some of there are several lack of implementation so that the improvement is not distributed equally. This difference ought to be described as the result of implementation quality of each meeting which affects the improvement of students' skill in each phase.

According to the analysis of problem solving domain, it is established that domain of problem analysis has lowest improvement. The result can be attributed to the fact that in the first meeting, only 75% of students' activity have generally obtained. Therefore, the treatment was not effective enough to train students' ability in problem solving. It should also be stated that the initial skill of students have already reached very high level, consequently it is hard to improve the skills into higher level. To strengthened, only half of students complete group worksheet in problem analysis. As assumption, students are not interested in identifying problem which is presented mostly in passage form.

On the contrary, evaluation domain illustrates satisfactory result where the improvement is the highest of all. It is related to students' involvement during the activity of designing which is qualified as high involvement. This domain is related with activities in the second and third meeting. Accordingly, the result of second meeting implementation shows that both teacher and students' activity indicate that
the criteria of implementation in this meeting are the highest of all, which means that
the implementation was conducive, and so does students treatments which were run
extensively. So does in third meeting where are general criteria in this meeting has
been obtained. To strengthened, Group worksheet fulfillment also indicates that
group worksheet task in evaluating problem solving by comparing experiment result
is completely fulfilled.

It is indeed, illustrates that the completeness of activity could affect skill
improvement of students. However, in some cases, the completeness of activity is not
always fostering high significance of improvement. Taking domain of problem
solving planning as example, this domain is related with activities in second meeting,
it is assumed that the improvement are likely to be high considering that the
implementation quality is high as well. In fact, the improvement of this domain is
medium, in which that there are other obstacle that cause optimal improvement
unreachable.

The obstacle is caused by the fact that students are more comfortable to do
experiments by cookbook method which is given by teacher. This statement is
identified based on the result of questionnaire regarding to the implementation of
problem based experiment which stated that 100 % of students are more likely
to consider to choose cookbook experiments, hence the method is effortless comparing
to problem based experiment method. Thus, it is identified that students' response
toward the implementation is also important to maximize the treatment.

Regarding the analysis of response, it shows that generally students are
excited about the activities which were conducted during the implementation. Mostly,
students' response toward science instruction is quite positive. Students, in this case, are
mainly more excited toward experiment activities instead of other science instruction
activities. As Watt and Elbutt (Hart et.al ,2000) stated that students likely to prefer
experiment activity which offer more opportunities for self-directed enquiry.
Kelly et al (2008) also reports that students respond that they are given more chance to learn and explore the material. Generally, students which are treated by problem based experiment feel more challenged to do experiment activity.

Further, the implementation of problem based experiments fostered positive response in general. Students' response indicates that the activity which is arranged gives more challenge for them to explore. Moreover, students, indeed, felt the advantage of the implementation were students argue that their ability to solve problem improve more.

However, it is appeared that there is some resistance which emerged during some activities. For instance, students responded that they are likely preferred to use cookbook instead design their own procedure. This perception might be fostered that students are not motivated to design their own procedure because they are rarely given stimuli to explore more during activity as the effect of cookbook method.

This phenomenon is similar with research conducted by Kelly et al (2008). They report that students are often resist to do activity in doing activity because the students feel that they need to give more effort and time in designing experiment activity. Complicated activity and long period of time becomes the biggest obstacle that makes students resist doing problem based activity instead of doing cookbook experiment.

Working on the solution of those obstacles and resistance above, there are several solution that can be done to minimize the obstacle. The activity should be arranged to be more interested by presenting the problem in the other media. For instance, it is better to use media such as film or video documenter that is more appealing to students. Teacher should also working on group arrangement, since most of the activities are involving group work. Thus, it is very important to consider group type that is appropriate for the condition of class.
CONCLUSION

Taking into account previous research findings, it can be concluded that students problem solving skills in the concept of separation method through problem based experiment are improved with the improvement of each domain described as:

1. The improvement of students' skill in problem understanding is categorized as low with n-gain value is 0.1.
2. The improvement of students' skills in problem solving planning domain is classified as medium with n-gain value is as much as 0.6.
3. Domain of problem solving evaluating improved in high category with value is much as 0.8.
4. The improvement of problem solving skill in domain of conducting problem solving is medium with n-gain value is as much as 0.5.

