

PREPARING AN INNOVATIVE CHEMISTRY TEACHING MODULE INTEGRATED CHARACTER EDUCATION

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Abstract - The objectives of this research are (1) to know student and teacher perception for electrolyte and non electrolyte solution existing textbook (2) to obtain an standardized innovative chemistry teaching module of electrolyte and non electrolyte solution material for senior high school grade X in the second semester suitable and in accordance with related curriculum, (3) to determine the effect of using innovative chemistry teaching material toward learning outcome of students of senior high school grade X in the second semester in Medan. The research data analysed by descriptive and inferential statistics methods. The result data shows that (a) the existing electrolyte and non electrolyte solution existing module had already meet standard but it is possible to develop, (b) we have obtain an innovative electrolyte and non electrolyte solution teaching module for senior high school grade X in the second semester. This module contain learning strategy which able to developing student learning outcomes and characters. (c) the innovative teaching module have fulfill standardized for National Education Standard Bureau (BNSP), (d) Student learning outcomes which taught by this module give better than taught by existing textbook.

Keywords: innovative teaching module, electrolyte and non electrolyte, student's learning outcomes

1. INTRODUCTION

Educational problems associated with the low quality of education in Indonesia, particularly in secondary educational level are often discussed in the mass media. Many efforts have been made to improve the quality of education such as providing training to improve the quality of teachers, curriculum improvement periodically, repair facilities and educational infrastructure, and improve the quality of school management (Ho, 2009). However, indicators of the quality of education have not shown significant improvement. Improving the quality of education should be carried out continuously and through innovation. Improving the quality of education and efforts to optimize learning should be supported by all elements and stakeholders involved in the learning process in schools. Teachers can participate in optimizing the chemistry learning outcomes by preparing quality teaching materials (Silaban, 2014).

In the process of teaching and learning activities cannot be separated from the importance of teaching material. Although teacher can explain the material with clear and complete, teaching material remain a priority and essential needs. Teaching material must be able to present the material in accordance with the demands of the curriculum, following the development of science and technology, and contains a predetermined competency (Jippes, et al, 2009). With the provision of quality teaching material is expected to create a student-centered learning. Student-centered learning has several advantages which can optimize instructional time in class that seemed relatively short and may be able to increase students' motivation (Cheang, 2009).

Teaching material as a source of learning is very important to get attention because it can equip, maintain and enrich learning, increase the activity and creativity of learners. Good teaching material, standard and innovative can improve student achievement because students are motivated to use the teaching material during inside of class and outside of class lessons for enrichment and self-regulated learning (Situmorang, 2013). Educational innovation is a plan or pattern that can be used to build the curriculum, designing teaching material and as a director of learning activities inside or outside the classroom. Innovation in education is often associated with the renewal that comes from creative thinking, findings and modifications which include ideas and methods used to solve educational problems (Riskin et al, 2006). Learning innovation using text books need to be done to increase student achievement so that the impression longer learning for the students (Tompkins et al, 2006). In learning innovation, learning objectives is a very important thing to be considered.

In the curriculum 2013, learning process is not only emphasizes on the aspect of knowledge, but also on aspects of skills and attitudes (Silaban, 2013). Efforts to develop students' learning attitudes often associated with character education. In accordance with the educational objectives set out in the LawNo. 20 Year 2003 about National Education System in Article 3 states that the purpose of education is formation character of students. The Government through the Ministry of National Education has tried as much as possible to implement character education to all levels of formal education from elementary to college. However, there was found a few cases of shifting morals and behavior of students: violence among students, fighting between students, cheating, ditching, lying, lack of respect and manners of students to parents and other that show formal education failed to form good characters students.

Development of standard teaching material through chemistry learning innovation by integrating character education is very urgent to be done in preparing good quality teaching material that can improve Indonesia's human resources which has good character. Good quality and standard of chemistry teaching material for senior high school will be able to help students in learning. In addition, the provision of an integrated character education in the teaching material on any sub topic that is appropriate in the chemistry teaching material can grow good character of students (Situmorang, 2013).

Maximum utilization of learning resources can explore science in full compliance in accordance with the level development of learners (Jippes, et al, 2010;. Bentley, et al, 2010). Good teaching material should always follow the development of technology, art and reality of life in an increasingly globalized society (Ho, et al, 2009) In a good textbook can effectively support the achievement of competence and meaningful to the student achievement, textbooks must meet the standards quality (Labov, 2006). Therefore, teaching materials as a resource for student learning must meet national standards that have been set by our government for secondary education (Simatupang, 2013).

