4th International Seminar of Science Education

"Development of Science Curriculum in 21st Century"

Bandung, 30 October 2010

Proceeding
ISBN: 978-979-99232-3-3

Identification of problem difficulty in learning chemistry at Class XI of high schools in Lampung Province as input for LPTK (Especially Chemical Education Study Program of Lampung University)

Sunyono
Lecturer of Chemical Education Studies Program, University of Lampung
email: sunyono@unila.ac.id

ABSTRACT

Research on the identification of problem difficulty in learning of chemistry at class XI of high school conducted to identify the competencies and motivation to study for class XI, pedagogical competence of teachers, characteristics of the chemical concepts of class XI, and inputs for Chemistry Education Studies Program of Lampung University in developing a course curriculum. This research was performed in 5 districts, each district was taken 3 schools representing the Schools of National Standards (SSN), Potential Schools, and Pilot schools. Every school is drawn at random 10 people students at class XII to test the level of difficulty of chemical materials at class XI. As for the teachers in each school was taken two people of chemistry teachers from class XI. Results of the research showed that (1) pedagogical competence of teachers at class XI for all categories of school (SSN, potential, and pilot schools) identified middle category, (2) chemical materials difficult to be taught by teachers and difficult to study by students for all categories of school are the same, namely the materials of Thermochemistry, Reaction Rate and Chemical Equilibrium; (3) Content curricula in Chemical Education Studies Program has been aligned to the needs of the chemical substances in high schools, but the chemical materials are difficult to be taught by teachers and difficult to study by students, especially at class XI and the ability of students in exploring critical thinking skills have not received more attention.

Key word: Pesagogical Competencie, difficult, Standard national schools, potential schools, pilot schools.

BACKGROUND

Results of preliminary observations and discussions with some chemistry teacher of high school in Lampung Province are obtained that the results of studying chemistry of class XI students have been very low. Despite the various efforts made by teachers to improve student learning outcomes, but results are still far from expectations and still lower when compared with learning completeness criteria. The low student learning outcomes are allegedly due to motivation, interests and activities of students in the learning process is very low, so it looks the students are never prepared to accept the subject matter of each meeting.

Chemical materials first semester of high school of class XI containing enough concepts difficult to understand by the students, because it involves chemical reactions and chemical calculations, both in subject matter thermo-chemistry, reaction rate, and chemical equilibrium. Thus, delivery of chemical materials first semester of classes XI with demonstration and discussion methods seem less than optimal in improving student learning activities and interests, let alone implemented during this demonstration at any time simply due to limitations of equipment and chemical substances. In the learning process during this look less attractive, so that students feel bored and lacking interest in the chemistry lesson, the class atmosphere tended to be passive, very few students who asked the teacher even if the material is taught cannot be understood, as a result when the test was held, the value of chemical obtained by students is very low. In this kind of learning they will feel as though his soul was forced to learn so depressed. Circumstances cause annoyance, boredom, indifference, so that attention, interest, and student motivation in learning is low. This will impact on not reaching the goal of learning chemistry.

Results of the research conducted during this (Sunyono, 2005), was the low student learning outcomes are caused in general students had difficulties in problems solving involve chemical reactions and chemical matter, due to

the lack of understanding of chemical concepts and a lack of interest the students towards chemistry lesson. In addition, the teacher failed to give concrete examples of reactions that exist in the environment and often encountered students. Therefore, it takes an effort to optimize the chemistry lesson in class by applying the right approach and method.

Based on the above description, it can be said that the low activity, interests, and chemistry students' learning outcomes can be caused by several factors including: (1) Submission of materials chemistry by teachers with the methods of demonstration which only occasionally and discussions tend to make saturated students, students just crammed with information that is less concrete and less attractive because the discussion is theoretical, (2) Students were never given direct experience in observing a chemical reaction, so that students take chemistry subject matter is abstract and difficult to be understood, (3) teaching methods used by teachers less variable and not innovative, so boring and do not attract students. This demonstrates that competence of chemistry teachers who still needs to be improved.

The low activity in the study of chemistry students allegedly caused by chemicals is the science that is not useful in later life, in addition to the notion that chemistry is the science that is difficult to learn. To increase the interest and motivation to learn chemistry students, teachers need to make efforts to increase the quality of learning through creative and innovative activities. The learning of chemistry oriented to growth of critical thinking skills need to be developed, so that students can understand that chemistry is the science involved in everyday human life, so the above assumption can be minimized. Thus, the learning of chemistry should to consider the characteristics of students, characteristics of chemical materials, and condition of the school or school-owned facilities. Therefore, it is necessary to identify the learning problems of chemistry, in terms of student motivation and competence of students and the characteristics of the chemical concepts that students will learn.

