Chemistry Education

Research Report
TEACHING GRANT KBI FMIPA UNIMED

THE DEVELOPMENT OF CHEMISTRY LEARNING MODULE FOR RSBI SENIOR HIGH SCHOOL STUDENTS

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RESEARCH SUMMARY

THE DEVELOPMENT OF CHEMISTRY LEARNING MODULE FOR RSBI SENIOR HIGH SCHOOL STUDENTS

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The development of chemistry learning module for Rintisan Sekolah Berstandar Internasional (RSBI) Senior High School Students (SHS) is explained. The study is aimed to develop and standardize teaching module to be used as a learning media to increase the student's achievement in teaching of chemistry subjects. The research was carried out with the combination of research development and experiment. Research development is conducted to develop and standardize chemistry learning modules based on competence based curriculum (KTSP), where the experiment is done by teaching SHS students using of a sets of chemistry learning modules compare with conventional teaching with exited textbook that have been used in the target schools. The population of this research were SHS of three RSBI schools at Medan, Tebing Tinggi, and Brastagi. The sample is selected by using purposive sampling to choose two classes in every school where one is treated as experimental class and another is as a control class. The selected samples in every class were grouped based on their achievement on chemistry in the first semester to make them in to two categories, the relative high achievement (HA) and relative low achievement (LA). Experimental class is tough by using chemistry learning modules while the control class is tough by using exited textbook. The data were collected by using sets of multiple tests covering all chemistry subjects being taught. The student's achievement is obtained from their ability to answer the question before teaching (pretest), soon after learning process have been conducted (postest-1), and one month after learning process have been conducted (postest-2).

The results showed that the chemistry learning modules have been developed based on KTSP curriculum. The chemistry developed learning modules have been standarized and the performance of the developed chemistry learning modules are categorized to good- very good. The performance of developed chemistry learning modules successively for on the topic of Solubility and Solubility Product (Module 1) is categorized as very good (average 3.59), Hydrocarbons (Module 2) is categorized as very good (average 3.64), Thermochemistry is categorized as very good (average 3.48), and Oxidation and Reduction Reactions are categorized as very good (average 3.49).

The developed chemistry learning modules have been used as learning media in the teaching of chemistry subjects. The results obtained from pretest showed that the classes (experimental and control class) are relatively equal that make them suitable for teaching treatments activities. The chemistry learning modules have been used as teaching media in the teaching of chemistry subjects, and their affectivities to increase students achievements are also measured. It is known that the developed chemistry learning modules are very effective to increase student's achievement on chemistry subjects, where the students achievement on chemistry by using innovated teaching modules are higher than that by using existing text book, and the two method are significantly different. There is a positive correlation (r^2=0.862) between the students achievements with student's motivation on studying chemistry when using developed

chemistry leaning modules on the teaching of Solubility and Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions, while in the control class where for the teaching and learning with existing chemistry textbook the correlation is found very low (r^2=0.258). It is suggested to use developed chemistry leaning modules as a teaching and learning media on teaching of chemistry subjects because sets of modules be able to motivate the RSBI students to study chemistry independently by themselves and as results will increase their achievements in chemistry subjects.

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The development of chemistry learning module is very interesting to discuss as it is believed that sets of suitable teaching materials could motivate students to study and will increase the student's achievement in chemistry. The study on the development of chemistry learning module for has been carried out to obtain a standard teaching and learning modules in teaching chemistry to be used in Rintisan Sekolah Berstandar Internasional (RSBI) Senior High School Students (SHS). The developed chemistry learning modules has been used as teaching and learning media increase student's achievement in the teaching of selected chemistry subjects.

The chemistry learning modules have been developed and standaridized on selected chemistry topics. Packages of chemistry modules are simple, interesting, easy to read and could help student to learn independently. The Chemistry learning module consists of basic competence, standard competence, chemistry materials on the subject of Solubility and Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions. Every chemistry modules are equipped with problem examples and the strategy to solve chemistry problems, excercises, evaluations and key answer related to chemistry topics. The results have proved that developed chemistry learning modules can be used to improve student's achievement in chemistry.

I wish to take the opportunity to give thanks to God for His grace that given the knowledge and health to research team to complete the progam on time. I also express my thanks to Indonesian Government through Directorate General of Higher Education for financial support to conduct the study under Teaching Grant Hibah PPG MIPA Bertaraf Internasional. Special thank is given to the coordinator of International and Bilingual Program FMIPA UNIMED for nominating the research team to conduct the studies. I owe my thanks to my research group who hve been working hard and help the research team optimally in various ways. Finally, I wish to thank Chemistry teachers and the Head of Schools in some RSBI Senior High Schools at medan, Tebing Tinggi and Brastagi for their services to the research teams to do the research in their schools.

I hope the results on the development of chemistry learning module could be used as suitable and standard material in the teaching and learning process in Senior High School Students Rintisan Sekolah Berstandar Internasional. Any suggestions raised to the authors are accepted to make the research better. It is also suggested to the schools to motivate the teacher to do development of learning module to make the students interested in learning chemistry.

Medan, 9 December 2012

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CHAPTER I

INTRODUCTION

1.1. Background

The development of human resources become a key role in the development of country, and tha could be meed through education. The human resources in Indonesia has to be improved in order they could meet the requirement in a competition in global era. The Governments try their best to improve the quality of education, which is start form elementary school to the university. The development in education sector for midle shools has been conducted with the existence of Bilingual class as *Rintisan Sekolah Berstandar Internasional* (RSBI) or *Sekolah Berstandar Internasional* (SBI). Most of the RSBI and SBI schools in Indonesia are using bilingual teaching, where the teachings are conducted in Indonesian language and English for subject matter of Mathematics, Chemistry, Biology, and Physics. However, most of the schools are still using text book that are published in Indonesian languages. Therefore, it need to develop the learning materials to meet the competence for students who study in RSBI or SBI schools. This is the reason to do the research in providing the learning materials for Senior High School (SHS) in RSBI and SBI schools. The development of chemistry learning module for RSBI Senior High School is conducted through innovation.

Innovation in teaching and learning activities is very interesting to discuss, as it is believed that implementation of the right teaching method would increase student's achievement in learning chemistry. Learning module is very important to be used in helping students in the teaching and learning process. Therefore, innovation on chemistry learning module has to be made to obtain a good and effective media to be used in studying chemistry (Blom-Zandstra and Van Keulen, 2008). A good chemistry teaching module could help the students to understand the concept of chemistry clearly (Bain, et.all. 2005). It is very important to use teaching and learning module in the teaching of chemistry subjects. The chemistry subjects that are developed are mainly categorized as a difficult subject to be thought to students. Chemistry topic is dealing with investigation and calculation, where to understand chemistry concept the students need the knowledge as the combine of theory, practice and illustration. It is compulsory to use innovated teaching module in addition to conventional method to improve the student's achievement on chemistry.

The facts have been proven that many students of senior high school consider that chemistry is a difficult subject so that they have feeling to face problem in learning the subject. This case may be caused by the presentation of the topics by the teacher is less interesting, and the teaching method is also conducted in a boring manner. Therefore, the students face the difficulty to understand the basic concepts of the Chemistry (Situmorang, *et.all.*, 2006).

Improving the quality of education should always be performed continuously conventionally or through innovation. Improving the quality of education carried out by setting goals and standards of educational competence in order to anticipate future changes and demands that will face students as citizens of a nation, so they are able to think globally but act locally. One effort to improve the quality of education is through the provision of quality textbooks (William, 2002). Text book or teaching module is one book that contains descriptions of educational materials about the subjects, compiled systematically and have been selected based on specific objectives, learning orientation, and development of students. With textbooks, learning programs can be implemented in a more regularly, cause teachers as implementers of education will get clear guidance material.

Module is a teaching material that contains a complete unit of learning subject, that is arranged independently with another subject, and the materials are arranged sistematically in order could be used to help students in reaching the objectives that has formulated specifically and clearly. The learning module is prepared more coplete and consisted of concept and theory, illustration, drills, problems and answers. The learning module has to be able to help students to study by their style independently, so they use different technique to solve certain problems based on their knowledge background and their ability (Situmorang, dkk., 2011). The module is designed as interesting materials that could be used as a learning media to guide the students to learn with or without the help of a teacher.

To improve the basic concept for students to learn could be conducted through providing a good teaching materials such as text books and modules related to the students development (Situmorang and Saragih, 2012). The purposes of the research are to develop chemistry learning module to be used as learning materials for RSBI Senior High School Students in order the student could achieve the highest communication on the teaching and learning process.

1.2. Identification of Research Problems

To make the research is focused, therefore, the identification of the research problems is set as follows:

(1) How to develop a standard chemistry learning modules that could be used as a learning media on the teaching of chemistry in RSBI senior high school?.

(2) How effective is the developed learning modules to increase the student's achievement on solving problems dealing with related chemistry subject compared with conventional teaching method?.

(3) Can the developed modules be used as chemistry teaching and learning media on the teaching of chemistry in order to obtain the intensive communication on the teaching and learning process to meet the students achievement in chemistry?.

(4) Are there any relationship between the developed chemistry modules with student's motivation on studying chemistry on the teaching of SHS chemistry topics?.

1.3. Research Objectives

The research objective is to develop chemistry learning modules of (1) Solubility and Solubility Product, (2) Hydrocarbon, (3) Thermochemistry, and (4) Oxidation and Reduction Reactions to be used as learning materials for RSBI Senior High School Students. Specific objectives of the study were:

(1) To develop good and standard chemistry learning modules to be used as a learning media on the teaching of chemistry in RSBI senior high school.

(2) To investigate the affectivity of developed learning modules by looking the student's achievement on solving problems dealing with related chemistry subject after using innovated learning module compared with conventional teaching method.

(3) To obtain the best and suitable chemistry teaching and learning media with developed modules on the teaching of chemistry in order to obtain the highest communication on the teaching and learning process to meet the students achievement in chemistry.

(4) To determine the relationship between the developed chemistry modules with student's motivation on studying chemistry on the teaching of SHS chemistry topics of Solubility and Solubility Product, Hydrocarbon, Thermochemistry, and Oxidation and Reduction Reactions.

CHAPTER II

DEVELOPMENT CONCEPT AND LITERATURE STUDY

2.1. Text Book as Teaching Media

Textbook as a learning resource that is very important in learning, although in the education has been recognized that the real source of learning and there are a lot everywhere. Learning resources can be human, books (library), the mass media, natural environment, and educational media (Chambliss, 2001; Chavkin, 1997; Parmar and Cawley, 1993). Learning resource is anything that can be used by learners as a place of teaching in order to provide ease of to someone in their learning or facilitate the process of teaching and learning (Rudzitis, 2003). Textbook is one of learning resources used in teaching and learning, and until now the book still plays an important role (Carter and Mayer, 1988). The book is an instructional media are dominant role in the classroom. Learning resource consists of two kinds, such as: (1) Source of learning that is designed or used to help the teaching and learning (learning resources, by design): books, brochures, encyclopedias, films, videos, tapes, slides, film strips, overhead, (2) source of learning which are utilized in order to provide ease of to someone in the learning of all kinds of learning resources that exist around them. Learning resources are not designed for the benefit of the purpose of an activity called teaching (learning resources by utilization): the market. Shops, museums, community leaders, park. Learning resources can be viewed as a unitary system in which there are components that are interconnected and affect one another (Chiang-Soong and Yager, 1993). Efficiency of the book as a learning resource for learning has a very importance, in addition to complement, preserved and enriched, learning resources can also improve the activity and creativity of students that are very beneficial to both teachers and students.

Textbook could be used to help the students to solve the problem of education, and at the same time it provides positive information that lead the students to think, behave, and development (Chambliss, 2001). Textbook is useful to develop insights in the learning process to be taken, provide teaching materials that learned and operational steps to navigate in rigorous standard materials completely (Good, *et.al.*, 2010). Textbook is very important in teaching and learning because it can strengthen and support the information material presented by the teacher in learning to grow,

easy to remember and can be repeated for that information to grow and develop, and achieve the desired competencies. Textbook is a central role in empowering students because books can be a source of information and can attract the student's interest, and intent to control information with high motivation. Textbook serves as a guide student learning activities, incorporating information difficulty level in gradually, including practice questions and solving problems related. The textbook can satisfy demands of the curriculum the curriculum's implementation, even exceeding that can used as a discourse to exercise the power of reason and the formation of student attitudes in the face of a relatively fast changing world (Holliday, 2002).