From the survey result in chemistry textbook for senior high school / Islamic senior high school in several bookstores in North Sumatra province is known that in general chemistry book not follow the curriculum 2013 (Simatupang, 2013). The unavailability of a standard textbook in accordance with the demands of the curriculum 2013 are increasingly making it difficult for students to learn chemistry (Situmorang, M., 2013). Based on the results of analysis from several experts (teachers and lecturers) toward chemistry book publisher Tiga Serangkai, the results showed that this book has not been fully in accordance with the demands of curriculum 2013.

In the chemistry book entitled *Kimia Berbasis Eksperimen* publisher Tiga Serangkai on the topic electrolyte and non electrolyte solution there are still found some weaknesses, such as systematic and lack of utilization of instructional media to increase students' motivation. Utilization of instructional media must meet with the advancement of technology and development of times to maximize student learning outcomes because media can represent what is less capable said by teacher through words or certain phrases (Silaban, 2013).

2. METHODS

This research is Research and Development (R&D) model which is combination of research development and experimental. This type of research is research development model adapted from Borg and Gall. The research was done on September 2014 up to February 2015 in some senior high school in Medan.

This research was using 2 classes in each school. In the experimental class were taught by using innovative chemistry teaching material and for control classes were taught without using innovative chemistry teaching material. Instrument used in this research was questioner's sheets validation of expert team and cognitive test that was validated. The stages of this research consist of (1) analysis stage, (2) product development stage, (3) formative evaluation stage, (4) revision and (5) summative evaluation stage, as give in Figure-1.

Data of student learning outcomes through application of chemistry teaching material in studying electrolyte and non electrolyte solution for senior high school student grade X in the second semester. Pre-test was done before giving teaching treatment and post test was done after giving teaching treatment.

Analysis data of student learning outcomes was done by using normality testing through Kolmogorof-Smirnov Test using SPSS 20 at the significance level $\text{sig.} > \alpha$ (0,05) to know whether the data is normal distribution or come from equal population (homogenous) used homogeneity variance test

(Levene's test). Hypothesis testing was done through independent sample t-test with significant level $\alpha = 0,05$ by using SPSS 20.