The thinking process is a cognitive process, that is a mental activity to acquire knowledge and is a complex effort and reflective, and is an effort to gain experience creatively (Costa, 1985). Thinking skills can be grouped into basic thinking skills and complex thinking skills. Complex thinking skills commonly known as high-level thinking skills are also known as critical thinking and creative thinking. High-level thinking skills (critical and creative) seems suitable to be developed in the learning of chemistry in that the material most abstract, complex, and closely related to everyday life. Development of critical thinking skills in learning to prepare learners in towards the fulfillment of his own intellectual needs. Thus, the development of critical thinking skills in learning will involve students as thinkers rather than someone who learned in verbally. According to Ennis (in Costa, 1985), there are 5 indicators of critical thinking skills, namely: (1) a simple explanation, (2) develop basic skills, (3) concluded, (4) provides further explanation, and (5) set of strategies and techniques. Learning-oriented on developing critical thinking skills will be able to motivate student learning.

New paradigm in learning of chemistry, including chemical is learning where students are not only required to learn more about the concepts and principles of chemistry verbally, recitation, the introduction of formulas, and the introduction of terms through a series of verbal exercises, but should be in chemistry teaching, teachers give more experience to students to better understand and guide the students to use their chemical knowledge in his daily life (Gallagher, 2007). This is in line with the opinion of Piaget (1970) that a child will more easily digest the concepts and knowledge if in him the existing structures and intellectual stratum. Structure and intellectual stratum formed when the human intellect to adapt to things that are absorbed by the senses. Therefore that, in the learning of chemistry required high-level thinking skills.

The learning is oriented on developing critical thinking skills can be done through the learning by use process skills approach. The a process skills approach is an approach that puts the skills of science that includes basic skills in science and science process skills through discovery activities (Rezba in Prasetyo, 1998). Discovery learning model (inquiry) is one model of learning with the process skills approach that emphasizes on improving students' ability to process information, in the sense of how students capture the existing stimulus and save it as meaningful information in itself in the short term and long term, and using back that information to solve problems of interest (Aripin, 1995).

METHODS OF THE RESEARCH

The study was a descriptive qualitative research with a population of all high school students and teachers in the Province of Lampung. The research sample was taken from 5 districts, these are City of Bandar Lampung, Metro City, South Lampung, Tanggamus, and Central Lampung. In each district were taken 3 schools representing the high school of national standard school (SSN) (1 school), potential high school (1 school), and pilot high school (1 school). Every school is drawn at random 10 people class XII students to test the level of difficulty the materials of class XI. As for the teachers in each school was taken 2 person of chemistry teachers from class XI. Research instrument to identify students' competencies are arranged in the form of multiple choice questions with 5 options. To reveal the students' learning motivation, the instrument used is the motivation questionnaire with 5 Likert scale (Strongly Agree = SA, Agree = A, Doubt = D, Disagree = DA, and Strongly Disagree = SD), and scores are each SA = 5; A = 4, D = 3; DA = 2, and SD = 1). While the instrument for teacher is a questionnaire of pedagogical competence with four option multiple choice of 35 statements. To determine the chemical materials difficult to be taught by teachers conducted through interviews with chemistry teachers of class XI.

RESULTS AND DISCUSSION

A. Pedagogy Competencies of Teacher

The result of teachers' pedagogical competence questionnaire, obtained the striking differences between chemistry teachers in school of national standards, potential, and the pilot schools. Based on the results of data analysis, chemistry teachers' pedagogical competence of class XI is presented in the following table:

Table 1. Data of Chemistry teachers' pedagogical competence of class XI

Category of Schools	Competency Score
SSN	39,81
Potential	32,42
Pilot schools	31,37
Average	34,53

Maximum score = 50

Based on the above table, it appears that the pedagogical competence of teachers for each grade there is no difference, namely the competence of teachers for each category of schools in middle category, where the average score of chemistry teacher competence of class XI at 34.53.

B. Chemical Material difficult to be taught by teachers

The result of interviews with chemistry teachers of class XI was found that the level of difficulty of chemical material that is taught for each category of schools is not much different between high school teachers in the SSN, the potential high school teachers, and the pilot schools high school teachers. Questionnaire results are presented in the following Table 2.