The regulation of Minister National Education No. 11 Year 2005 explains that the textbook is a mandatory reference book for use in schools that includes learning materials in order to increase faith and piety, manners and personality, the skills of science and technology mastery, sensitivity and ability aesthetic, potential and physical health are compiled based on national education standards. Good book must contain the vision, mission, context, content, and the process itself of any information presented so as to make students motivated to learn (Martono, 2005). A quality book serves as an effective learning media to achieve objectives and deliver students to the destination of competence. Any textbook can have advantages and disadvantages so it can not satisfy readers. Presentation of information in a textbook is expected to comply as many aspects of teaching and learning activities students can do by themselves (Tompkins, et al., 2006).

Textbook can be a very meaningful learning media, if the textbook is used as a communication tool to bring accurate information from learning resources to learners. Media is a tool that is used as a communication tool in the learning process so the information is complete and fully can be accepted by learners so that learning activities can occur with optimum and efficient (Silitonga and Situmorang, 2009). Some of the excess use of books as a medium of learning, including (1) It can present the message or information in large quantities, (2) the message or information can be studied according to student needs, interests, and the speed of each, (3) Can learn anytime and anywhere because of portability, (4) would be more interesting if completed with color and images, and (5) improvements / revisions easy. While the weakness of the textbook as the medium of printed materials are: (1) Manufacturing process takes a long time, (2) a thick print material may be tedious and off the

interest the students to read, and (3) if the paper was torn, printing materials be easily damaged and torn.

2.2. Learning Module in Teaching Activities

Learning module in teaching activities can refer to a unit of time, approximately 20 minutes or at a teaching package that includes guidelines for teachers and learning materials for students. In the latter sense, the module is a unit of teaching and learning programs is the smallest, being studied by the students themselves individually or be taught by the student to himself; after students complete one unit, he stepped forward and study the next unit. Thus, teaching the use of modules is a specific strategy in implementing individualized instruction in a rather comprehensive. Teaching module, as developed in Indonesia, is a package of teaching materials which contain a description of objective typical lesson, teachers guide sheet that describes an efficient way of teaching, reading materials for students, key to the answer sheet on the working papers of students, learning evaluation tools.

Each module is a smallest unit of teaching and learning program that outlines in detail the general instructional objectives which are supported, specific instructional objectives to be achieved, the unit learned discussion, the role of teachers, tools and resources used, learning activities undertaken by students in a sequence and the tasks that had to do, how well organized the evaluation instrument, how students get feedback. Thus, targeted to achieve educational goals efficiently and effectively, the students can follow the teaching programs in accordance with the rate of progress / pace myself and can appreciate the learning activities, either by getting tutoring from teachers and without have it. Form of individual teaching is used, rather than teaching given to students as individuals, but teaching that involves every student in the class with a maximum of creating external conditions are optimal for each student and serve the principle of continuous progress in the study (Winkel, 1996).

2.2.1. Elements of Learning Module

Learning module is set as a learning package that contains one unit of a single concept and it is suggested that learning module includes a set of activities that aim to facilitate students achieving a set of learning objectives. The elements of a learning module are (a) module is a set of learning experiences that stand alone, (b)

module is intended to facilitate students achieve a predetermined set of goals, (c) modules are units that relate to one another hierarchically. As of teaching materials, modules have certain characteristics that distinguish it from other teaching materials. According to Russell (1974) characteristics of the module include: (a) self contain, (b) rely on individual differences, (c) of association, (d) use a variety of media, (e) active participation of students, (f) immediate reinforcement, and (g) control strategy evaluation. Similarly, the module has certain components as one of the characteristics of individual learning. The components of the module consist of: (a) rational, (b) purpose, (c) test inputs, (d) learning activities, (e) self-tests, and (f) final test.

The module is the smallest unit of teaching and learning program, which outlines details: (a) instructional goals to be achieved, (b) topic that will be used as the base of the learning process, (c) subjects to be studied, (d) position and function modules in the unity of the broader program, (e) the role of teachers in teaching and learning, (f) tools and learning resources are used, (g) learning activities should be done and the students lived in a sequence, (h) work sheet to be filled by students, (i) evaluation program to be implemented. It can be concluded that the module is one form of print media that contains a learning unit, equipped with various components to enable students who use it to achieve goals independently, with the least possible assistance from the teacher, they can control evaluate their own abilities, which in turn can determine where to start learning to do next. The modules as an instructional package that is self-instruction, recognition of individual differences in learning, makes the formulation of learning objectives explicitly, an association, structure, and sequence of knowledge, use a variety of media, active participation of students, the direct reinforcement of student response, the evaluation of students' mastery or learning outcomes.

2.2.2. Learning Module in Teaching and Learning Process

Learning with module systems are characterized as follows: (a) each module should provide information and give clear guidelines on what should be done by a learner, how to do it, and learn what resources should be used, (b) an individual learning module, so the effort to involve as much as possible the characteristics of learners, (c) learning experiences in the module are provided to help learners achieve the learning objectives as effectively and efficiently as possible, and enable learners to make learning active, (d) learning material is presented in a logical and systematic,

so that learners can tell when he started and when to end a module, and does not raise questions about what to do or learn, (e) each module has a mechanism to measure the achievement of learners' learning objectives, mainly to provide feedback for students in achieving mastery learning.

There are 12 elements in the module are: (a) topic statement, a sentence that includes the issues that will be taught, (b) rational, a brief statement that expresses the rational and the usefulness of such material to students, (c) concept statement and prerequisite, namely the statement that defines the scope and sequence of the other concepts in key areas, (d) concept, namely abstraction or main idea of the subject matter contained in the module, (e) behavioral objectives, namely a statement of what skills students should master, (f) pretest, the test to measure initial skills students have before attending class, (g) teacher suggest techniques, namely the instructions to teachers about what methods are applied in assisting students, (h) suggest student activities, activities that must be done to achieve student learning goals, (i) multimedia resources, which indicate the source and a wide selection of material that can be used when working on modules, (j) post test and evaluation, the teachers implement the conditions and criteria for assessment of student performance, (k) remediation plans, namely to help students who are weak in reaching certain criteria, (l) general reassessment of potential, which refers to the need for continuous assessment of the elements of the module.

The elements of the module consisted of: (1) teacher guide as an instructions in the teachers for learning process to guide the various activities that must be implemented by the class, the time provided for that module, learning tool should be used, and the evaluation, (2) Student activity sheets, which contain subject matter that must be mastered by students, (3) work sheets, sheets that are used for tasks to be done, (4) Key work sheet, which answers to the tasks, so that students can match their own work in order to evaluate the results of his work, (5). Sheet test, the evaluation tool used to measure whether objectives have been achieved formulated in the module, and (6) key test sheet, a correction of the assessment tool. The components of the module which is used as an independent learning program are as follows: (1) guidelines for teachers, (2) student activity sheet, (3) worksheets, (4) key work sheets, (5) test sheets, and (6) key test sheet.

The advantages of learning with the system modules can be stated as follows: (1) focusing on the ability of individual students, because they basically have the ability to work independently and more responsible for their actions, (2) the existence of control over learning outcomes through the use of competency standards in each module that must be achieved by learners, (3) the relevance of the curriculum is shown with the goals and how achievement, so that learners can find out the relationship between learning and results will be obtained, (4) preparation of a good module requires specific expertise. Success or failure of a module depends on the constituent, (5) difficult to define the process scheduling and graduation, and require very different educational management from conventional learning, because each student completed the module in a different time, depending on the speed and capabilities of each, (6) learning support in the form of learning resources, in general quite expensive, because each must find their own learners.

2.3. Competence Based Curriculum in High School

Curriculum in senior high school (SHS) is composed of operational curriculum, developed, and implemented by each unit of education with high school is an Education Unit Level Curriculum (SBC) as a development from a Competence Based Curriculum, that is the curriculum with respect to standards of competence and basic competencies developed by the National Education Standards Agency (BSNP). In National Education Standards (SNPs Article 1, paragraph 15) stated that the Education Unit Level Curriculum is the operational curriculum developed and implemented by each educational unit. Preparation of CBC conducted by educational units with respect to and in accordance with standards of competence and basic competencies developed by the National Education Standards Agency (BSNP). SBC conceived and developed based on Law Number 20 of 2003 on National Education System of article 36 paragraph 1 and 2 as follows: (1) curriculum development follows the national standard of education to achieve national education goals, (2) the curriculum at all levels and types of education developed by the principle of diversification in accordance with educational unit, the potential of the region, and learners.

Some things that need to be understood in relation to the curriculum unit level of education are as follows: (1) SBC in accordance with each educational unit, the potential and regional characteristics, and social culture of local communities and

learners, (2) schools and school committees to develop curriculum and educational unit level syllabus basic framework based on curriculum and competency standards, under the supervision of the education service district, and religion departments responsible for education, (3) unit level education curriculum for each program of study in college developed and specified by each university according to the National Education Standards.

SBC is a curriculum development strategy to achieve effective school, productive, and achieve. SBC is a new paradigm of curriculum development, a wide autonomy in each unit of education, community education and involvement in order to streamline the process of teaching and learning in schools. Autonomy is given for each unit of education and the school has particularly to process flexibility in resources, financial resources, learning resources and allocate them according to priority needs, as well as more responsive to local needs.

SBC is an idea about developing a curriculum that is put in the position closest to the learning, the school and education units. Empowering schools and education by providing greater autonomy, in addition to showing the attitude of the government response to the guidance of the community are also a means of improving quality, efficient, and equity of education. SBC is one form of education reform that gives autonomy to schools and education units to develop curriculum in accordance with the potential, guidance, and individual needs. Autonomy in curriculum development and learning is a potential for schools to improve teacher performance and school staff, offering direct participation of relevant groups, and raise public awareness of education, especially curriculum. In the SBC system, the school has "full authority and responsibility" in setting the curriculum and learning in accordance with the vision, mission and objectives, the school is required to develop strategies, set priorities, control empowerment of various potential in school and the environment, as well as answer to the public and government.

In SBC, curriculum development can under taken by teachers, principals, and School Committee and Board of Education. The agency determined is institution based on consensus from local officials, education committee at regional parliaments (DPRD), local education officials, head teachers, education workers, representatives of parents of students, and community leaders. These institutions set the school's policy under the provisions of the applicable education. Furthermore, the school

committee needs to set a vision, mission and objectives of schools with different implications for programs of operational activities to achieve school goals.

In general purpose implementation of SBC is fatherly freedom and empowering education units through the granting authority (autonomy) to educational institutions and encourages schools to conduct participatory decision making in curriculum development. In particular purpose of the application of SBC is to: (1) improving the quality of education through freedom and school initiatives in developing the curriculum, manage and empower the resources available, (2) increasing awareness of citizens and communities in development school curriculum through the return of joint decision, (3) increasing the competition is healthy between the educational that will be achieved. The characteristics of SBC are as follows: (a) SBC gives freedom to each school to conduct educational programs in accordance with the school environment, the ability of learners, available resources and local distinctiveness, (b) parents and community can be involved actively in the learning process, (c) teachers should be independent and creative, (d) teachers are given the freedom to utilize various methods of learning.

2.4. Teaching Method in Chemistry

Teaching methods are means by which the teacher attempts to bring about the desired learning. Basically, method in teaching concerns the way teachers organize and use techniques of teaching, subject matter, teaching tools, and teaching materials to meet teaching objectives. It consists of formulating the goals and objectives for teaching, selecting the subject matter and the teaching procedures that will best achieve those objectives, carrying out the procedures, evaluating the success of the learning activities and following up their successes and failures. Because teaching method includes selecting content and instructional materials as well as teaching procedures, it determines to a large extent what pupils actually teach (Clark, 1967). Application of teaching method is complicated with equipment of learning–teaching, increase motivation of studying.