REFERENCE


THE IMPACT OF TEAM GAMES TOURNAMENT WITH READING INFUSION TOWARDS THE IMPROVEMENT OF STUDENTS' LEARNING ACTIVITIES AND ACHIEVEMENT IN WAVES TOPIC

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ABSTRACT

As one of alternative solution for the lack of activities and low achievement in science learning, Team Games Tournament (TGT) with reading infusion is implemented through pre experiment research with one group pretest posttest design in which the samples are fourteen low-achiever-students in secondary-2 level in one of private school in Bandung who are chosen through availability sampling. It is found that after the lesson has been conducted there is medium improvement of students' achievement as the average normalized gain value is 0.43. The highest improvement is in remembering (C1) domain and the lowest improvement is in applying (C3) domain. Moreover, students' activities also improve in the second cycle of lesson implementation, which is seen from the increasing percentage of students who did visual, oral, motor and writing activities that promote learning. The implementation of TGT with reading infusion also give positive impact toward the learning interaction among students, where symmetric interaction more likely appear on the second cycle of lesson implementation. Yet, the implementation of reading infusion is still very poor where according to questionnaire result it is found that most of the students did not want to read the science text because they want teacher explain the concept later and most of them taught that reading science text before coming to science lesson is useless.

Keywords: Team Games Tournament (TGT), Reading infusion, Learning activity Learning achievement, Waves topic

INTRODUCTION

The teaching and learning process of science lesson should be conducted in an interactive, inspiring, fun and challenging way that also motivate students to actively participate, and provide opportunity for students to build innovation, creativity, and independence according to their talents, interests, as well as
physical and psychological development (Permendiknas No.41, 2007). Science
lesson also need to be well-designed to stimulate curiosity, interest and enjoyment in science and its methods in enquiry (UCIES, 2012)

Based on the preliminary study done in secondary 2 - low achiever class in one Cambridge based school, it is found that most of the students did not pay attention to teacher explanation and did not show active participation during the science lesson took place. Moreover, based on the results from questionnaire filled by students, it is found that generally, students are not enjoy and feels frustrated in learning science. From opened questions given, it is found that most of the students regard science as difficult, not interesting and complicated subject especially when they deal with formulas, calculations and various terminologies which are hard to understand. This condition does not challenge and motivate students to learn science. Consequently, it results in low students' achievement where the average of previous physics chapter test score is still below the minimum completeness criteria.

To cope with this problem, applying instructional model that stimulate their interest to learn and makes them enjoy during learning science is done in this research that is by applying one of cooperative learning type, Team Game Tournament (TGT). TGT is believed can improve students' achievement by building positive interaction among students Slavin (2008). Some other researchers have proved that the use of TGT can improve students' motivation to learn and learning achievement (Fadhilah, 2011; Hulten, 1974; Edward, 1972), students' learning achievement (Ismoyo, 2012; Yuliani, 2011; Slavin and Kartweit, 1979) and students' learning activity as well as learning achievement (Kusmiati, 2011).

In this research the topic will be used to implement this learning model is waves topic. This topic is chosen because it comprises of many terminologies, formula and calculation that might be difficult to be understood by low achiever students in secondary-2 level. In contrast with previous research, in this research TGT will be integrated with reading infusion. This is done to prepare students
with prior knowledge before instructional process takes place. It is necessary to make students possessing ability to analyze, synthesize and critique the information that has critical role in learning process and production of learning achievement (Fang, et.al, 2008). It is hoped that integrating TGT with reading infusion can give positive impact toward students' learning activity and achievement. Thus, this research attempts to investigate the impact of TGT with reading infusion toward the improvement of students' learning activities and achievement in waves topic.

The research issues are given as follow:

1. The impact of Team Games Tournament with Reading Infusion towards the improvement of students' learning activities in waves topic
2. The impact of Team Games Tournament with Reading Infusion towards the improvement of students' learning achievement in waves topic
3. The impact of Team Games Tournament with Reading Infusion towards students' learning interaction pattern?
4. Students' response toward Team Games Tournament with Reading Infusion implementation?