Table 2. Analysis of Chemical Materials Difficult to be Taugh According Opinions of Teachers

Category of Schools	Materials of Class XI	(%)
SSN	Thermochemistry	80
	Reaction Rate	40
	Chemical Equilibrium	60
Potential	Thermochemistry	60
	Reaction Rate	60
	Chemical Equilibrium	40
Pilot schools	Thermochemistry	80
	Reaction Rate	80
	Chemical Equilibrium	60

Based on Table 2. shows that the chemical materials of class XI that difficult is taught in the opinion of teachers in a row are a Thermo (80%), Chemical Equilibrium (60%), and the rate of reaction (40%) for high schools of national standard (SSN). For potential high schools a difficult matters in a row are a Thermo (60%), rate of reaction (60%), and Chemical Equilibrium (40%). As for the pilot high schools, chemical materials of class XI that difficult is taught in a row are a Thermo (80%), rate of reaction (80%), and Chemical Equilibrium (60%).

C. Learning Model Used

In general, the chemical study carried out by teachers is learning with direct instruction approach that is still dominated by the teacher. Cooperative learning is often only used by high school chemistry teachers in the schools of national standard and potential, while at the pilot schools more lectures and exercises. Likewise, process skills approach through experimental methods are often only used by high school chemistry teacher at the schools of national

standard, while the potential schools rarely done, and even in the pilot schools have never done learning with practical, due to limited equipment and chemical substances.

D. Student Competencies

Basic competencies students are calculated through a diagnostic test of chemical materials in class XI in order to search for chemical materials which are difficult to study by students. For the purpose of these diagnostic tests can be achieved, then the questions on the test of chemical materials in class XI were tested in class XII, with the number of students who tested as many as 10 persons. The results of diagnostic tests of chemical materials presented in the following Table 3.

Table 3. Average Values of The result of Chemical Materials Diagnostic Test

Materials Tested	High Schools Category		
	SSN	Poten-tial	Pilot schools
Atomic Structure & Periodic System	58,00	52,67	44,00
Thermo chemistry	46,67	42,67	34,67
Reaction Rate	42,67	34,67	30,67
Chemical Equilibrium	32,50	26,50	29,50
Solution	49,00	46,50	36,00
Colloidal	65,33	56,67	56,00

Based on Table 3. chemical materials of class XI which are difficult to study high school students for all categories of school (SSN, potential, and pilot schools) in succession from the lowest to the highest values is the material of Chemical Equilibrium, Reaction Rate, Thermochemistry, Solution, Atomic Structure and the Periodic System, and colloid. The average value of the results of diagnostic tests for high school students in SSN is better than potential high schools and pilot high schools. From Table 3. can be said that learning chemistry of class XI in pilot high schools seems less good, so need to look for alternative learning solutions on difficult materials such.

Based on the analysis of student chemical competencies of class XI, was in accordance with the statement teachers (the interview) about the material that is difficult to be taught to students, namely materials are Thermochemistry, Reaction Rate and Chemical Equilibrium.

E. Student Motivation

Results of questionnaires about students' motivation are presented in Table 4. follows.

Table 4. Average Score of Student Motivation in Learning Chemistry

Schools Category	Average Score of Motivation	Information
National Standard Schools (SSN)	3,92	Good Motivation
Potential Schools	3,68	Good Motivation
Pilot schools	3,63	Good Motivation

Based on Table 4. is that high school students' motivation to learn chemistry for all categories of school (SSN, potential, and pilot schools) diagnosed with either (high). If viewed from an average score of the student's motivation shows that students from SSN has a higher motivation than students in potential schools, and the pilot schools. The difference between high school students from potential schools and pilot schools is no different, with the difference score was not far adrift.

F. Analysis of Chemistry Education Studies Program Curriculum and its relation to the Materials Chemistry of Class XI

In the curriculum of Chemistry Education Studies Program in 2008, subjects related to chemical materials difficult to be taught by teachers and difficult to understand students in class XI are Basic Chemical Subjects, Physical Chemistry I, Physical Chemistry II, Chemical Solution, Schools Chemistry Curriculum Review, and Methodology of Learning Chemistry. The content of each course can be seen in the following Table 5.

Table 5. Contents of Curriculum of Chemistry Education Studies Programs Directly Related to the Materials Thermochemistry, Reaction Rates, Chemical Equilibrium, and the solution.