Teaching is exciting, rewarding work, but, like all other professions, it is demanding. It requires that is practitioners clearly understand what should be done to bring about the most desirable learning in pupils and be highly proficient in the skills necessary to carry out these tasks (Saragih and Situmorang, 2006). These skills and understanding make up teaching method which includes a sound knowledge of the

strategies and techniques available, the ability to select and use subject matter, familiarity with the nature of the learner and an understanding of learning theory and its application (Lockman, *et.all.*, 2008; Clark, 1967). Teaching is a composition of activities to convey subject matter to students that can receive response, manage, and develop subject matter. A process of interaction, the teachers does something valuable to students and the students do something in return as positive responses. From their definition, so teaching is a way and process which has related one another between the teachers and students and both of them are active to do activities. Teaching is also defined as any action performed by an individual (the teacher) with the intention of facilitating learning in another individual of the learner. Another definition, it is said that teaching is an activity to organize environment as well as and related with students so that created studying process. Biggs divided the meaning of teaching in three, they are: (1) Quantitative view, the teaching is meant as the transmission of knowledge. In this case, teacher only rules her subject matter and best convey to the students. About success or failure of the students is not teacher's responsible. (2) Intuitionally, teaching is the efficient orchestration of teaching skills. In this case, teacher is demand always ready to adapt some techniques of teaching to the students which have kinds of studying type's also different talent, ability, and need. (3) Qualitatively, teaching is meant as the facilitation of learning, which is effort to make easy studying activities of students to reach understanding themselves. Based on definitions above so can conclude that teaching method is a ways to do activities which composed from an environment consists of the teachers and students so created interaction in activities and then learning-teaching process is done best, purpose of learning is reached.

The conventional method in teaching is known as a lecture is one of the oldest and most basic pedagogic tools given by philosophy of idealism. As used in education, the lecture method refers to the teaching procedure involved in clarification or explanation of the students of some major idea. The teacher is more active and students are passive but teacher also uses question answer to keep them attentive in the class. Although experience and educational research show that the lecture is less effective than activity methods at school level, many teachers find themselves spending at least 30 to 50 per cent of their teaching time in lecturing (Mohan, 2002). Carter Good's dictionary defines lecture method as an instructional

procedure by which the lecture seeks to create interest, to influence, stimulate, or mould opinion, to promote activity, to impart information, or to develop critical thinking, largely by the use of the verbal message, with a minimum of class participation; illustrations; maps, charts, or other visual aids may be employed to supplement the oral techniques. It is suggested that the lecture method serves four basic purposes: to motivate, to clarify, to review, and to expand (Mohan, 2002). In brief, a lecture method is a way to convey an information and verbal message to the students to conquer limited of literature which according to ability to buy it and student's understanding.

The advantages of the conventional method in teaching could be identified as follows: (1) the lecture method is the most economical way of getting a large amount of information across to a large class, (2) A teacher can convey the information in minimum time, thus enabling the syllabus to be covered within stipulated time, (3) It is economical in terms of both money and time; (4) The lecture is useful in imparting factual information in efficient manner to convey facts to the students who have difficulty reading their texts; (5) The lecture helps to channels the thinking of the students in a given direction; some abstract topics in science are best taught by the lecture method, (6) The teacher, through tact, style and presentation can get the message been transferred effectively.

The weakness of the conventional method in teaching could be identified as follows: (1) the method is apt to be misused. The 'pouring in' of information is psychological unsound unless it can be done in a meaningful way, (2) Science is best learnt by doing. There is no provision for activities in this method as the students are passive (listeners), (3) The rate of imparting information by teacher may seem too fast for the students who are restless by nature, preoccupied with their own immediate problems and often handicapped by limitations of vocabulary and background of experience, (4) A poorly planned, poorly delivered lecture fails to motivate the students, (5) The lecture method is not very successful in imparting attitudes and skills, as it does not touch the affective and psychomotor faculties of the learner, (6) As student interaction is minimum, social attitudes and values may not be fostered, and (7) The lecture method cannot cater to individual grasping capacities of the students (Sagotsky, *et.all.*, 2008).

Considering the strengths and the weakness of the conventional method in teaching, most of the teaching activities in chemistry are being conducted in the lecture format. The flexibility of the teaching method for various conditions made the method suited to be combined with various teaching methods for teaching chemistry topics, including the laboratory experiment and the demonstration method. Therefore, the innovated teaching methods discussed in this study are always in combination with lecture method or conventional method.

2.5. Chemistry Topics for Module Development

The development of chemistry module for RSBI and SBI schools in this study is conducted followed by the success in the development of module in the previous tudy for Chemical Kinetiocs and Conentration (Situmorang, *et.all.*, 2011). The chemistry topics to develop to become learning module are: (1) Oxidation and Reduction Reactions, (2) Solubility and Solubility Product, (3) Thermochemistry, and (4) Hydrocarbon. All these topics are developed independently in different class and treated equally in RSBI schools. The short description of the chemistry topics to be developed are explained in the following discussion.

2.5.1. Oxidation and Reduction Reactions

Oxidation and reduction reactions also known as redox reaction takes place around us; consider the rusting of irons and the reactions in batteries that produce electricity. The concept of redox reaction was first developed in the 18^{th} century. The first concept was based on oxidation reactions]that involve a gain of oxygen and reduction reactions that involve a gain of oxygen and reduction reactions that involve a loss of oxygen. In early 20^{th} century, scientist noticed a basic characteristic of the oxidation and reduction reactions in terms of their chemical bonding, that is, a transfer electron. Such a transfer indicates that oxidation and reduction reactions take place simultaneously. Hence, they are called oxidation-reduction reactions or simply redox reaction. The module explains the topic on redox reaction concept which covers the subjects: (1) Development of Redox concept; (2) Autoredox Reaction (Disproportionation Reaction); (3) Nomenclature system of compounds according to Oxidation Number; (4) Application of Redox Reactions in Daily Life.

2.5.2. Solubility and Solubility Product

When a substance in the form of solid electrolyte is dissolved in water, it will dissociate into ions. The ions will collide and reform the solid phase. The condition at which the rate of electrolytes to dissociate and form ions is the same as the rate of the collisions of the ions to form the solid again is called dynamic equilibrium or ionic equilibrium. At the ionic equilibrium, the concentrations of ions from solid electrolyte no longer change with time. The solution is said to be saturated. The concentration of the substance in a saturated solution is called the solubility. Solubility is defined as a measure of one substance's ability to dissolve in a specific amount of solvent at standard temperature and pressure. As an example, a mixture of sugar and water forms solution, which is a mixture of solute and solvent. Solute is substance dissolved in a specific amount of solvent; usually the amount of the solute is less than that of solvent. Solvent is substance used to dissolve solute, commonly the amount of the solvent is more than that solute. Therefore, in this case, sugar is the solute while water is solvent.

2.5.3. Thermochemistry

Thermochemistry is a branch in chemistry that studies the heat of reaction involved in a chemical reaction. As the heat of reaction is a form of energy and most chemical reactions take place under constant pressure, the heat of reaction is better known as ***enthalpy change*** (ΔH). The law of Conservation of Energy states that: "Energy cannot be created or destroyed, it can only be changed from one form to another". The value of Energy (E) cannot be measured. This, However, is not a problem as we are only interested in energy change, ΔE, where the amount does not depend on the process it undergoes but on the initial and final states only. $\Delta E = E_{final} - E_{initial}$. Change of energy in a system may occur in two ways, (1) If the system absorbs or releases heat, and (2) If the system performs work or receives work. If heat is symbolized as q and work as w, then : $\Delta E = q + w$. The value of q and w can be positive or negative. Taking the analogy of the gain (+) and loss (-) principle. If the system releases heat or perform work, then the system experiences loss as it releases energy. Thus, ***the values of q and w are negative (-).*** If the system absorbs heat or receives work, then the system experiences gain as it obtains energy. Thus, ***the values of q and w are positive (+).*** In describing energy change (ΔE) accompanying chemical reactions, several definition that are used are: System is part

of the universe where energy change takes place, Surrounding is everything in the universe that is outside the system, and Boundary separates the system and the surrounding. A system can be distinguished into:

(a) An open system, which allow matter and energy to cross the boundary. For example: Matter and energy (heat) are allowed to cross from the system / hot coffee to the surrounding.

(b) A closed system, which allow energy but not matter to cross the boundary. For example : only energy (heat) is allowed to cross the wall of the bottle and can.

(c) An insulated/ adiabatic system, which does not allow energy to cross the boundary. For example: energy is not allowed to cross the wall of the thermos.

(d) An isolated system. Which does not allow matter or energy to cross the boundary. For example neither energy or matter is allowed to cross the Styrofoam.

2.5.4. Hydrocarbon

Hydrocarbons are simplest organic compounds. Containing only carbon and hydrogen, they can be straight-chain, branched chain, or cyclic molecules. Carbon tends to form four bonds in a tetrahedral geometry. Hydrocarbon derivatives are formed when there is a substitution of functional group at one or more of these positions. The classifications for hydrocarbons defined by IUPAC nomenclature of organic chemistry are as follows: (1) Saturated hydrocarbons (alkanes) are the simplest of the hydrocarbon species and are composed entirely of single bonds and are saturated with hydrogen, (2) Unsaturated hydrocarbons have one or more double or triple bonds between carbon atoms. Those with double bond are called alkenes. Those containing triple bonds are called alkynes, (3) Cycloalkanes are hydrocarbons containing one or more carbon rings to which hydrogen atoms are attached, and (4) Aromatic hydrocarbons, also known as arenas, are hydrocarbons that have at least one aromatic ring. Hydrocarbons can be gases (e.g. methane and propane), liquids (e.g. hexane and benzene), waxes or low melting solids (e.g. paraffin wax and napthalene) or polymers (e.g. polyethylene, polypropylene and polystyrene).

2.6. Hypothesis

To make the study to be focused based on the objective of the research, therefore the hypothesis of this research are given as follows:

(1) Good and standard chemistry learning modules could be developed in order to be used as a learning media on the teaching of chemistry in RSBI senior high school.

(2) Developed chemistry learning modules are effective to increase student's achievements on solving problems dealing with related chemistry subject compared with conventional teaching method.

(3) Developed chemistry learning modules could be used as chemistry teaching and learning media on the teaching and learning process in chemistry to increase students achievement in chemistry.

(4) There is a positive correlation between developed chemistry modules with the student's motivation to study chemistry on the teaching of chemistry topics of (a) Oxidation and Reduction Reactions, (b) Solubility and Solubility Product, (c) Thermochemistry, and (d) Hydrocarbon.

CHAPTER III

RESEARCH METHODS AND IMPLEMENTATION

3.1. Overview of the Research

The studies are conducted with the combination development and experimental research. The development covers the work on making learning modules by improving the performance of existed reference text book that have been used in international and bilingual class senior high schools (RSBI and SBI schools). The experiment is conducted to apply the developed learning module in the teaching of chemistry to high school students. The method used is the combination of survey and intervention via field experiment. Survey is used to investigate the quality of textbooks that have been used in RSBI and SBI schools and analyzed them for its chemistry contents. Survey is also used to determine the effectiveness of developed learning modules that could motivate the students in learning process. An intervention methods are conducted to investigate the affectivity of developed chemistry modules to increase the student's achievements compare to the teaching by using ordinary chemistry text book in four chemistry subjects, they are (1) Oxidation and Reduction Reactions, (2) Solubility and Solubility Product, (3) Thermochemistry, and (4) Hydrocarbon. The overview of the research is summarized in Figure 3.1.

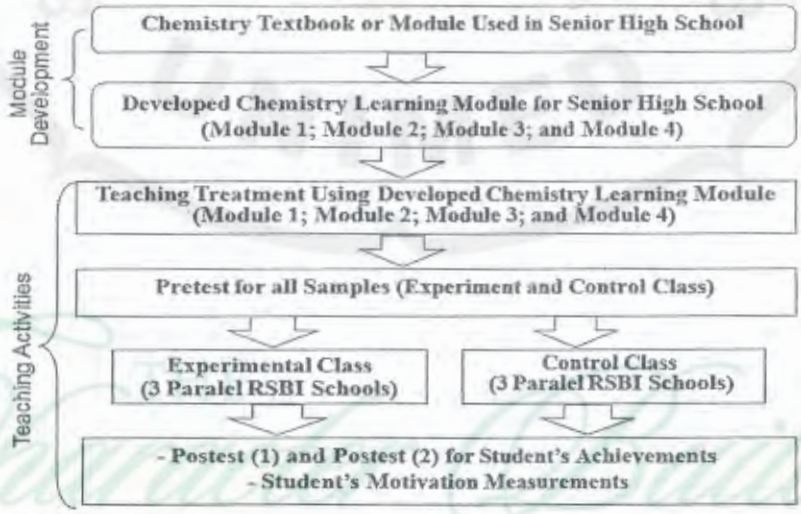

Figure 3.1. The overview of research on the development of learning module to increase student's achievement in the teaching of chemistry subjects.