LITERATURE REVIEW

As an effort to improve students' learning activities and learning achievement, TGT as one type of cooperative learning model will be implemented in this research. Slavin stated that in TGT students are not accustomed to interact each other, communicate one to the other and work together only, but students also have to understand the concept and compete to be the best (Lang & Evans, 2006). According to the relevant research, it is found that TGT has advantages such as increase academic achievement, improve students' attitudes toward learning, create students peer tutoring, stimulate the outside world, and dissolve social barrier (DeVries, 1980). Therefore, students will be motivated, have sense of responsibility to be the best for the sake of team success because the main idea behind TGT is to motivate students to support and help each other in mastering
concept being taught (AEA 267, 2007). Basically, TGT is belonging syntax that derived from its components. The syntax are: 1) class presentation, 2) study team, 3) tournament, 4) team recognition, and 5) bumping.

Moreover reading activity will be infused before the lesson takes place. Fang and Wei (2010) suggest that if students are provided time to read science texts and taught how to use reading strategies, they not only become more proficient readers, but also learn science content more effectively. One of the reading techniques that can be used to study the particular scientific text is Survey, Question, Read, Recite and Review technique (SQ3R) which is developed by Francais P Robinson (Depdiknas, 2008) that will be conducted by students. The reading infusion can prepare students with prior knowledge before coming to science lesson while TGT can create a learning condition which is challenging, exciting, make students enjoy in learning but still prioritizing mastery of concepts being learned, and make peer tutoring possible since students will be assigned into heterogeneous team composition. High academic ability students are expected to help other member to mastery the concept and also give motivation to teammates to contribute good score for team success. On the other hand, low academic ability students are expected to ask for help from other teammates to understand the concept. The interaction among team members will make students participate more actively in the lesson, thus improving their learning activity and as a result, learning achievement also will be improved.

**RESEARCH DESIGN**

This research adopted pre-experimental research with one group pretest posttest design. Prior to treatment, pretest was done, while post test was done after the treatment given. The treatment that will be given to the subject is TGT with reading infusion that will be implemented in two cycles. The implementation of Team Games Tournament (TGT) with reading infusion is this research regards to the syntax of TGT where before students involved in TGT, they were given homework in form of reading task to read articles related to the concept that will
be taught. The reading technique used to understand the article is SQ3R (Survey, Question, Read, Recite and Review) where students are given 5 questions which are constructed according the steps of this technique. The home work aims to prepare students with adequate knowledge before following the lesson.

**Subjects**

The subjects of this research are 14 low achiever students in secondary-2 level in Cambridge based school who are chosen through availability sampling. The selection of subject with this method is not regarding to the aspect of strata, random or region, but subjects are selected based on its availability.

**Tools**

To evaluate achievement, test that consists of 30 multiple choice questions with four choices were used in pretest and posttest. The achievement test is limited to the aspects of the cognitive abilities that correspond to the learning objectives in the syllabus used in schools where the research took place that is from remembering (C1) domain until applying (C3) domain.

The tools used to record interaction pattern is observation sheets adopted from Roychoudhury and Roth (1996) study. The aspects that will be observed are students' interaction, type of interaction, task completion method, attention of students, orientation of task completion, and helping or problem solving. The observer is asked to fill in the observation sheet by choosing criteria which appear in teams which are being observed.

Teacher and students’ activities during lesson implementation were recorded in an observation sheet that constructed according to the syntax of TGT. The students' activities which are observed and recorded are visual, oral, motor and writing activities. This observation sheets will be filled in by the observer who observed during the lesson. Observation sheet is not tested first, but fairly coordinated with the observer in order to avoid misunderstandings during filling
process. Observer will be asked to fill in the columns in observation sheet using checklist, which will then be processed by the percentage interpretation.

This instrument will be used to record the students' response toward the implementation of TGT with reading infusion that focus on three indicators: response toward working as a team, response toward games in science instruction and response toward reading infusion. Each indicator comprises of ten statements. Students are required to choose one out of five scale (strongly disagree, disagree, undecided, agree and strongly agree) for each statement.

RESULTS AND DISCUSSION

The results is discussed by focusing on the improvement of learning achievement and learning activity where the data results of TGT with reading infusion implementation and the data results of students' response are used as supportive data.

It is found that TGT with reading infusion, indeed have impact on the improvement of students activities and achievement. Generally, the learning achievement improve with medium category while the learning activities improves as much as 18.35% on the second cycle of lesson implementation compared to the first cycle of lesson implementation, although in both cycles its indicator completion is on the same criteria in which most of the learning activities criteria are obtain. The improvement of learning achievement and learning activities will be discussed further below.