No	Subjects	Description of Subjects	The content of SMA materials in Class XI
1	Basic Chemistry	This course provides a chemical basis starting from the knowledge of chemistry gained from high school.	All Material contained in the Competency Standards (SK) and Basic Competency (KD) of subjects Chemistry
2	Physical Chemistry I	This course is an introduction to understanding the chemical theory relating to various types of energy, the direction of the process, state of equilibrium, and equilibrium phase.	SK and KD are containing Material of Thermochemistry.
3	Physical Chemistry II	This course is an introduction to understanding the ongoing rate of a chemical process in terms of physical chemistry through a discussion of the microscopic approach.	SK and KD is containing Materials of Rate of Reaction and Chemical Equilibrium
4.	Chemical Solution	Discussion includes the concentration of the solution, a solution of electrolytes and non electrolytes, salting reaction, the equilibrium of ions in solution, and redox reactions.	SK and KD are containing Materials of Chemical Equilibrium, Solutions, and Redox.
5.	Schools Chemistry Curriculum Review	This course to train and develop students' ability in high school chemistry curriculum outlines. In the execution of the activities covered by the review syllabi, and teaching materials used in high school.	All Materials contained in SK and KD subjects Chemistry.
6.	Methodology of Learning Chemistry	In a lecture this course students are expected to understand the chemical nature, the nature of learning and learning event, learning models of chemistry and their implications, and practicing some chemical teaching models	In connection with the selection of learning strategies by teachers to implement learning materials of chemistry.

When seen from Table 5. such, it appears that there is linkage content of lectures from some courses with a breadth and depth of chemical materials in high school of class XI in particular the first semester, as well as associated with the deepening of the content of the curriculum chemistry (SK and KD) of high school and learning strategy selection for each chemical material in high school. Thus, students pre-service teacher were provided with both the substance of science to master the material chemistry in high school, and a variety of techniques and teaching methods for different material characteristics of chemistry. However, based on research results turned out to teachers still have difficulty in teaching some chemical materials (such as thermochemistry, the rate of reaction, chemical equilibrium, and solution), as well as chemistry teachers are still difficult in exploring students' critical thinking skills through learning in the classroom, and through activities practicum in the lab. Therefore, the contents of lectures for several courses that need to be improved both the substance and the skills of students, especially in developing critical thinking skills. Improvement courses should be refer to the contents of some chemical materials difficult to be taught by teachers, especially in lecture courses such as Chemistry Curriculum Review, Methodology of Learning Chemistry, and Advanced School Chemistry.

CONCLUSION

1. Pedagogical competence of Chemistry teachers at class XI for all categories of

school (SSN, potential, and pilot schools) identified middle category.

2. Chemical materials difficult to be taught by teachers and difficult to study by students for all categories of school is the same, namely the material Thermochemistry, Reaction Rate and Chemical Equilibrium.
3. Content curricula in Chemical Education Studies Program has been aligned to the needs of the chemical substance of the material in schools, but the chemical materials are difficult to be taught by teachers and difficult to study by students, especially at class XI and the ability of students in exploring critical thinking skills have not received more attention.

REFERENCES

Aripin, M., 1995. *Pengembangan Program Pengajaran Bidang Studi Kimia.*, Penerbit: Erlangga. Jakarta.

Costa, A.L. and Presseisen, B.Z., 1985. *Glossary of Thinking Skill.*, Developing Minds: A Resource Book for Teaching Thinking,. Alexandria: ASCD.

Gallagher, J.J., 2007. *Teaching Science for Understanding: A Practical Guide for School Teachers.,* Pearson Merril Prentice Hall. New Jersey.

Liliasari., 2007. Scientific Concepts and Generic Science Skills Relationship In The 21st Century Science Education. ***Seminar Proceeding of The First International Seminar of Science Education.,*** 27 October 2007. Bandung. 13 – 18.

Piaget, J., 1970. *Genetik Epistemology.* Columbia University Press. New York.

Prasetyo, Z.K., 1998. *Kapita Selekta Pembelajaran Fisika.*, Universitas Terbuka, Depdikbud. Jakarta.

Roestiyah, N.K., 1985. *Masalah Pengajaran Sebagai Suatu Sistem.,* Penerbit: Bina Aksara. Jakarta.

Sunyono, 2005., Optimalisasi Pembelajaran Kimia pada Siswa Kelas XI Semester 1 SMA Swadhipa Natar melalui Penerapan Metode Eksperimen Menggunakan Bahan yang Ada di Lingkungan., *Laporan Hasil Penelitian (PTK)*, Dit.PPTK & KPT Ditjen Dikti, 2005.