In the development of learning module, the chemical materials is innovated to obtain a standard chemistry module, those including the contents, performance, language, visibility, illustration, problem example, drill, solving and problems. In the experiment, the study is started from sampling process to obtain experimental class and control class in each of the selected schools. The study is then followed by pretest that was the preliminary evaluation before the teaching treatments being carried out. The teaching treatments by using developed chemistry learning modules were then conducted to the experimental classes, and the teaching by using existing chemistry text book were proceeded for control class, followed by post test in all samples. The data collected in this study are the student's achievement (achievement score) from evaluation test (post test 1 and postest 2), and their motivation from questionnaire distributed to all participants involve in the study. The complete procedures in conducting the research are detailed in research procedures.

3.2. Research Location and Research Objects

The study is conducted in North Sumatra in different schools that categorized as RSBI or SBI schools that using Bilingual, Indonesian and English as a formal language. The study is conducted at Academic Year 2012/2013, on August to November 2012. The time of this research is adjusted suitable with the schedule allocated in the SHS when the target materials of chemistry subjects are being taught and at the same time the research is conducted without interfere the students and the teachers activity in the selected schools.

Research objects are (1) chemistry text book that have been used in RSBI and SBI schools, (2) The chemistry teacher that are actively teach chemistry subjects, and (3) Senior High School students that were active in the Academic Year 2012/2013. The administration processes have to be made to ask the permission to the member of the researcher, in order they are feel free to do research in the schools to perform research. After an agrement from SHS targets have been obtained, and the teacher in the school have agree to help the researcher in preparing the study, then the research tim are starting doing research from selection of the target sample, introducing an innovated teaching module, preparing standard module, doing teaching activities based on the research procedures prepared by the researcher, conducting evaluations (pretest and pos test) and obtaining the data on the students motivation towards the developted chemistry learning modules of four chemistry subjects.

3.3. Population and Sample

The populations of the study are all high school students of science (IPA) year XI in RSBI or SBI schools. The samples are chosen purposively selected due to the limitation the researcher. The samples being chosen for the study are SMAN 1 Tebing Tinggi, SMAN 1 Brastagi, and SMAS Methodist 1 Medan. The distribution of the students in the selected samples is presented in Table 3.1.

Table 3.1. The description of population and samples in SHS that selected as samples in the study for development of chemistry learning module to increase student's achievement in the teaching of chemistry

No	Name of Senior High School	Selected Class	Sellected sample		Total sample
			HA	LA	
1	SMAN 1 Medan	2	30	30	60
2	SMAN 1 Tebing Tinggi	2	30	30	60
2	SMAS Brastagi	2	30	30	60

HA = Student with relatively high achievement in year XI
LA = Student with relatively low achievement in year XI

The sample in each school is divided into two classes for each of the schools, they are chosen one class as experimental class, and one class as control class. The number of sample will be taken from each class is limited to 30 students. The lists of the name of the students are arranged in a series of order based on their performance from previous record of chemistry subjects, followed by removing outlier samples from the list after the pretest being given because the only homogenous samples are included in the study. Student's performance is obtained from their results in previous semester on chemistry subjects. The selected students in each class was then divided into two groups, those are the student with relatively high achievement (HA) they are taken starting from the bottom to the upper number from the list of the name of the students. The other group was the student with relatively low achievement (LA) they are taken starting from the top down to the next number from the list of the name of the students. Each group of samples was given the same treatments but only the selected samples are used as a research data without notification to the participants.

3.4. Research Design

The research containing of group of students treated with the teaching by using innovated module, and the conventional method that only given an ordinary lecture in the class, all with the same subjects (in cycles). The two treatment classes by using innovated module are named as experimental treatment classes, and the conventional method is named as control class (Situmorang and Situmorang, 2009; Situmorang, *et.all,* 2009, Situmorang, *et.all,* 2010; Situmorang, *et.all,* 2011). The design of the research is presented in Table 3.2.

Table 3.2. Research design of the development of chemistry learning module to increase the student's achievement in the teaching of chemistry.

Group of Samples	Avarage student's Achievement					
	Pretest		Postest 1		Postest-2	
	Experiment	Control	Experiment	Control	Experiment	Control
HA						
LA						
Avarage*						
t-test						

HA = Student with relatively high achievement in year X
LA = Student with relatively low achievement in year X
*Avarage from total sample of HA and LA

The intervention are known as experimental research, with conducting teaching treatment differently, (1) those classes which to be taught by using innovated learning module, and (2) Conventional Method that to be taught by using ordinary lecture only, followed by the study explained in Situmorang, *et.all.*, (2000). In each of the experiment and control class are divided into HA group (the student with relatively high achievement), and LA group (student with relatively low achievement). In this research, the study used innovated learning module as teaching treatments in the experimental class, and the control class was taught using conventional method. Students in every group were taught with the same topic of chemical kinetics at the same of allocated time as scheduled in the schools.

3.5. Research Procedures

Research procedures are consisted of two stage, they are: (1) First stage is a development of chemistry learning module in the teaching of chemistry subjects, and (2) Second stage is implementation of the teaching activities as shown in Figure 3.1. The development of chemistry learning module is conducted starting from the (a) analysis and evaluation of Senior High School chemistry textbook with related

chemistry topics, (b) Organizing draft of Chemistry Learning Modules based on curriculum KTSP, (c) Conducting expert judgment of developed chemistry learning module, and Application of the developed chemistry learning module. The research procedures are outlines in Figure 3.2.

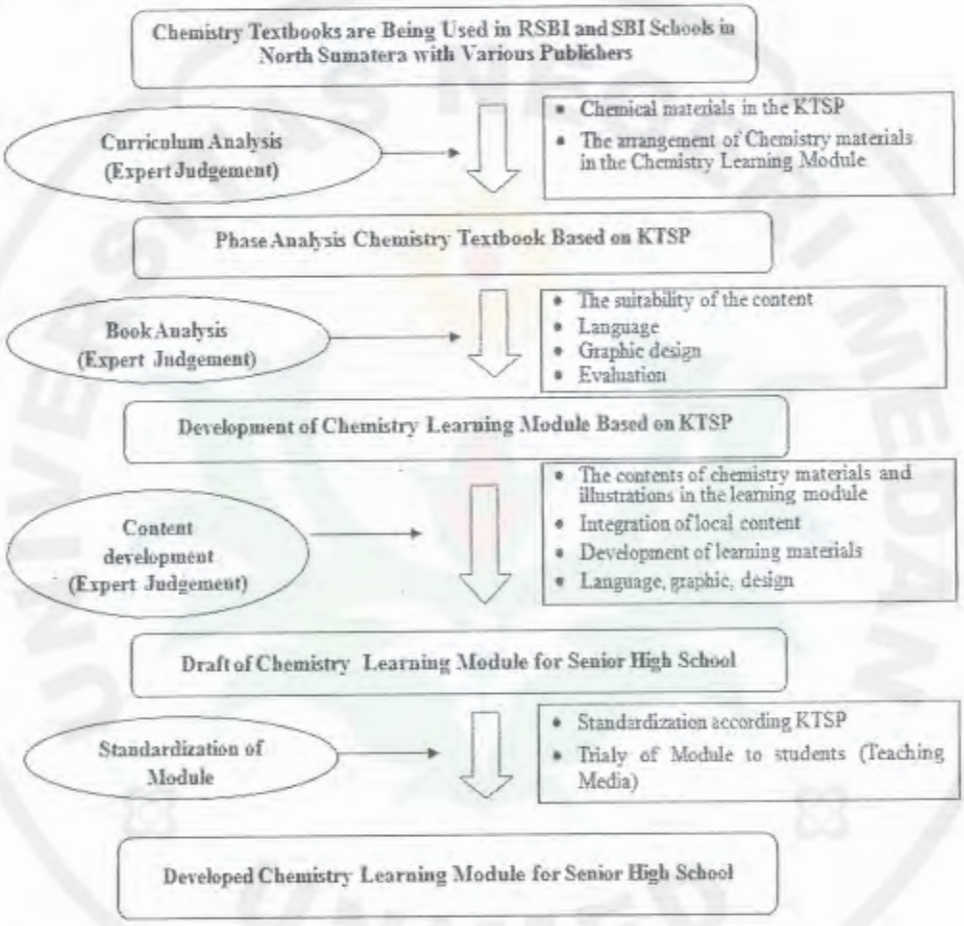

Figure 3.2. The procedure to be followed in the development of chemistry learning module to be used in RSBI and SBI schools.

Research procedures on the effectiveness of developed chemistry learning modules into the students achievements on the teaching of chemistry are summarized in Figure 3.1, they are (a) arranging the research instrument, (b) sampling, treatment teaching and evaluation, and (c) conducting survey to investigate the motivation of the students in learning. The complete procedures begin from administration process to have permission to do experiment in state senior high schools (SHS) that are categorized as RSBI and SBI schools. In to the target SHS, the class sample are chosen to be included in the study, followed by sampling process to obtain

experimental class and control class in each of the shools. Before the treatments have been done, the samples are homogenized in order to have the samples with the relatively same knowledge in chemistry. The pretest is given to obtain the data on the achievement of the students on chemistry. The evaluation was conducted prior to the teaching, both for experimental classes and control classes. The data obtained from pretest was used to see the variation of the samples before the teaching treatments being carried out, where the outlier samples has to be excluded from the data, those are the data obtained for the students with the achievement test are far from the other students.

The study was then followed by the teaching treatments for both experimental class and control class. Teaching treatments are given by using developed chemistry learning module to experimental classes and conventional method was for control class. The data of the student's achievement on chemistry were obtained from evaluation test that were conducted at the end of the teaching. The teaching procedures are repeated for three other subjects by using innovated learning module to experimental classes and conventional method was for control class, followed by evaluation. The questionnaire is then distributed to the students to record the motivation of the students that is effected by the developed chemistry learning module. The effectiveness of the developed learning modules are then investigated from student's achievement on chemistry.

3.5.1. Arranging the research instrument

The instruments used in this study are evaluation test (Pretest, and Post test-1), and a set of standard questionnaire distributed to respondents. The evaluation tests are arranged based on the topics being taught in the study. Before using the evaluation test, the items on the evaluation test has been standardized using standard procedures. The questions on the evaluation tests are tryout to senior high schools students, and items on the tests are assessed to investigate the normality, homogeneity, validity, reliability and level of difficulties of the instrument. Normality of the test is assessed by using Chi-Quadrate Test by determining amount of interval class, where amount of interval class using Chi-Quadrate test is six according to six areas which are in curve of standard value, determining length of class, by using formula of bigger data minus smaller data divided by six. The homogeneity of the test which is used in this research is by dividing the bigger

variance to the smaller variance. The validity refers to how far test measures what will be measured. The validity of the test which is used in this research is empiric validity, whereas technique which is used is product moment correlation technique by Pearson. The reliability of the test is consistency of measurement. To obtain the reliability of the test in this research is used Kuder Richardson's formula, that's K-R 21 because the test is multiple choices. The difficulty level of the test is also evaluated by using discrimination index of the test to investigate the ability of the instrument to differ between students. The standard test chosen in this study are 20 problems, and all of them are group into set of standard evaluation test.

Standard questionnaire to be used in this study are adopted from the study conducted by Silitonga and Situmorang (2008). The questionnaire is consisted of three set of question categories with four options from strength opinion to weak opinions. The firs component named as component A covered item 1-16, second component named as the component B covered item 17-35, and third component named as component C covered item 36-40. All questions raised in the questionnaire are assumed to be adequate to be used in assessing the motivation of the students on learning chemistry that is related to the innovated learning module.

3.5.2 Teaching Treatment

Teaching treatments are conducted to experimental class and control class. The experimental classes are given the teaching procedures by using developed chemistry learning module and the other class use existing chemistry text book. The steps to variables in this research are controlled, where both of classes are given the same subject matter, the time teaching alocated are considered similar, and teacher who is teaching subject matter is maintain the same in both class. Into the experimental class, the teaching is arranged starting from divided the students into set of group of four students, and then to the students the explanation on the subject being taught are given starting from the simple concept followed by complex concept and question problems. The teaching was then followed by given a set of chemistry learning module to the students in the class. The teacher is then taught the way of solving the problem given in the developed chemistry learning module.

