The need analysis of chemistry module based on REACT (relating, experiencing, applying, cooperating and transferring) to improve critical thinking ability

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Abstract. This research was aimed to find out how students’ need of chemistry module based REACT (Relating, Experiencing, Applying, Cooperating and Transferring) to improve students’ critical thinking ability. The subjects of this research was the students of XI grade in three school in even semester of academic year 2016-2017 that contained of 48 students of Senior High School 2 Bandar Lampung, 38 students of Senior High School 3 Bandar Lampung and 46 students of Senior High School 12 Bandar Lampung. The data was gathering used non-test method by using open questionnaire with 13 questions. The results showed that 84.84% of students stated that the development of chemistry module based REACT on colloid material is needed. The analysis of hand’s book was used aspects of critical thinking proposed by Facione (2011) are interpretation, analysis, evaluation, conclusion, and explanation. Based on the result of the analysis of hand’s book at Senior High School 12 Bandar Lampung for critical thinking in colloid material that indicate 50% indicator is appropriate, while for indicator of inference and explanation only 16.67% appropriate, then for indicator analysis and evaluation doesn’t have conformity. Based on the results of the analysis shows that the hand’s book used have not empowered critical thinking ability with maximum. The development of chemistry module on colloid material is needed to overcome the problem of hand’s book that hasn’t maximized critical thinking ability, then the development of module oriented to REACT learning model (Relating, Experiencing, Applying, Cooperating, and Transferring).

Key words: critical thinking ability, module, REACT

1. Introduction

Education is a process in influencing students to adjust to the environment, so that students are expected to function in the life of the community. The government seeks to improve the quality of education through the development of the education system, including in the 2013 curriculum and the Law on the education system. One of the objectives to be achieved through education is the formation of an Indonesian human who has the spiritual, religious and life skills and intelligence needed for himself, the people, the nation and the state, in accordance.

The curriculum of 2013 has one of the characteristics of developing core competencies. The core competencies emphasize to students to have religious competence, social competence, cognitive competence and good psychomotor competence. Ideal learning process can involve students actively and not only emphasizes the cognitive aspect but also on the psychomotor and affective aspects. The
expected learning is innovative learning, relevant to the needs and the active role of the students in learning.

One of the abilities that must be developed in chemistry learning is critical thinking skills. Critical thinking skills of students is the ability of high-level thinking is important to have students because of the ability to think critically can equip students in facing problems in the future not only in classroom learning. Critical thinking skills is one of the characteristics of scientific attitude which is one of the goals of chemistry education in high school. The guidance of critical thinking at all levels of education is felt to be very important, so how to teach students to think critically is an important issue in education.

Critical thinking can’t be taught through lecture methods, because critical thinking is an active process. The intellectual skills of critical thinking include thinking of analysis, thinking synthesis, reflective thinking and should be learned through actualization of appearance. Critical thinking can be taught through laboratory activities, inquiry, term paper, homework that presents opportunities for evocative thinking, and exams designed to promote critical thinking skills [1].

Modules can potentially trick critical thinking skills because critical thinking trainings can be done independently, flexibly and repeatedly. Learning using a module allows students to enhance optimal learning activities in accordance with the level of ability and progress students gain during the learning process [2]. The module can potentially improve students' critical thinking skills if the contents of the module can spur students to solve and analyze problems and evaluate information [3]. Teaching method and approach will determine the level of proficiency of students. Teachers should use student-centered approach to stimulate the students mind thus help students acquire and master the knowledge [4].

Based on observations in three state high schools in Bandar Lampung indicate that the learning process that is carried out by teachers in general is still a teacher center and students are given less opportunity to develop the thinking skills (student center). Student participation to study chemistry is very low, it is proven when the researcher participate in teaching and learning activity seen the student just listen and record explanation of teacher in front of class. Students in Senior High School 3 Bandar Lampung during the learning process only hold on to worksheets as learning resources, while for Senior High School 12 Bandar Lampung, student learning has been given facility in the form of printed book which is loan from school. Based on the results of the analysis of teaching materials using aspects of critical thinking proposed by[5] indicates that the teaching materials used have not empowered critical thinking skills with the maximum.