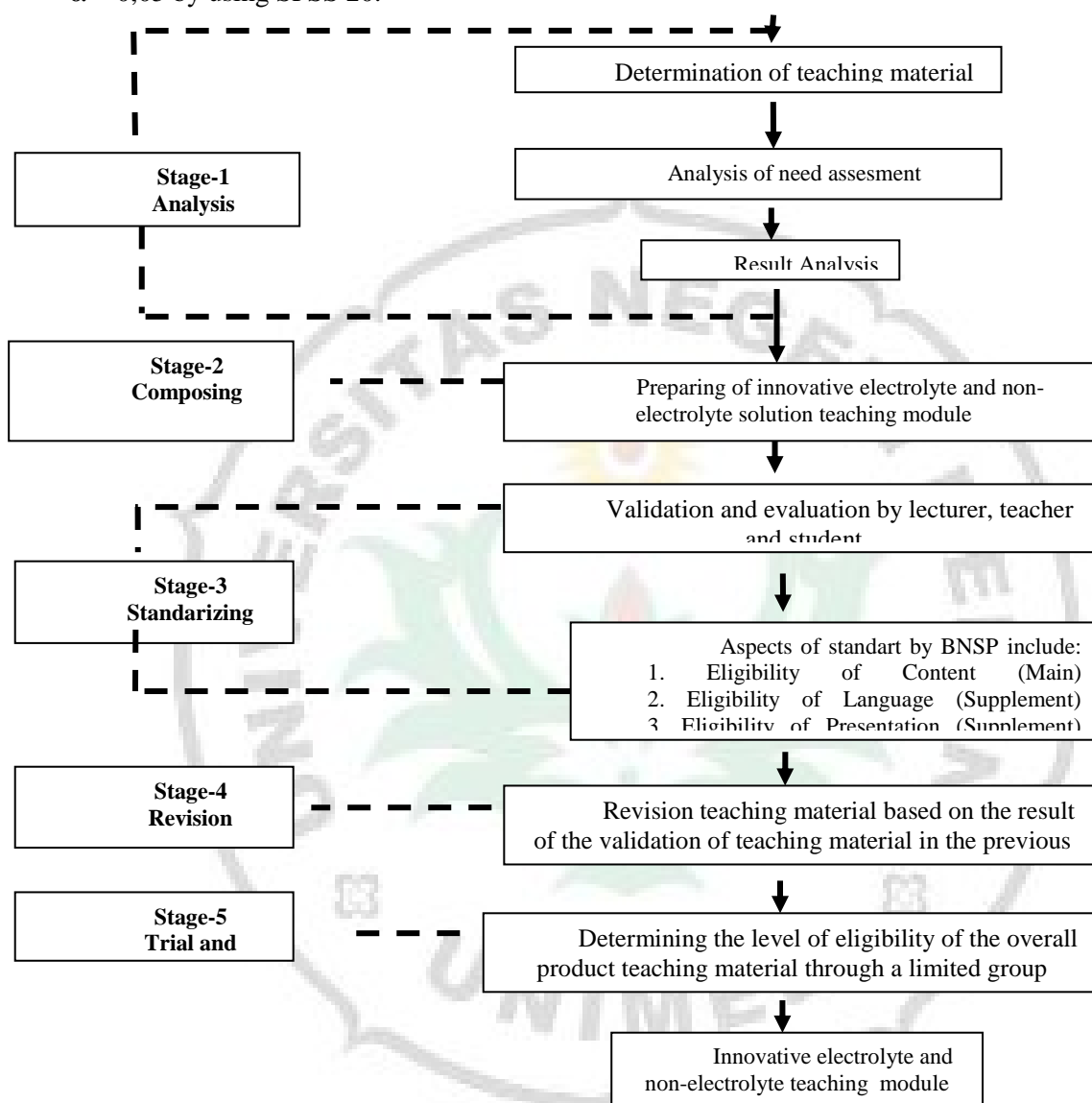


Figure-1. Flow diagram of reseacrh (modified from Borg & Gall method)

3. RESULT AND DISCUSSION

The Development of teaching material is adjusted with KI and KD for chemistry in senior high school grade X in the second semester. Chemistry teaching material which is developed contains material electrolyte and non electrolyte solution according K-13.

3.1. The innovative electrolyte and non electrolyte teaching module

Innovation that is done in the development of chemistry teaching material for senior high school grade X in the second semester is adjusted with the objective of learning that must be achieved. Development that is done generally followed with illustration of Figures, examples and tests that can help students to understand more about chemistry teaching material that is suitable with the basic competence.

Development of this chemistry teaching material is also followed with additional variation of practice test, integration laboratory experiment in the teaching material, integration activities outside of schools in the teaching material, arrangement of learning media, and also arrangement of test in the aspect (a) cognitive, (b) affective and (c) psychomotor.

The description about the development and innovation of the innovative chemistry teaching material of each subject is given in the following description. Development of chemistry teaching material electrolyte and non-electrolytes solution is done in n early all sub-topics. Innovations are:

1. Additional variation of practice test
2. Integration of laboratory experiment in the teaching material
3. Integration of activities outside of schools in the teaching material
4. Integration of character education
5. Arrangement of learning media
6. Arrangement of test in the aspect (a) cognitive, (b) affective and (c) psychomotor

Description detail about the development of teaching materials is:

a. Additional variation of practice test

Additional variation of practice test has the function to make easier for students to understand the chemistry material of electrolyte and non electrolyte solution and make deeper mastering about the material. Variation of practice test is given in the form: understanding test (page 7 and 18), competence test (page 18) that is equipped with a short guide that the make student easier to understanding chemistry material such as tips (page 7 and 15), treasury (page 7 and 15) and key words (page 2). Additional of practice test in the teaching material is expected can increase independent character and improve students to learn by themselves. Teaching material is also equipped by various applications of electrolyte and non-electrolyte solution in the daily life (page 19, 20, 21 and 22).

b. Integration of laboratory experiment in the teaching material

One of source learning that can be used as a center of learning is laboratory. Laboratory need to be preserved and managed, because it has role to support effectiveness and to optimize the learning process through organizing various functions that involved service function, supplying the function/development of learning media, research and development and function that is also relevant to increase of effectiveness and efficient of learning. Teaching material which is developed by writer consist of some experimental procedures that will help the student in the laboratory. Laboratory activities in the teaching material consist of two kinds namely activity (page 14) and experimental (page 9). Integration of laboratory experiments is expected will promote good character of students such as; independent, curiosity, honest, discipline, tolerance and collaboration with the other students. Laboratory experiments are also can promote fortitude character that is expected students can find the natural of scientific reality from an object in the nature and social life. With the present of laboratory experiments will promote curiosity of students as a model of scientific attitude of the candidate of scientists.