To the control class, the teaching procedure has been arranged start from given the explanation on the subject being taught to the students on a simple concept to complex concept followed question problems, but the teaching is conducted without

learning module, only using chemistry text book. In between the explanation, the teacher giving the questions to be answered related to subject, and some students are asked to answer. After teaching and learning process have finish, the students are then be asked to give comments, followed by the explanation from the teacher on the right answer. The teacher was then taught the way of solving the problem related to chemistry topics.

3.5.3. Data Collection and Analysis

The data obtained in this study are the respondent's opinions for the developed chemistry learning modules, the student's achievements after the teaching and learning process, and the student's motivation during the study. Student's achievement is obtained from the student's ability in to solve problem in evaluation tests, they are pretes is conducted before the teaching process, postest-1 is conducted after the teaching process, and postest-2 is carried out after leaving one month from the teaching activities. There are 20 questions are used for each of the learning module that covered the chemistry topics in the modules, and the data is counted from student's achievement in sample class for the right answer. The data is based on school and treatment group. Pretest is carried out before the teaching treatment onto the experimental class and control class. The score obtained in the pretest is set up to measure the student's achievement in subject matter as well as to homogenize the sample. The decision was made from the data to reject or to receive the students as sample in the study. Those students with the score in the achievement test are far from the other students are counted as outlier sample, and then not to be included in the data processing, but the students are treated in a normal manner without notification.

The teaching treatment was conducted to experimental classes and control classes. Postest-1 was carried out after the teaching treatment onto the experimental class and control class. The score obtained in the postest-1 are intended to measure the student's achievement in subject by the effect of the innovated teaching method and conventional method. The results are calculated to investigate the influence of the innovated teaching method onto the student's achievement in chemistry. The decision has been made based on the measurement and hypothesis testing by using statistics.

CHAPTER IV

RESEARCH RESULTS AND DISCUSSION

4.1. Development and Standardized of Chemistry Learning Module

Four chemistry modules are developed independently ollowed by standarisation to become developed learning chemistry module. The development is conducted based on the syllabus, Competency Standards, and Basic Competencies, and the enhancement of chemistry materials that meet the requirement of standard learning module. The developed learning modules are presented at the end of this report. In the development process, there are four Bilingual Students of FMIPA Unimed are ask to write draft of set modules for their thesis under the suvervision of their accademic supervisor. The modules were innovated to make them standard and easy to use in the teaching and learning process. To make the modules are informative and easy to understand by the learners, the structure of the module is design systematic, containing of chemistry materials that relevant to chemistry subject, enrich the materials with various sources and topics, equipped with example of problem-solving, problems and key answer. The package of chemistry modules are attached in the last page of this report (**Appendix 2-5**).

The developed module has been standardized to make the chemistry learning module standard for Senior High School chemistry. The standardization is conducted to analyze Competency Standards and Basic Competence in KTSP; to determine the chemistry contents with the Competency Standards and Basic Competence in KTSP to make it suited to KTSP; and to use the set of learning module for trial to students and teachers in RSBI school. The standardization procedures for draft of chemistry learning modules have been conducted successively: (1) using expert judgments with Chemistry Lectures, (2) using experience chemistry teacher that have teach chemistry subject in SBI and RSBI schools, and (3) using the developed chemistry learning module to become learning media for RSBI students, at the same time the students are asked their opinions on the performance and veasibility of the package modules. All standardization procedures have been conducted by using set of questionaire. The contents of the questions in the questionaire covering the components of the innovated module for its completeness of contents and the accuracy of content,

followed by the question on the presented the extension of material and the clear the derived of chemistry material.

The questions being raised in the questionaire are intended to investigate the performance of chemistry materials that have been included in the chemistry learning modules. The components of the questions are specifically to ask the completness of chemistry materials based on the KTSP curriculum, the presentation of the chemistry materials in standard learning materials, the order of the chemistry materials starting from introduction, main concepts, and the example of concepts, and the application of chemistry concepts in the modules that is important into real life. The design of the developed modules are also been asked whether the layout, presentation of illustration, table and images are meet to the need of the readers. The use of language in its simplicity and easy reading is also evaluated. All questions are raised in multiple choice option starting from strong opinion with positive response of very good (score 4) down to a very low opinion with negative view of very poor/bad (score 1). The opinions of the respondents for each of the developed chemistry learning modules are summarized in Table 4.1.

The performance of developed chemistry learning modules on the topic of Solubility and Solubility Product (Module 1) has been assessed by the respondents of Chemistry lecturer (average of 3.67), Chemistry Teacher (average of 3.78), and SHS students (average of 3.31) are all positive, with total average of 3.59, categorized as very good. With the same procedures, the performance of developed chemistry learning modules on the topic of Hydrocarbons (Module 2) has also been assessed by the respondents of Chemistry lecturer (average of 3.67), Chemistry Teacher (average of 3.83), and SHS students (average of 3.41) are all positive, with total average of 3.64 also categorized as very good. Module 3 on the topic of Thermochemistry has also been assessed by the respondents of Chemistry lecturer (average of 3,46), Chemistry Teacher (average of 3.50), and SHS students (average of 3.49) are all positive, with total average of 3.48 is also categorized as very good. The 4th module on the topic of Oxidation and Reduction Reactions has also been assessed, where the opinion from Chemistry lecturer (average of 3.54), Chemistry Teacher (average of 3.50), and SHS students (average of 3.43) are all positive, with total average of 3.49is also categorized as very good.

Table 4.1. The performance of chemistry learning moduler on thetopic of (1) Solubility and Solubility Product, (2) Hydrocarbons, (3) Thermochemistry, and (4) Oxidation and Reduction Reactions, based on the judgment by Chemistry lecturer, Chemistry Teacher, and SHS students (The number is the average value from 288 respondents).

Compo-nents	Description of Chemistry Module	Respondents Opinion on Chemistry Module																Avarage
		Module 1				Module 2				Module 3				Module 4				
		P	Q	R	Av-1	P	Q	R	Av-2	P	Q	R	Av-3	P	Q	R	Av-4	
Content	The completeness of contents	4.00	4.00	3.52	3.84	4.00	4.00	3.25	3.75	3.00	3.67	3.33	3.33	3.50	3.33	3.07	3.30	3.56
	The accurate of content	4.00	4.00	3.43	3.81	4.00	4.00	3.58	3.86	3.50	3.67	3.58	3.58	3.50	3.67	3.07	3.41	3.67
Extension	Presented the extension of material	3.00	3.33	3.13	3.15	3.50	4.00	3.58	3.69	3.50	3.33	3.41	3.41	3.50	3.67	3.67	3.61	3.47
	Clear the derived of material	3.50	3.67	3.00	3.39	3.50	3.66	3.08	3.41	3.50	3.33	3.41	3.41	3.00	3.67	3.73	3.47	3.42
Depth	The material is presented in good order: introduction, main concepts, and the example of concepts	3.50	3.67	3.35	3.51	4.00	4.00	3.33	3.78	3.50	3.33	3.41	3.41	3.50	3.33	3.20	3.34	3.51
	Application concepts with real life	3.50	3.67	3.30	3.49	3.00	3.33	3.33	3.22	3.50	3.67	3.58	3.58	3.50	3.33	3.20	3.34	3.41
Design	The suitable between design layout with the target material	4.00	4.00	3.43	3.81	4.00	4.00	3.66	3.89	3.50	3.33	3.41	3.41	4.00	3.33	3.87	3.73	3.71
	Presentation of illustration, the table and images	3.50	3.67	3.30	3.49	4.00	4.00	3.58	3.86	3.50	3.67	3.58	3.58	3.50	3.67	3.53	3.57	3.63
	Involving learners (interactive)	3.50	3.67	3.09	3.42	3.50	4.00	2.83	3.44	4.00	3.33	3.83	3.72	3.50	3.33	3.20	3.34	3.48
Language	In accordance with the development of learner	4.00	4.00	3.39	3.80	3.50	4.00	3.75	3.75	3.00	3.33	3.16	3.16	4.00	3.67	3.30	3.66	3.59
	Communicative	3.50	3.67	3.43	3.53	3.00	3.66	3.41	3.36	3.50	3.67	3.58	3.58	3.50	3.33	3.73	3.52	3.50
	Straightforward (the accuracy of use the term, language and symbol)	4.00	4.00	3.39	3.80	4.00	3.33	3.50	3.61	3.50	3.67	3.58	3.58	3.50	3.67	3.60	3.59	3.65
Average		3.67	3.78	3.31	3.59	3.67	3.83	3.41	3.64	3.46	3.50	3.49	3.48	3.54	3.50	3.43	3.49	3.55

Note (P) Chemistry lecturer, (Q) Chemistry Teacher, (R) SHS students, (Av) avarage

The results showed that that the Content of the chemistry based on the completeness of contents (average of 3.56) and the accuracy of the content (average of 3.67) are categorized as very good for all respondents. The extension of the chemical equilibrium in the text book has been presented clearly (3.47), and the derivate of material is sufficient (3.42) are categorized as very good for all respondents. Furthermore, the results from the dept of the chemistry materials in the module are asked on whether the material is presented in good order starting from introduction, main concepts, and the example of concepts (average 3.51), and the application concepts with real life (average 3.41) are also categorized as very good for all respondents. The results on the design of the innovated module , where the material is presented in good order: introduction, main concepts, and the example of concepts (average 3.71), their layout, presentation of illustration, table and images are all categorized as very good, where the average is 3.63, while for the interactive involvement of learners given by the module is also good (average 3.48). The module has also written in a good format where the English language used in the module is suited to the bilingual students. The module is categorized as good (average 3.59) in accordance with the development of learner, and the communication used in the module is simple and easy to read (average 3.50), and is also categorized as good in the message where it is written straightforward, accurate in using the term, language and symbol (average 3.65).

It is concluded that all respondents are agreed with the developed Chemistry Learning Module as learning resources on the teaching of (1) Solubility and Solubility Product, (2) Hydrocarbons, (3) Thermochemistry, and (4) Oxidation and Reduction Reactions. It is concluded that a standard chemistry learning module on Solubility and Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions have been developed through innovation of teaching materials and teaching methods where the chemistry material are suited to CBC curriculum. The module has been analyzed and standardized by using expert reviewers of Chemistry University Lecturer and Chemistry High School teacher, followed by trial on to SHS students. The module is design suited to the need of SHS students for SBI and RSBI schools. The module is ready to be used as a learning media on the teaching of Solubility and Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions in international or bilingual teaching senior high school. Set of developed modules is presented as supplement in Appendix 2-5.

4.2. Student's Achievement on Chemistry before Teaching Treatment

Before the teaching treatment in experiment and control class, the student's achievements on chemistry were obtained from the evaluation test given to the student at the beginning of the teaching activity (pretest). The student's achievement was measured by giving a set of evaluation as pretest to all students in order to know their knowledge on the specific topics of (1) Solubility and Solubility Product, (2) Hydrocarbons, (3) Thermochemistry, and (4) Oxidation and Reduction Reactions.. The result of pretest is also important to excluded the outlier data where is set if the data is very far from normal data. If the students already know the topics of chemistry subjects, they are not included in the calculation of the data. For outlier data, all students are treated as normal students, but their data is excluded. The results from pretest are also useful to know the degree of their normality and homogeneity of the data being used in the study. The student's performance from pretest for both experimental classes and control classes in a given group of teaching treatment using innovated module is presented in Table 4.2.

The results on the student's achievements in the teaching of Solubility and Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions based on the pretest showed that almost all students for both experimental classes and control classes in a given group of teaching treatment have low performance in chemistry. The results in pretest shown that in general, the students in three schools have the same knowledge in the target materials to be taught to the students. Almost all students have low performance in the pretest in the teaching of chemistry subjects of (1) Solubility and Solubility Product, (2) Hydrocarbons, (3) Thermochemistry, and (4) Oxidation and Reduction Reactions. The calculation results of data as summarized in Table 4.2 can be seen that the student's achievement in chemistry is categorized as low performance. Every group in the class has low average achievement for a Group of teaching treatment using innovated chemistry module with the average for experimental class (M=31.39±15.58) where for control class (M=31.69±13.69). The analyze of the data shown that there is not significances different for both of class in for a group of teaching treatments using innovated chemistry module are not significantly different with control class, where the $t_{calculated}$ -0.0344 < t_{table} 1,662. The results showed that all samples are equals in their performance in chemistry in three schools, event though the variations in pretest are varied in different schools.