To overcome the problem of teaching materials that have not maximized critical thinking ability, the development of module oriented to REACT learning model (Relating, Experiencing, Applying, Cooperating, and Transferring). Activities based on REACT strategy increase students’ interest and affect their learning positively. According to physics students, learning process gained more meaning because they could enjoy the learning process by directly apply it in real activities and know the implementations of what they learned. Learning process remained as a real experience [6]. Based set of problems above, this study makes early analysis about students’ need for REACT based chemistry module.

2. Theoretical Framework
2.1. Theory of Learning
In the view of constructivism, learning is an active process that students build their own knowledge [7]. Therefore, students must be actively involved and students become center of learning activities in the classroom. The constructivism approach in teaching applies cooperative learning on the theory that students will more easily find and understand difficult concepts when discussing such issues with their peers [8].

Vygotsky's theoretical implications of learning using this module apart from being used as independent teaching materials, this module is also integrated in learning through discussions and experiments conducted in small groups. Providing assistance in the form of guidance, warning,
encouragement by the teacher during the early stages of learning is done so that the more students can take over responsibility independently. Knowledge was shaped by the student through a problem or case given by the teacher associated with the application in the daily life of the environment, so that students are expected to gain meaningful learning [9].

2.2. REACT Learning Model

REACT learning model according to [10] has stages as follows: (1) relating, (2) experiencing, (3) applying, (4) cooperation, and (5) transferring. Here is a process of implementation of learning with REACT learning model which is a cycle of activities, meaning the process is never interrupted.

REACT learning model has several advantages compared with conventional learning, which are: (1) The relating stages in this model can help teachers in relating the material / concepts that are taught to real situations, (2) The experiencing stage can encourage students in connecting the knowledge they already possess with its application in daily life, (3) The applying stage can increase students’ understanding of the material given by the teacher by linking it to everyday life, so the material can be easily understood without having to memorize it, (4) The cooperating stages can increase student activity in the learning process where students are asked to be active in cooperating with friends of one group, and (5) The transferring stages can improve students' ability in conveying or transferring a new concept into a more complex problem [11].

REACT methodology can be applied in context based teaching successfully (1) when the projects and activities are chosen that are related to students’ daily life, (2) when students are motivated to get necessary data, (3) when students get the chance of applying of knowledge, (4) when students study cooperatively, (5) and when students are helped to discover connections that enable them to transfer knowledge from one context to another [12].

Teachers can maximize the outcomes of this type of learning by successfully applying the REACT strategies in their everyday lessons: relating what is being taught into the context of the real world, experiencing the new knowledge, applying new concepts to the real world situations, solving problems by communicating with each other, and transferring that knowledge to an experience that they will have in the future [13]. In the contextual learning process, learning occurs when the content of the knowledge creates meaning in learners’ mind, making connection between the context to be studied and real world situation. This is because students could learn a lot of physics terms in the learning process [6]. Learning based on REACT methodology may train students’ critical thinking ability.

2.3. Critical Thinking Ability

Critical thinking is thinking to systematically investigate the thought process itself. It means not only deliberate thinking, but also exploring how we and others use evidence and logic [14]. Critical thinking in terms of these skills, identifying assumptions, checking out the validity of them, examining different perspectives, and then making informed decisions [15]. Critical thinking aims to achieve a critical assessment of what we will receive or what we will do for logical reasons [8]. Critical thinking was focuses on skills as involving solving problems, formulating inferences, calculating likelihoods, and making decisions [16]. According to definitions above, critical thinking means one’s ability to process consideration about some information with their cognitive ability. Critical thinking aspects are interpretation, analysis, evaluation, inference, explanation, and self-regulation [5].

2.4. Module

Module as an independent learning package that includes a series of experience learning experience that has been planned and systematically designed to facilitate students in achieving learning objectives [17]. Module is one of learning material which is intact and systematic. It includes set of planned learning experiences and is designed to help students master the goal of the learning [18].
3. Method
The research method used is qualitative method. The data were collected by four stages, that were observation, interview, questionnaire distribution and material analysis. The study was conducted in February 2017 at three public schools in Bandar Lampung. The subjects of the study were students of class XI IPA of 134 students that contained of 48 students of Senior High School 2 Bandar Lampung, 40 students of Senior High School 3 Bandar Lampung, and 46 students of Senior High School 12 Bandar Lampung. The interview stage was conducted to 3 chemistry teachers, to know the condition of the school and the process of learning activity in the classroom directly by the speaker ie the chemistry subject teacher. Observations were made by collecting data on the state of the school and the ongoing learning process. The questionnaire distribution stage is given to the students. Questionnaire given in the form of an open questionnaire, to find out the reason students answer yes or no on each question. Calculated percentage of students answered yes and no for each question, then analyzed to know the needs of students of chemical modules Then the last stage of the analysis of teaching materials done by assessing the suitability of the content, delivery and use of books and modules using aspects of critical thinking skills by [5]. Result of analysis of teaching materials used to know the extent of fulfillment of each aspect of critical thinking in teaching materials used in Senior High School 2 Bandar Lampung, and Senior High School 12 Bandar Lampung.