Learning Activities

As shown on figure 1, there is improvement in each type of learning activity which is measured.
There is the improvement of students' visual activity where on the second cycle of lesson implementation, visual activity indicators are generally fulfilled. Nevertheless, the number of students who pay attention to teacher explanation or information reduce as much as 10.71%. It happens because according to the implementation data results, on the second cycle of lesson implementation there are some activity indicators that are not fulfilled by all of the students. It is because teacher did not perform any activity in bumping stage and skip some activity in closure stage. Teacher did not inform the new composition of tournament table during bumping stage because there will be no more tournament. Moreover, teacher also did not give reading task to students during closure since the implementation of team games tournament with reading infusion has already finished. As a result, students did not do any activities, including pay attention to teacher explanation or information as the respond to teacher activities.

Similarly, students' oral activities also improved from almost half of to most of indicators are fulfilled on the second cycle of lesson implementation. The highest average percentage of oral activity is discuss with teammates during study team stage. This finding is in line with the fact of interaction pattern changing that appear on the second cycle of lesson implementation, in which the asymmetric interaction pattern is no longer exist which indicates that there is no more team

Figure 1 The average of students' learning activity percentage in each type of learning activity
members who dominates discussion thus all of the member participate actively during study team, including participate in discussion. It is because there is team competition element which builds positive interaction among students, so that they are motivated to support and help each other in mastering concept being taught (AEA 267, 2007). The lowest average percentage in oral activity is *posing question or opinion* related to the concept being taught. It is because during the lesson took place, teacher rarely provide chance for students to pose questions or opinion as it is seen on the learning scenario, where the one who actively pose question is teacher.

It is also found that there is improvements of students' motor activities from most of to generally indicators are fulfilled. The motor activity that improved the most is *sit in appropriate team or tournament table* during study team and tournament stages. During the first cycle of lesson implementation, students are still difficult to be controlled since this kind of lesson is new for them, moreover in the beginning some students do not accept the arrangement of team member assigned by teacher, so most of them reject to sit in appropriate team. The rejection is also happen during tournament stage where it is especially done by students who are assigned in low tournament table. But, in the second cycle of lesson implementation, students are easier to be controlled. Nevertheless, students activity in playing game decrease as much as 14.29% because in the second cycle of lesson implementation there is one students who absent and there are two students who come late to class.

Still according to the learning activity data results, it is found that there is the improvement of students' writing activities. *Complete or give correction to the worksheet* activities is the highest improvement compare to the other as it improves as much as 35.71%. It is because in the second cycle of lesson implementation, the number of students activity during study team increase including students who pay attention to teacher explanation during confirmation.
Learning Achievements

There is the improvement of students' achievement after TGT with reading infusion has been implemented where the improvement itself is categorized as medium. This finding is in line with one of TGT advantage stated by David DeVries (1980) where the implementation of team games tournament can improve students' achievement. It is because the implementation of TGT enables students' to perform better on task (DeVries, 1980) as there is the improvement of students' worksheet completion percentage that can promote the improvement of academic achievement, including cognitive achievement. Moreover, TGT also builds positive interaction among team members (Slavin, 2008) where students are belonging sense of responsibility to be the best for the sake of team success in tournament so that students support and help each other in mastering concept. This statement is proved by the finding of interaction pattern in which symmetric interaction pattern is more frequently appear.

However, the students' achievement improvement is not optimal yet. It is found that most of the students (57.14%) experience high improvement in learning achievement. Only a few of them (14.29%) experience high improvement, and almost half of students (28.57%) experience low improvement in learning achievements. The improvement in each cognitive domain also not distributed equally as it is seen on the figure 2 below. It indicates that there are some inadequacies of TGT with reading infusion implementation that will be discussed further.

Table 4.3 Students achievement improvement in each cognitive aspect

<table>
<thead>
<tr>
<th>Cognitive domain</th>
<th>% Score</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
<td>Posttest</td>
</tr>
<tr>
<td>Cl</td>
<td>28.57</td>
<td>76.19</td>
</tr>
<tr>
<td>C2</td>
<td>30.80</td>
<td>57.59</td>
</tr>
<tr>
<td>C3</td>
<td>18.75</td>
<td>49.11</td>
</tr>
</tbody>
</table>

Note: <g> = normalized gain average
According to the data results, it is found that remembering (C1) domain has the highest improvement compared to the other cognitive domain, where the improvement is categorized as medium. It is because, in this cognitive domain students just need to remember the concept that has been learned to be able to answer a question associated to this cognitive domain. However, the medium improvement illustrates that in this domain, some students are still having difficulties in promoting retention of information that he knows in some concept, such as in recognizing amplitude of wave. It is because during the lesson implementation, according to worksheet indicator completion results, only 64.29% students can complete the indicator in this concept. However, most of remembering domain indicator has been obtained since the implementation of TGT with reading infusion much emphasizes remembering (C1) domain.