Table 4.2. The student's achievement based on pretest (before teaching activities) on the teaching and learning activities by using developed chemistry learning module compare with chemistry textbook in the teaching of chemistry subjects of (a) Solubility and Solubility Product, (b) Hydrocarbons, (c) Thermochemistry, and (d) Oxidation and Reduction Reactions. Numbers in table are means and standard deviation.

Name of Schools	Group	Student's Achievement (The average score on Pretest before teaching activities been conducted)							
		Module 1 (Solubility and Solubility Product)		Module 2 (Hydrocarbons)		Module 3 (Thermochemistry)		Module 4 (Oxidation and Reduction Reactions)	
		Experimen	Control	Experimen	Control	Experimen	Control	Experimen	Control
SHS 1 Medan	HG	34.00±3.16	33.00±4.21	46.00±5.16	60.00±3.33	46.00±14.04	45.67±19.54	38.70±5.24	38.69±4.20
	LG	46.00±3.16	50.00±7.45	33.50±6.25	45.00±4.08	50.33±10.93	39.00±13.12	28.04±6.92	22.01±4.52
SHS 1 Tebing Tinggi	HG	30.00±6.67	30.50±6.43	51.00±3.16	57.00±4.21	24.33±7.29	26.79±9.41	35.39±4.48	41.94±3.13
	LG	54.50±6.85	48.00±7.15	32.50±5.89	37.50±3.53	20.33±10.77	26.00±5.63	24.02±4.68	24.69±4.52
SHS 2 Brastagi	HG	23.50±6.26	25.50±5.99	51.00±4.59	53.00±4.83	20.33±10.77	27.33±5.63	35.38±3.19	34.72±2.78
	LG	46.00±8.43	39.50±3.69	30.00±9.42	36.50±3.37	27.00±5.92	25.00±4.23	24.02±4.68	22.01±5.52
Total	HG	**29.17±5.36**	**29.67±5.54**	**49.33±4.30**	**56.66±4.12**	**30.22±15.70**	**33.41±15.91**	**36.49±4.52**	**38.45±4.46**
	LG	**48.83±6.15**	**45.83±6.09**	**32.00±7.19**	**39.00±3.66**	**32.56±15.54**	**30.00±11.03**	**25.36±5.67**	**22.90±4.88**
	Total	**42.25±6.76**	**39.25±6.79**	**40.00±5.74**	**48.16±3.89**	**31.39±15.58**	**31.69±13.69**	**30.93±7.57**	**30.68±9.11**

Note: HG = Students who have high value in second semester
LG = Students who have low value in f second semester

The pretest for teaching and learning module of Solubility and Solubility Product has been conducted. From the data, can be seen that student's achievement is still low, because each class had low average achievement. The average in experiment class for low group (29.17 ± 5.36) and average for control class for low group (29.67 ± 5.54). The average for high group in experiment class (48.83±6.15), and average for high group in control class (45.83±6.09). The results show that all students are being used as samples categorized as low achievement in mastery of Solubility and Solubility Product. Therefore, the samples were used for further studies. Those were set for experimental class where the student treated by a given a set of innovated chemistry module as media in learning process, while the other class as control class were given the same teaching treatment by using textbook as media or without module.

The same procedure have been conducted before the teaching of Hydrocarbons. The result on the student's achievements in the teaching of hydrocarbon based on the pre-test showed that almost all students for both experimental and control class in a given group of teaching treatment have low performance in chemistry. The results in pre-test shown that in general, the students in three schools have the same knowledge in the target materials to be taught to the students. Value of average in the experiment class for a group that would be teaching treatment by using module is (40.66 ±5.74), while in control class for a group of teaching by using book is (48.16 ±3.89 both of them have low achievement. Averaging value of high group in experimental class is 49.33 ±4.30 (and for control class is 56.66 ±4.12, where the t_{count} -5.776< t_{table} 1.319. Averaging value of low group in experimental class is 32.00 ±7.19 and for control class is 39.66 ±3.64, where the $t_{count} < t_{table}$ (-4.688 < 1.318).

The student's achievement in the teaching of Redox Reaction based on the pretest showed that almost all students for both experimental classes and control classes in a given group of teaching treatment have performance in chemistry. Every group in the class has low average achievement for a group of teaching treatment using developed chemistry module with the average for experimental class (30.93±7.57) where for control class (30.68±9.11), the analyze of data shown that there is not significances different for both of class in for a group of teaching treatments using developed chemistry module are not significantly different with control class.

It is seen from the data that some students are having high achievements in (a) Solubility and Solubility Product, (b) Hydrocarbons, (c) Thermochemistry, and (d) Oxidation and Reduction Reactions from their score in pretest for both in experimental

class and control class. High achievement for some students in the study probably due to their ability in guessing the answer as the test have been design in multiple test. However, the data are not excluded from the population as their achievements are not exceeded the high mark and the data could be used to see the consistency of the data from post test after the teaching treatments. Therefore, some high marks students in the pretest are still included in the sample, and they are not categorized as outlier sample. The results concluded that all students are being used as samples in the study categorized as low achievement in teaching of chemistry kinetic. Therefore, the samples are used for further studies. Those are set for experimental class where the student will be given a set of developed chemistry learning module in the teaching process, while the other groups are given the same teaching treatment without module.

4.3. Influence of Teaching Module on the Teaching of Chemistry Subjects

The studis are being conducted to investigate the influence of four developed chemistry learning modules to increase student's achievements in learning chemistry subjects compare with the results obtained from conventional method by using existing text book in the schools. The developen chemistry modules are consisted of four chemistry learning modules, they are Module 1 with the topic of Solubility and Solubility Product, Module 2 with the topic of Hydrocarbons, Module 3 with the topic of Thermochemistry, and Module 4 with the topic of Oxidation and Reduction Reactions. In to the experimental groups, the students are taught with developed chemistry learning modules followed by performing postest-1 to investigate their achievement related to the intended teaching method. The evaluation test (postest-1) for each of the package module has been conducted after the teaching procedures been performed, and the results are summarized in Table 4.3.

The results showed that the students achievements in experimental classes are all found different with the students achievements in control class. The average achievement for experimental class is M=84.44±8.33, that is higher than that with conventional method, where the achievement average is M=75.28±11.62. Analyzing the data statistically concluded that experimental class are significantly different to a control class, where the t-test was found at $t_{calculated}$ 7,964 > t_{table} 1,662. The data analysis have been made to investigate if there is a different in the students achievement for group of students categorized as high achievement (HA) and with those students that are categorized as low achievement (LA).

Table 4.3. The student's achievement based on postest-1 (after finish teaching activities) on the teaching and learning process by using developed chemistry learning module compare with chemistry textbook in the teaching of chemistry subjects of (a) Solubility and Solubility Product, (b) Hydrocarbons, (c) Thermochemistry, and (d) Oxidation and Reduction Reactions. Numbers in table are means and standard deviation.

Name of Schools	Group	Student's Achievement (The average score on Pretest before teaching activities been conducted)							
		Module 1 (Solubility and Solubility Product)		Module 2 (Hydrocarbons)		Module 3 (Thermochemistry)		Module 4 (Oxidation and Reduction Reactions)	
		Experimen	Control	Experimen	Control	Experimen	Control	Experimen	Control
SHS 1 Medan	HG	78.00 ±6.32	74.5±9.23	86.00±5.16	76.00±3.94	80.33±8.76	79.33±9.42	76.69±4.69	68.04±2.82
	LG	81.50±7.47	77.0±5.87	85.00±5.77	63.50±10.01	81.00±6.32	70.33±8.12	72.72±5.84	70.05±3.53
SHS 1 Tebing Tinggi	HG	66.50±7.47	62.00±5.87	68.50±11.31	75.00±12.24	88.67±6.40	86.67±4.50	74.71±4.20	68.69±7.06
	LG	72.50±6.35	69.00±9.94	70.00±10.54	68.50±16.67	93.33±6.73	85.33±4.81	74.72 ±2.78	70.04±9.02
SHS 2 Brastagi	HG	60.50±6.26	52.00±11.35	54.50±19.78	52.00±19.17	80.00±7.32	65.33±8.96	80.71±7.98	74.72±2.78
	LG	72.50±11.37	66.00±6.14	53.00±19.32	48.50±17.48	83.33±5.23	64.67±7.90	76.68±11.01	77.38±5.60
Total	**HG**	**68.33±6.68**	**62.83±8.82**	**69.66±12.08**	**67.66±11.78**	**83.00±8.42**	**77.11±11.85**	**77.37±6.21**	**70.48±5.45**
	LG	75.50±8.39	70.67±7.32	69.33±11.87	60.16±14.72	88.33±8.07	73.44±11.22	74.71±7.30	72.49±7.16
	Total	66.50±8.82	59.00±8.75	64.33±7.32	55.50±7.32	84.44±8.33	75.28±11.62	76.04±6.85	71.49±6.39

Note: HG = Students who have high value in second semester
LG = Students who have low value in f second semester

The results on the evaluation postest-1 for three parallel classes of high schools showed that the group of students that categorized as high achievement (HA) that treated with innovated teaching module has its achievement at average of (M=83.00±8.42) that is higher than that with the same group of students that categorized as high achievement (HA) thought with conventional method that is made as the control class was (M=77.11±11.85) (see the details in Table 4.3). Analyzing the data statistically concluded that experimental class are significantly different to a control class, where the t-test was found at $t_{calculated}$ 3,757 > t_{table} 1,680. By using the same analysis for group of students with low achievement (LA), the results for three parallel classes of high schools showed that the group of students of LA with innovated teaching module has average of (M=88.33±8.07) that is higher than that with the same group of students LA with control class was (M=73.44±11.22). Analyzing the data statistically concluded that experimental class are significantly different to a control class, where the t-test was found at $t_{calculated}$ 8,008 > t_{table} 1,680.

The results have been seen closely for each of the chemistry learning modules, we found that Module 1 is very effective to increase the students achievement on the teaching of Solubility and Solubility product. From the average of student's achievement that shown in table 4.8, in SMA N 1 Medan, experiment class (M=79.75±6.89) is higher than control class (M=75.75±7.55). It shows that there is significance difference of student's achievement in SMA N 1 Medan. In SMA N 1 Tebing Tinggi, student's achievement of experiment class (M=69.50±6.91) is higher that control class (M=65.50±7.91). It means there is significance difference of student's achievement in SMA N 1 Tebing Tinggi. Same with both schools, experiment class (M=66.50±8.82) was also has higher student's achievement than control class (M=59.00±8.75), that shows there is significance difference of student's achievement. Based on the average of student's learning outcomes, can be seen the arrangement of student's outcomes of each schools from the higher to the lower that was SMA N 1 Medan, SMA N 1 Tebing Tinggi and SMA N 1 Berastagi. Average of high group learning outcomes of post test-1 in experiment class is M=75.50±8.39 while for control class is lower (M=70.67±7.32). And also for low group, average of student's achievement, experiment class 68.33 ± 6.68 also higher than control class M=62.83±8.82. From the average can be seen that there is significance difference of student's achievement between control class and experiment class. It means that learning module as media gave influence in increasing student's achievement of

solubility and solubility product topic. Statistical analysis has shown that t_{count} = 4.56 while t_{table} at α = 0.05 is 1.32, it means that chemistry learning module gave contribution in increasing student's achievement in high group students. For low group, it is found that t_{count} = 3.66 while t_{table} at α = 0.05 is 1.319, means that chemistry learning module give contribution in increasing student's achievement.