4. Result
Observation has done by collecting data about the state of the school and the learning process that took place in Senior High School 2 Bandar Lampung, Senior High School 3 Bandar Lampung and Senior High School 12 Bandar Lampung directly. Based on the observations in Senior High School 3 Bandar Lampung shows that the learning process that is implemented by teachers in general is still the teacher centre and students are given less opportunity to develop the thinking skills (student centre). During the learning process, students only stick to the student worksheet as a learning resource. Student participation to study chemistry is very low, it is proven when the researcher participate in teaching and learning activity seen the student just listen and record explanation of teacher in front of class. However when students are confirmed about the material presented by the teacher, students can not answer and the chemistry concepts obtained are less precise. Similarly, the observation results at Senior High School 12 Bandar Lampung, that the study of chemistry is still using the lecture method. Through this method, teachers play an active role so that students are not given space to develop their potential. During the learning process students have been given facilities in the form of a printed book that is a loan from the school.

Questionnaires are given to students to find out the students’ needs on chemical modules. Questionnaires pertain to chemical books used by students, systematic modules, modules that help develop critical thinking skills, and modules equipped with practicim activities. From the result of questionnaire, it is known that students do practicum in chemistry learning (35.82%), laboratory and library availability can help to understand chemical concept (41.79%), using chemistry book as study guide (65.67%), chemistry book (54.47%), students use more than one chemistry book for additional literature (47.76%), teachers use special teaching materials to teaching chemical concept (29.8%), teacher give chemical module to study chemical concepts (45.98%), students enthusiastic in following chemistry lessons (81.34%), easy to understand colloidal material (55.22%), students find difficult to understand colloidal material with chemical books they use and methods applied by teacher (44.02%), teacher used contextual learning method in chemistry learning process (35.07%), student need alternative teaching material to learn colloid concept with more easy and interesting (79.1%), students agree that module based REACT help them to understand colloid material(84.84%).

The analysis of teaching materials conducted using aspects of critical thinking proposed by [5] are interpretation, analysis, evaluation, conclusion, and explanation. Based on the results of the analysis of teaching materials at Senior High School 2 Bandar Lampung indicates that 50% of interpretation indicators are appropriate, while for the analysis and explanatory indicator is only 16.67% appropriate, and for the conclusion indicator is only 33.33% appropriate. Then for the evaluation indicator there
has been no compliance. Similarly, the result of the analysis of teaching materials that have been done in Senior High School 12 Bandar Lampung obtained for critical thinking ability in Colloidal material is showing 50% indicator of interpretation is appropriate, while for indicator of inference and explanation only 16.67% accordingly, then for indicator analysis and evaluation there is no match. Based on the results of the analysis shows that the teaching materials used have not empowered critical thinking skills with the maximum. So it is necessary to develop modules on colloidal material.

5. Discussion and Conclusion
The students’ need for modules based REACT is reinforced by the results of the questionnaire given to the students. Students of Senior High School 2 Bandar Lampung and Senior High School 12 Bandar Lampung have used the book as a source of reference learning, while students in Senior High School 3 Bandar Lampung only use worksheet as a learning resource. Books used in schools have not empowered critical thinking skills to the maximum.

Another finding is that the teaching experience given by the teacher is more emphasized on lecture, exercise and laboratory is not optimal. These activities seem monotonous and have not emphasized the students' active activities in building the concept. One way to tackle the problem is to use an innovative model of learning that is appropriate in its application in the classroom.

Modules that have the potential to improve students' critical thinking skills are activity-based modules one of them is a module oriented to the REACT learning model. Modules based REACT are modules that are characterized by the syntax of REACT learning proposed by [10]relating, experiencing, applying, cooperating and transferring. This module based REACT is used by students as a guide in studying chemistry as in colloid material. Based on the above description it can be concluded that students need modules based REACT to improve critical thinking skills.

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