Similarly, students' ability in understanding (C2) domain improved with medium category after the TGT with reading infusion has been implemented. It indicates that in this domain, students are still difficult to build connection between new knowledge to be gained and their prior knowledge especially in describing what is meant by vibration; explaining the relationship between period and frequency of vibration; and in explaining waves frequency and its relation to wavelength. It is because, according to the students' worksheet completion, only almost half of students complete the indicator of describing what is meant by vibration. In contrast, most of the students actually has obtained the indicator of explaining period and frequency of vibration but the relationship among them is not really emphasize, so that students have difficulty in answering a question related to relationship between frequency and period. Moreover, according to the students' worksheet completion, it is seen that there is only a few number of students who are able to explain the concept of wavelength and only half of the students able to explain the frequency of waves, thus it is still difficult for most of the students to explain the relationship between wavelength and frequency of waves.
On the other hand, the improvement of students' ability in applying (C3) domain is included into medium category. Although the improvement of this domain is included into medium category, actually it is the lowest improvement among the other domain. It means that students still having many difficulties in applying formula or concept into a new case or problem although the concept which is used is still the same especially in calculating the period of longitudinal and transversal waves. Actually, according to students' worksheet completion, most of students able to use the formula for calculating period in both longitudinal and transversal waves, but when the problem is different, they cannot apply their knowledge into the new problems. It is because students are often remembering the formula without knowing how to apply the formula into other problems or cases since the lesson implementation students' ability in applying (C3) domain are not sufficiently emphasized. It is strengthened by the fact that the average C3 indicator fulfillment seen on the students' worksheet completion is only 59.82%. To overcome this, the students' ability in applying (C3) domain should be more emphasized during the lesson implementation especially in class presentation. The reading task also needs to emphasize applying (C3) domain, especially in the text given and on the question in review stage of SQ3R reading method.

However, according to the pretest and posttest distribution for each indicator fulfillment, the implementation of TGT with reading infusion has a good impact in improving students' concept mastery in specific concept, such as characteristics of transversal waves, characteristics of longitudinal waves, and concept of waves in general where the indicator for those concept are generally fulfilled after the lesson has been conducted.

Other factor that resists the optimal improvement of learning achievement and learning activity is the very poor implementation of reading infusion. There are only two students who did the reading task while in the second cycle of lesson implementation there are three students who collect the worksheet, including those who did the first reading task. It happen because, according to questionnaire results, most of the students did not want to read the science text because they
want teacher explain the concept later so that most of them taught that reading science text before coming to science lesson is useless. This finding illustrate that students are lack of motivation to read. It is because students lack the requisite literacy skills and reading method that allow them to access the texts that might otherwise interest them. The reason behind this is before the lesson implemented the teacher explanation about how to do the reading method after pretest implementation is not adequate for the students. It will be better if students are habituated with SQ3R reading method before the implementation of team games tournament with reading infusion is done.

CONCLUSION

According to the results and discussion in previous chapter it can be concluded that after the implementation of team games tournament with reading infusion, there is medium improvement of students' achievement in cognitive aspect where the improvement of remembering (C1), understanding (C2) and applying (C3) domain is in medium category. The highest improvement is in remembering (C1) domain, while the lowest improvement is in applying (C3) domain. Students' learning activity also improved in which the most improvement is in visual activities and the less improvement is in oral activity.

There are three types of interaction pattern appear, those are symmetric, shifting asymmetric and asymmetric interaction pattern, where the most interaction pattern that appear is symmetric interaction pattern while the less interaction pattern that appear is asymmetric interaction pattern.

Students tend to have positive response toward the implementation of team games tournament with reading infusion, where the highest to lowest positive response is found in response toward working as a team, toward games in science instruction and toward reading infusion respectively.
REFERENCES