The inffluence of Module 2 to increase the students achievements has also studied on the teaching of Hydrocarbon as summarized in Table 4.3. It is found that the result from the table shows that student's achievement in SMAN 1 Medan in experiment class M=72.25±13.23 is higher than control class M=61.50±8.98, where both are significance difference. The student's achievement in SMAN 1 Berastagi in experiment class is M=51.75±17.81 is higher than that in control class M=37.25±15.50. where both are significance difference. The student's achievement in SMAN 1 Tebing Tinggi in experiment class M=66.00±7.55 is higher than that in control class M=58.00±9.60. where both are significance difference. Based on the average value of student's achievement, can be seen that the students of SMAN 1 Medan has the highest value compared to students of SMAN 1 Tebing Tinggi and SMAN 1 Berastagi. This is likely due to differences in treatment because every school taught by different teacher and also the different of student's achievement in English because the question that given to students is in English language. Averaging the value of high group in experimental class M=64.33±11.50 is higher than control class M=62.33±8.28 it shows there is significance difference with $t_{count} > t_{table}$ (2.145 > 1.318). In low group of experimental class the averaging value is M=62.33±8.28 is higher than control M=49.00±10.83 it shows there is difference significance with $t_{count} > t_{table}$ (3.819 > 1.318). The result of data analyze of the averaging value in post-test 1 in three schools shows that there is increasing influence of student's achievement after giving learning with chemistry module. According to hypothesis test, the value of t_{count} is 3.819. From the result shown there is a significant value between the value of t_{table} and t_{count}. So, it could be concluded that chemistry learning module gave contribution in increasing student's achievement in low group students. From the result of post test 1 in high group and low group both of them shown that there is a increasing value of student's achievement from their pretest before. It proved by there is significant value of t_{table} and t_{count}, so that can conclude the chemistry learning module gave contribution in increasing student's achievement students in high group and low group as well.

After doing teaching treatment was conducted postest-1 For Module 4 is aimed to investigate the influence of teaching treatments by using developed learning module onto student's achievement in chemistry compare with the results obtained from control class (using chemistry book). The result of evaluation post test-1 that have been conducted after the teaching procedures was summarized in Table 4.3. The data analysis have been made to investigate whether there was a different in the students achievement for group of students those were categorized as high achievement (HA) and with those students were categorized as low achievement (LA). By using the same analysis for group of students with LA, the results for three parallel classes of 3 schools, with the average value for experimental class (M=76.04±6.85) and for control class (M=71.49±6.39). It is concluded that development of chemistry learning module is effective to increase student's achievement. It was found that student's achievement of chemistry for students who are taught using chemistry module is higher compare with by using chemistry book. It also found that the standard chemistry learning module as a media provide high communication on teaching and learning process. Studying the influence of innovated teaching module into the student's at lower group has been performed. The second postest was conducted two weeks after pretest. The average of experimental class was obtained (M=83.26±10.45), and average for control class (M=78.71±16.46) as summarized in Table 4.3.

Based on the calculation postest-1 in high group t_{count} = 4.56 while t_{table} at α = 0.05 is 1.32, it could be concluded that chemistry learning module gave contribution in increasing student's achievement in high group students. Based on the calculation for pretest in low group t_{count} = 1.81 while t_{table} at α = 0.05 is 1.32, it could be concluded that chemistry learning module gave contribution in increasing student's achievement in low group students. Based on the calculation post test-I in low group: t_{count} = 1.19 while t_{table} at α = 0.05 is 1.32, it could be concluded that chemistry learning module didn't give contribution in increasing student's achievement in low group students.

The results from postest-1 concluded that the innovative learning module is very effective in increasing the student's achievement on solving problems dealing with chemistry topic of Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions. It is found that the students achievement on chemistry for group of students are being taught using developed chemistry learning modules are all higher compared with those group that are being taught using existing text book in target schools. It is also found that sets of chemistry learning module is categorized as

standard and suitable chemistry teaching and learning media on the teaching of Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions as the modules provide the highest communication on teaching and learning process, where the students could use the module for self learning, and as results to increase their achievement in chemistry.

The influences of develoved chemistry learning modules onto the student's achievement on the teaching of chemistry in topic of Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions have been evaluated after leaving the subjects for one month from the teaching process have been conducted. The evaluation is done by obtaining the postest-2, and the results are summarized in Table 4.4. The effect of develoved chemistry learning modules towards student's achievement can be seen after a period of one month has been done from the teaching activities. The resultas from postest-2 has been performed to know the students ability on solving problem on the subject matter of chemical kinetics after leaving the teaching process for one month. The data showed that there were increasing progress of student's achievement after the students have been taught with develoved chemistry learning modules (Table 4.3 and Table 4.4).

It was also known that the student's achievement in experimental class was different with the student's achievement in a control class. The student's achievement in the experimental class compare to a control class for almost all parallel classes of 3 senior high schools, with the average value for experimental class is M=75.00±6.78 compare to a control class with average of M=70.86±5.15. Analyzing the data statistically concluded that experimental class are significantly different to a control class, where the t-test was found at $t_{calculated}$ 7,004 > t_{table} 1,662. The analysis of the data obtained for experimental class showed that the average value in both of class shows that there is a significance difference of student's achievement. For high and low group in each of class either experimental class or control class defined that there is different averaging value of student's achievement. The student's achievement for group of students in a higher group that is the students that having high value in first semester, where the average value of high group on experimental class is obtained M=77.15±5.88 that is higher than that in control class with M=66.10±8.06.

Table 4.4. The student's achievement based on postest-2 (after a month from the teaching activities) on the teaching and learning process by using developed chemistry learning module compare with chemistry textbook in the teaching of chemistry subjects of (a) Solubility and Solubility Product, (b) Hydrocarbons, (c) Thermochemistry, and (d) Oxidation and Reduction Reactions. Numbers in table are means and standard deviation.

Name of Schools	Group	Student's Achievement (The average score on Pretest before teaching activities been conducted)							
		Module 1 (Solubility and Solubility Product)		Module 2 (Hydrocarbons)		Module 3 (Thermochemistry)		Module 4 (Oxidation and Reduction Reactions)	
		Experimen	Control	Experimen	Control	Experimen	Control	Experimen	Control
SHS 1 Medan	HG	78.50±7.84	75.00±5.77	86.00±5.16	76.00±3.94	82.00±6.22	65.93±8.81	86.70±10.90	70.04±20.20
	LG	79.50±10.12	75.00±3.33	85.00±5.73	63.50±10.01	80.86±4.71	66.93±7.95	86.04±7.97	68.72±22.02
SHS 1 Tebing Tinggi	HG	63.00±5.37	58.00±6.75	68.50±11.31	68.50±11.31	75.00±6.78	70.86±5.15	74.70±6.87	78.70±8.77
	LG	68.00±5.87	60.50±11.41	70.00±10.54	70.00±10.54	76.40±4.11	71.13±6.08	74.70±6.87	75.36±13.35
SHS 2 Brastagi	HG	60.00±7.45	48.00±9.47	54.50±19.78	52.00±19.17	74.46±4.64	61.53±10.22	87.38±10.64	92.70±6.63
	LG	59.50±4.97	48.00±9.19	53.00±19.32	48.50±17.48	70.80±6.57	62.73±9.59	90.04±8.46	86.71±9.45
Total	**HG**	**59.75±6.21**	**48.00±9.33**	**69.66±12.08**	**69.66±12.08**	**77.15±5.88**	**66.10±8.06**	**82.93±11.03**	**80.48±15.95**
	LG	67.17±6.88	60.33±7.33	69.33±11.87	69.33±11.87	76.02±5.13	66.93±7.87	83.59±10.01	76.93±17.05
	Total	69.00±6.98	61.00±7.98	69.66±7.12	67.66±5.32	75.00±6.78	70.86±5.15	83.26±10.45	78.71±16.46

Note: HG = Students who have high value in second semester
LG = Students who have low value in f second semester

Statistical analysis has shown that the students taught by using develoved chemistry learning modules at high group of an experimental class and control class is significance difference, where $t_{calculated}$ 5.220 > t_{table} 1,680. Furthermore, the influence of innovated teaching module into the students at a lower group has been performed. The same analysis for group of students in a lower group that is the students that having low value in second semester for experimental class with the averaging value is obtained at M=76.02±5.13 is also found higher than that observed in a control class where the average value is obtained M=66.93±7.87. Statistical analysis has shown that experimental class and control class is significance difference, where $t_{calculated}$ 6.521 > t_{table} 1,680. Student's achievements on high and low group for both experimental classes are higher than that obtained in control classes. The results imply that develoved chemistry learning modules is found effective in increasing the student's achievement in chemistry due to the ability of the method to make the students easily remembered about the subject matter. The result of data analyze in three schools on the first postest showed that there is increasing influence of student's achievement after giving develoved chemistry learning modules to the students in the teaching of Solubility and Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions. It is concluded that develoved chemistry learning modules are suited to increase the student's achievement on the teaching of chemistry subjects. Sets of developed chemistry learning modules are helping students to learn chemistry as they provide the highest communication on teaching and learning process. By using the module, the students could actively learn by themselves under the guidance of the teacher for solving difficult and complex problems.

4.4. Student Motivation and Teaching Method

The developed chemistry learning modules have been disigned optimumly to meet the standar materials as required by BNSP and UNESCO for book standard. The learning modules have been used by the students as learning materilas in the class and self learning to meet the competence standard in the learning of Solubility and Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions. To investigate the motivations of the students on learning chemistry that is related to the developed chemistry learning modules, the questions were raised to students by using standard questionnaire developed by Silitonga and Situmorang (2008), that were modified by Situmorang, *et all* (2009) which has been modified as explained in Situmorang, et.al (2011).

Table 4.5. The relationship between students' motivations with student's achievements by using developed chemistry learning module compare with chemistry textbook in the teaching of chemistry subjects of (a) Solubility and Solubility Product, (b) Hydrocarbons, (c) Thermochemistry, and (d) Oxidation and Reduction Reactions. Numbers in table are means of 30 samples.

No	Name of Schools	Module 1	Motivation component				Module 2	Motivation component				Module 3	Motivation component				Module 4	Motivation component			
		Post test	(1).	(2).	(3).	Total	Post test	(1).	(2).	(3).	Total	Post test	(1).	(2).	(3).	Total	Post test	(1).	(2).	(3).	Total
1	SHS N1 Medan (Exp)	79.75	40.19	39.19	15.78	95.16	85.50	38.30	46.32	13.82	98.44	80.66	38.19	37.19	13.78	89.16	74.71	37.30	45.32	12.82	95.44
	SHS N1 Medan (Control)	75.75	31.17	30.10	13.61	74.88	69.75	30.60	31.67	12.78	75.05	74.83	29.17	28.10	11.61	68.88	69.04	29.60	30.67	11.78	72.05
2	SHS N1 T Tinggi (Exp)	69.50	42.52	39.66	14.02	96.20	69.25	42.23	40.49	14.42	97.14	91.00	40.52	37.66	12.02	90.20	74.71	41.23	39.49	13.42	94.14
	SHS N1 T Tinggi (Control)	65.50	30.20	29.76	12.89	72.85	71.75	20.89	20.20	10.65	51.74	86.00	28.20	27.76	10.89	66.85	69.37	19.89	19.20	9.65	48.74
3	SHS N1 Brastagi (Exp)	66.50	42.60	36.49	13.01	92.10	53.75	42.70	40.89	13.71	97.30	81.66!	40.60	34.49	11.01	86.10	78.69	41.70	39.89	12.71	94.30
	SHS N1 Brastagi (Control)	59.00	25.18	30.25	10.38	65.81	50.25	25.51	29.80	10.19	65.50	65.00	23.18	28.25	8.38	59.81	76.05	24.51	28.80	9.19	62.50

Note: (1)-(3) = The category of motivation component in the instrument: (1) intrinsic motivation. (2) extrinsic motivation. and (3) environmental conditions

The questionnaire is consisted of three set of question categories with four options from strength opinion to weak opinions (Situmorang and Saragih, 2012). The components in the questionaire are consisted of the intrinsic motivation (1), the extrinsic motivation (2), and the environmental condition of the students on learning chemistry (3). After the teaching and learning process have been proceeded, the questionaire is distributed to the students and ask them to answer the questions realated to their motivation in the study for each of the learning modules. The summary of the students' achievements and their motivation in each of the target schools are presented in Table 4.5. The results showed that the students' motivations are vary between one schools with another target schools in their intrinsic motivation, extrinsic motivation, and the environmental conditions. The student motivations are distributed well due to the teaching treatment in experimental class and control class. Similar phenomena are observed on the students achievements in various schools on the teaching of chemistry subjects by using four modules, they are: (1) Module 1 with chemisytry topic of Solubility and Solubility Product, (2) Module 2 with chemisytry topic of Hydrocarbons, (3) Module 3 with chemisytry topic of Thermochemistry, and (4) Module 4 with chemisytry topic of Oxidation and Reduction Reactions (Table 4.5).