c. Integration of activities outside of schools in the teaching material

Study in the outside of school is one effort to create learning so the students will avoided from saturation, boring and learning perception that learning only in the classroom. So that, in the development of teaching material is integrated activities outside of schools. Each of the sub topic electrolyte and non-electrolyte solution is proposed different kind of activities outside of school that will be hold. Activities outside of the school that is given in the teaching material consist of observation assignment (page 23), project assessment (page 8), chemistry around us (page 24), and develop a spirit of entrepreneurship (page 23). For material chemistry of electrolyte and non electrolyte solution is a proposed student will visit public health center. Students are expected to know the composition of the chemistry material in the infusion and oralit. Many learning activities outside of school can be references for students to learn chemistry directly. Project assessment is presented in the teaching material consist of: (1) to design a simple experimental procedure to test about electrical conductivity of solution with using chemical materials and substances that is always used in the daily life and also try to make a poster for a scientific article (page 8), (2) try to make a battery from fruits (page 22), (3) try to make oralit by themselves as one way to increase and develop the spirit of entrepreneurship of students (page 23). Observation assessment that is presented in the teaching material related with electrolyte and non electrolyte material solution is visit public health center to know why the patient is observed need of infusion liquid, know the composition of the liquid infusion and oralit.

d. Integration of character education

The characters are integrated in the teaching material include honest character (pages 11 and 32), discipline, tolerance and cooperation (page 11), respect (page 4), independent (page 32). Integration of honest character, discipline, tolerance, cooperation, and independent in teaching

material is done through the provision of activities to students in the form of experiments. While the integration of character appreciated by providing the data on the chemical character that has been discover about acid and base theory. Hopefully with this character education can train students to be able to respect himself and other people.

e. Arrangement of learning media

The development of knowledge and technology will support various efforts to do innovation in utilizing the results of technology in the teaching and learning process. Teachers are expected to be able to use learning media that is presented by schools and also must be able to create their own learning media that is adjusted with the development and the demand of the era. Teachers at least can use simple and complex instruments of learning media that can achieve the objective of learning. In the teaching material that is developed is presented a web-based learning media such as blogs (page 22). In the blog address that is given in the teaching material, students can access and learn chemistry electrolyte and non-electrolyte material everywhere and every time.

f. Arrangement of test in the aspect (a) cognitive, (b) affective and (c) psychomotor

Test in the teaching material is developed based on three competences that must be achieved by students, namely cognitive (page 26), affective (page 33) and psychomotor (page 33). The targets of cognitive test is students be able to mastery competence three is understanding, applying and analyzing factual knowledge, conceptual, procedural, and meta-cognition based on their curiosity about knowledge, technology, art, culture, and humanities with the insight of humanity , nationality, politics, and culture related with the effect of phenomenon and occurrence, and also apply procedural knowledge in the specific field study suitable with the talent and interest to solve the problems. The targets of affective test is students can mastering the main competence one is understanding and applying religion ideology that is followed and the main competence two is understanding and applying attitude of honest, discipline, responsible, care (help one to each other, work with the other students , tolerance and peace), polite, responsive and pro-active and show the attitude also as a part from the solution from various problems in the effective interaction with the social and natural environment and also place it as a reflection of the nation in international relationships. The targets of psychomotor test is students can mastering the main competence four is processing, analyzing and presenting in the concrete and abstract areas related with the development of what is learned in the school independently, through affective and creative act, and also be able to use suitable method with the nature of science. With the present of tests in the form of cognitive, affective and psychomotor is expected that students can mastering all of the main competences.

Table 1. Description of innovative electrolyte and non-electrolyte teaching module

No	Sub Topic	Innovation and Component Development	Page in the teaching material
1	Definition of Electrolytes and Non electrolytes solution	- Additional keywords	2
		- Additional of critical thinking	3
2	Theory Acid-Base Arrhenius	- Integration of character appreciate	4
3	Ionization Reactions	- Additional comprehension test related ionization reaction on the strong electrolyte and weak electrolyte solution.	7
		- Additional tips and treasures	7
		- Project task	8