It is seen in Table 4.5 that the students motivation in experimental class which are treated by using developed chemistry learning modules are higer than those in control class that are treated by using existing textbook that are commonly used in the target schools. The same phenomena are found in all chemistry modules in the target schools, where the students achievements and students motivations ara higher than that in control class. It is believed that increasing in the chemistry achievements and motivations by the students are mainly effected by the influence of chemistry learning modules. The developed chemistry learning modules are able to motivate the students for self learning due to the facilities in the chemistry modules that could help sudents to learn by themself. The perfomance and the veasibilities of the developed chemistry learning modules are also make the students are interested to use the chemistry learning modules as main source to study chemistry.

It is seen that there are relationship between the students motivation with student achievements obtained from post test-1. The motivation of the students in experimental class are found higher than that in control class for all classes treated with different modules. The observation has been made in all experimental class showed that the students are very interested in using developed chemistry learning modules for self

study. It is seen in all experimental class that are using developed chemistry learning modules where the students are able to solve chemistry problems by the help of learning modules, and the results from evaluation test has showed that all students in experimental class have higher achievements compare to those in control class. The results showed that there is a positive relationship between the student's motivations with the student's achievement in chemistry subject of Solubility and Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions (r^2=0.862). The correlation of the student's achievements with the students motivations are believe due to the teaching module provided in their study. Many students are interested to learn chemistry by the help of the teaching module as media. The modules could help students to improve their study as they could learn the concept from module. The modules is also able to help students in solving complex problems in Solubility and Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions. It is clear that increasing the student's achievement in chemistry subject is related to their motivation in learning process as a results from the developed chemistry learning module provided in the teaching and learning process.

Using the same method to investigate the correlation between the students motivation with students achievement for control group has also been made. The results showed that there is a negative relationship between the student's motivations with the student's achievement in chemistry subject of Solubility and Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions BY USING conventional teaching (r^2=0.258). There correlation between the student's achievements with the students motivations are found very low. The results showed that many students are not motivated to study if only by using their existing text book.

4.5. Affectivity of the Lerning Module on Learning Chemistry

The affectivity of the developed chemistry learning modules into the student's achievement on the teaching of chemistry has been investigated in this study. The affectivity of the developed chemistry learning modules was performed by conducting the evaluation test after one month of the teaching treatments have been carried out to the groups of students. The component of the questions are arranged in the second evaluation test is almost the same as the question components in the first evaluation test, but the number of the chemsitry problems are rearranged randomly for all chemistry topics in all classes. The student's achievements based on the postest-2 is summarized in Table 4.4, and as the comparison for the results based on the postest-1 is summarized

in Table 4.3. Results on the second postest 2 showed that the student's achievement on the of students that are treated with developed chemistry learning modules in the teaching method has its achievement are higher than that thought with conventional method that is made as the control class. The affectivity of the teaching method is known from the time where the students still remember the subject matter in accordance with the teaching treatments were given in the teaching of chemistry. The affectivity of the developed chemistry learning modules is measured by comparing the student's achievement on solving the problem at the time the teaching treatments have been done compare to the student's achievement after a period of a month from the teaching treatment. The affectivity of the developed chemistry learning modules is compared, and the results showed that the affectivity of innovated learning module (114%) is higher than that with conventional methods (98%). The developed chemistry learning modules is effective in increasing the student's achievement on learning chemistry subjects of they are: (1) Module 1 with chemisytry topic of Solubility and Solubility Product, Hydrocarbons, Thermochemistry, and Oxidation and Reduction Reactions.

CHAPTER V
CONCLUSION AND SUGESTION

5.1. Conclusion

Chemistry learning modules have been developed and standardized to meet the requirement based on the KTSP curriculum. There are four chemistry modules have been developed. The chemistry learning modules have been used as teaching media in the teaching and learning process in RSBI schools. From the data obtained in the study, it is concluded:

1. Packages of good and standard chemistry learning modules have been developed to be used as a learning media on the teaching of chemistry in RSBI senior high school, they are: (1) Module 1 with chemisytry topic of Solubility and Solubility Product, (2) Module 2 with chemisytry topic of Hydrocarbons, (3) Module 3 with chemisytry topic of Thermochemistry, and (4) Module 4 with chemisytry topic of Oxidation and Reduction Reactionsis.
2. The developed chemistry learning modules are design well that are consisted of Competency Standards and Basic Competence, Standard Chemistry materials, Illustration, Problem solving, Evaluation Test, and Key answer that are design in easy reading, simple, and could be used for self learning.
3. The developed chemistry learning modules are effective to be used as learning media because they are suited to the need of students, be able to improve student's achievement on solving problems dealing with related chemistry subjects better than that with conventional teaching method by using existing chemistry text book.
4. The chemistry learning modules are found as suitable chemistry teaching and learning media on the teaching of chemistry because the design of the module is interesting, simple, and equipped with IT-base that be able to provide high communication on the teaching and learning process to meet the students achievement in chemistry.
5. It is found that there is a positive correlation between the developed chemistry modules with student's motivation on studying chemistry on the teaching of SHS chemistry topics of Solubility and Solubility Product, Hydrocarbon, Thermochemistry, and Oxidation and Reduction Reactions are high correlation (r^2=0.862), where for the teaching and learning with existing chemistry textbook the correlation is found very low (r^2=0.258).

5.2. Suggestion

From the results obtained in this study, some suggestion has to be raised in order the teaching and learning process on chemistry is effective in increasing the student's achievements, they are:

1. It is suggested to chemistry teachers to use standard innovated chemistry module in teaching of chemistry because the module is able to increase student's achievement and will give more interest impression learning than conventional teaching.
2. It is suggested to RSBI schools provide chemistry learning modules in their school to be used in teaching and learning process, especially for the teaching of chemistry based on the characteristic of the schools.

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SURAT PERJANJIAN PELAKSANAAN PEKERJAAN
(KONTRAK)
antara

DEKAN FMIPA UNIVERSITAS NEGERI MEDAN
Dengan
Prof.Drs.Manihar Situmorang,MSc.,PhD
tentang
PELAKSANAAN RESEARCH GRANT HIBAH PPG MIPA BERTARAF INTERNASIONAL

Nomor	:	0360 /UN.33.4/KP/V/2012
Tanggal	:	11 Mei 2012

Pada hari ini Jum'at tanggal sebelas bulan Mei tahun dua ribu duabelas, kami yang bertanda tangan di bawah ini:

1. Nama : **Prof.Drs.Motlan,MSc.,PhD**
   NIP : 195908051986011001
   Jabatan : Dekan FMIPA Universitas Negeri Medan
   Alamat : Jl. Willem Iskandar Medan Estate

Dalam hal ini bertindak atas nama Dekan FMIPA Universitas Negeri Medan yang selanjutnya dalam Surat Penjanjian Pelaksanaan Pekerjaan (Kontrak) ini disebut **PIHAK PERTAMA**.

2. Nama : **Prof.Drs.Manihar Situmorang,MSc.,PhD**
   NIP : 196008041986011001
   Jabatan : Dosen Jurusan Kimia FMIPA Unimed
   Alamat : Kompleks Grya Unimed Jl.Pelajar Timur Medan

Dalam hal ini bertindak selaku Ketua Pelaksana **RESEARCH GRANT HIBAH PPG MIPA BERTARAF INTERNASIONAL FMIPA UNIMED TAHUN 2012**, yang selanjutnya dalam Surat Perjanjian Pelaksanaan Pekerjaan (Kontrak) ini disebut sebagai **PIHAK KEDUA**.

Berdasarkan :Surat Keputusan Dekan FMIPA Unimed Nomor: 0344/UN.33.4/KP/V/2012 tanggal 6 Mei 2012 Tentang Penetapan nama penerima *Research Grant* yang didanai dari hibah PPG MIPA Bertaraf Internasional tahun anggaran 2012

Kedua belah pihak menyatakan setuju dan sepakat untuk mengikat diri dalam Surat Perjanjian Pelaksanaan Pekerjaan ini dengan Ketentuan dan Syarat syarat sebagaimana tercantum dalam Pasal-Pasal berikut :

Pasal I
PELAKSANAAN RESEARCH GRANT

Pihak Pertama menyerahkan Pekerjaan kepada **Pihak Kedua** untuk melaksanakan Research Grant yang berjudul: The Development of Chemistry Learning Module for RSBI Senior High School Student.

Pihak Kedua sebagai Ketua Pelaksana Research Grant, akan melaksanakan kegiatan dengan sungguh-sungguh dengan menggunakan standar norma pengajaran yang berlaku.

Pasal 2
HAK DAN KEWAJIBAN

2.1. **Pihak Pertama** menanggung biaya **Pelaksanaan** Pekerjaan sesuai dengan usulan atau proposal yang telah disetujui reviewer dan ketersediaan dana DIPA PNBP FMIPA Tahun Anggaran 2012

2.2. **Pihak Kedua** menerima biaya pekerjaan dan memberikan pertanggungjawaban administrasi pekerjaan dan keuangan kepada **Pihak Pertama.**

2.3 **Pihak Kedua** sebagai Ketua Pelaksana Pekerjaan berkewajiban menyampaikan Laporan Kemajuan Pelaksanaan **Pekerjaan** dan pertanggungjawaban biaya kepada **Pihak Pertama**

2.4 **Pihak Kedua** menyerahkan Laporan akhir sebanyak 7 (Tujuh) eksemplar kepada **Pihak Pertama** paling lambat 1 (satu) minggu menjelang masa akhir Pekerjaan

2.5 Laporan akhir sebagaimana disebutkan pada point 2.4 harus memenuhi ketentuan sebagai berikut: Ukuran kertas Kwarto, sampul kertas jeruk warna biru muda, dibagian bawah sampul dituliskan identitas sumber dana.

2.6. Hak cipta Research Grant ada pada **Pihak Kedua** sedangkan untuk penggandaan dan penyebaran laporan adalah wewenang **Pihak Pertama.**

Pasal 3
JANGKA WAKTU PELAKSANAAN

Jangka Waktu/Masa Pelaksanaan Pekerjaan ini selama 7 **(Tujuh) bulan** terhitung mulai tanggal 11 Mei 2012 sampai dengan 11 November 2012.

Pasal 4
BIAYA PENGAJARAN

4.1 Jumlah Harga/Nilai Kontrak adalah sebesar **Rp. 20.000.000,- (Duapuluh juta rupiah) yang dibebankan pada PROGRAM HIBAH PPG MIPA BERTARAF INTERNASIONAL FMIPA UNIMED TAHUN 2012,**

4.2. Pembayaran dilakukan 2 (dua) tahap yaitu:Tahap pertama sebesar 70% dibayarkan sewaktu surat perjanjian kerja ini ditandatangani kedua belah pihak.Tahap kedua sebesar 30% dibayarkan setelah **Pihak Kedua** menyerahkan laporan akhir Research Grant kepada **Pihak Pertama.**

Pasal 5
DENDA dan SANKSI

Apabila dalam batas waktu yang telah ditetapkan sesuai dengan pasal 2.4, **Pihak Kedua, belum** menyerahkan Laporan Akhir Research Grant kepada **Pihak Pertama**, maka **Pihak Kedua** akan dikenakan denda sebesar 1% dari Nilai Kontrak untuk setiap hari keterlambatan sampai dengan denda maksimum sebesar 5% dari Nilai Kontrak seluruhnya.

Pasal 6
PERUBAHAN

6.1. Apabila **Pihak Kedua** karena satu dan lain hal berkeinginan merubah Pelaksanaan Pekerjaan yang telah disepakati dalam Surat Perjanjian ini maka **Pihak Kedua** harus mengajukan permohonan perubahan tersebut kepada **Pihak Pertama**.

6.2. Perubahan Pelaksanaan Pekerjaan tersebut dapat dilakukan bila telah mendapatkan persetujuan secara tertulis oleh **Pihak Pertama**.

6.3 Apabila **Pihak Kedua** tidak dapat memenuhi Perjanjian Pelaksanaan Pekerjaan ini, maka **Pihak Kedua** wajib mengembalikan biaya Pelaksanaan Pekerjaan yang sudah diterimanya kepada **Pihak Pertama** untuk selanjutnya disetorkan kembali ke kas negara.

Pasal 7
TAMBAHAN

Surat Perjanjian Pelaksanaan Pekerjaan (Kontrak) ini ditandatangani oleh kedua belah pihak di Medan pada hari dan tanggal tersebut di atas, dibuat rangkap 3 (Tiga), dua diantaranya bermaterai cukup, yang masing-masing mempunyai kekuatan hukum yang sama.

Medan, 11 Mei 2012

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