No	Sub Topic	Innovation and Component Development	Page in the teaching material
4	Difference Solution Based on the electrical conductivity	– Additional of comprehension test related differences of solution based on its conductivity.	9
		– Integration of laboratory experiments to test the electrical conductivity of solution	9
		– Integration of character education in the form of honest character, discipline, tolerance and cooperation	11
5	Strong and Weak Electrolytes	– Additional solve the problem	13
		– Integration of laboratory experiments	14
		– Additional tips and treasures	15
6	Electrolyte solution is based on the type of bond	– Additional of critical thinking	16
		– Additional of competency test	18
		– Additional related knowledge test electrolyte solution based on the type of bond	18
		– Additional of chemistry puzzle	19
7	Applications electrolyte solution in daily life.	– Additional application of electrolyte solution in everyday life	19, 20, 21, 22
		– Additional of critical thinking	21
		– Integration of web-based learning media in the form of blog	22
		– Additional observation tasks	23
		– Additional an entrepreneurial spirit	23
		– Additional of chemistry around us	24
8	Evaluation Chapter	– Additional test about cognitive aspect	26
		– Integration of honest and independent character	32
		– Additional test about affective aspect	33
		– Additional test about psychomotor aspects	33

3.2. Standardization

Good textbooks refer to government regulation number 19 year 2005. The Indonesian Government Regulation number 19 year 2005 on National Educational Standard are intended to ensure the quality of education and educational supervision in order to realize the quality of national education. The research instrument used to standardize teaching material was already a standard questionnaire and had been used by previous researchers that establish the eligibility of standardization of teaching material. This questionnaire was given to chemistry lecturers and chemistry teachers who are experienced in teaching chemistry and mastering chemical material.

Each sub topic was analyzed by giving feedback in the form of a check list with the order of assessment, namely: 1= strongly disagree, 2 = disagree, 3 = agree and 4 = strongly agree. Analysis eligibility standard for teaching material was carried out by the number of respondents were 5 people

consisting of 2 chemistry lecturers who has minimum educational background S2 as much as 2 people and chemistry teachers who has minimum educational background S1 as much as 3 people.

The average score based on the eligibility testing standard analysis of chemistry teaching material which is developed presented in the table 1. below

It can be concluded that the innovative chemistry teaching material grade X in the second semester has been arranged by the researcher is appropriate and in accordance with K-13 and also can be used as teaching material in teaching chemistry for senior high school grade X.

Chemistry teaching material initially standardized using the expert validator (chemistry lecturers and chemistry teachers in senior high school) so that it can be used as a standard teaching material in teaching and learning process. The quality of teaching material was obtained by respondent's response toward the draft of teaching material which is developed by asking the opinion of the respondents based on assessment criteria: very positive/very good (score 4) to the most weak/not good (score 1). Components are assessed include standard eligibility of content, eligibility of language, eligibility of presentation and eligibility of graphical.

Tabel 1. The average score of eligibility testing of teaching material

Analysis of Eligibility	Score
Eligibility of Content	3,78
Eligibility of Language	3,79
Eligibility of Presentation	3,78
Eligibility of Graphical	3,86

. The quality of a textbook is something that is very important in science learning. The result of average score obtained for each standard eligibility analysis submitted to the chemistry lecturers and chemistry teachers showed agreement in the range of score 3.20 to 4.00. It means that chemistry lecturers and chemistry teachers in senior high school were agree to chemistry teaching material which is proposed and unnecessary be revised back. To know how much increasing student learning outcomes were taught by using chemistry teaching material was carried out experimental research into school. Based on the results analysis from questionnaire data about standard eligibility of teaching material was obtained chemistry teaching material eligible and in accordance with K-13.

3.3. Description of Student Learning Outcomes

To determine the increasing of student learning outcomes were taught by using this chemistry teaching material was carried out a research toward students in senior high school grade X in the second semester. This research was conducted in senior high school Dharma Pancasila, senior high school Al-Washliyah 3, and senior high school UISU Medan. Research in each school involves two classes, which consists of one experimental class and one control class. Experimental class was taught by using innovative chemistry teaching material which is developed based K-13 and a control class was taught without using innovative chemistry teaching material. In each class was given pre-test aimed to determine students' prior knowledge, while post-test was given after students got teaching treatment. The data obtained are presented in Table 2.

Table 2. Data of Student Learning Outcomes in Chemistry for Experiment and Control Class

Class	Data Description	SHS Dharma Pancasila Medan	SHS Al-Washliyah 3 Medan	SHS UISU Medan
Experiment	Pre-test	29,19 ± 7,08	20,74 ± 9,06	31,67 ± 6,18
	Post-test	74,19 ± 6,47	65,00 ± 8,32	77,78 ± 11,91
	Gain	0,64 ± 0,09	0,55 ± 0,11	0,68 ± 0,16
Control	Pre-test	22,56 ± 11,17	19,07 ± 7,47	29,76 ± 6,61
	Post-test	62,31 ± 10,75	53,33 ± 11,18	68,81 ± 9,86
	Gain	0,49 ± 0,18	0,42 ± 0,15	0,55 ± 0,14

It can be concluded that the average pre-test score was lowest for control class is the class that is taught without using innovative chemistry teaching material at senior high school Al-Washliyah 3 Medan is 19,07, while the average score pre-test was highest for experimental class is the class that is taught using innovative chemistry teaching material in senior high school UISU Medan is 31.67. The average score post-test was lowest for the control class that is class taught without using innovative chemistry teaching material in senior high school Al-Washliyah 3 Medan is 53.33, while the average score post-test was highest in experimental class that is taught by using innovative chemistry teaching material in senior high school UISU Medan is 77.78.

To the chemistry teaching material was done standard testing for eligibility of teaching material consists of the eligibility content, the eligibility of language, the eligibility of presentation and the eligibility of graphical by using standard questionnaires distributed to chemistry lecturers and chemistry teachers as an expert validator.

From the result assessment of chemistry teaching material was obtain the average score of the standard eligibility of content number 3 is recency has the highest score is 4.00, the average score of standard eligibility language number 2 is communicative has the highest score is 3,92, the average score of standard eligibility of presentation number 2 is supporting presentation has the highest score is 3.93, and the average score of standard eligibility of graphical number 1 is the size of teaching material has the highest score is 4,00. The result assessment of chemistry teaching material can be seen in the figure 2 below.

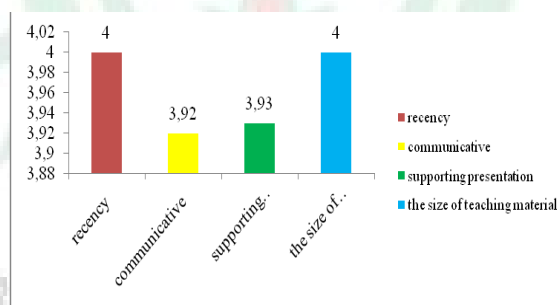


Figure 2. The result assessment of chemistry teaching material

From the results of the assessment above it can be concluded that the innovative chemistry teaching material grade X in the second semester has been arranged by the researcher is appropriate and in accordance with K-13 and also can be used as teaching material in teaching chemistry for senior high school grade X.

The average score of normalized gain was lowest for the control class is a class that taught without using innovative chemistry teaching material in senior high school Al-Washliyah 3 Medan is 0.42, while the average score normalized gain was highest for the experimental class is a class that taught using innovative chemistry teaching material in senior high school UISU Medan is 0.68. The average score of normalized gain is shown in the figure 3:

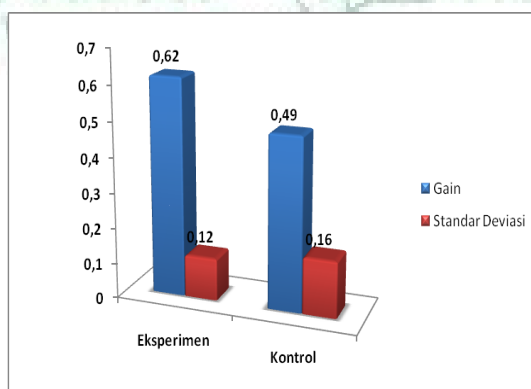


Figure 3. The average score gain from experiment and control class

The achievement of student learning outcomes in chemistry for each class is different, because the effect of the use or application of innovative chemistry teaching material in the classroom. The average score of the class that is taught without using innovative chemistry teaching material is lower than class that is taught using innovative chemistry teaching material. In the experimental class that is taught using innovative chemistry teaching material during teaching and learning process, students were demanded to have ability to analyze, work on the assignment provided by the teacher, then when students are exposed to a problem, they are very enthusiastic to solved it. While the control class that was taught without using innovative chemistry teaching material, students tends to be passive in the classroom, so that when students are faced with a question or a problem, only a small fraction could finish, i.e. students who basically have a good analysis.

4. CONCLUSION

- (a) The existing electrolyte and non electrolyte solution existing module had already meet standard but it is possible to develop.
- (b) We have obtain an innovative electrolyte and non electrolyte solution teaching module for senior high school grade X in the second semester. This module contain learning strategy which able to developing student learning outcomes and characters.
- (c) The innovative teaching module have fulfill standardized for national education standard bureau (BNSP).
- (d) Student learning outcomes which taught by this module give better than taught by existing textbook.

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