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OPPORTUNITY INTEGRATED ASSESSMENT TO MEASURE CRITICAL THINKING AND SCIENCE PROCESS SKILLS IN INTEGRATED MANNER IN CHEMISTRY LEARNING

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Abstract

Students should be prepared to cope with this world with higher level skills involving critical thinking and science process skills, so that they can solve problem in education learning and other fields. Besides, the main reason is those skills should not be separated. Critical thinking skills can be developed by enriching students' process skills. Getting students to think critically and act in accordance with science process skills that students have will improve their cognitive and skill aspects. Unfortunately, those students' ability is not balanced with the current assessment. The prior assessment should be changed to integrated assessment that provides a framework for assessing both students' critical thinking and science process skills. It enables teachers to determine the extent to which students are reasoning critically by integrating science process skills as primary tool for learning. The purpose of this study is to find why integrated assessment is needed to measure critical thinking and science process skills in integrated manner.

Key words: critical thinking skills, integrated assessment, science process skills

INTRODUCTION

Nowadays, we are in the area of science and technology where scientific knowledge has grown exponentially and technology has progressed at rapid pace. Science education plays a role major for the futures of societies. Globally, countries have continuously sought to improve the quality of science education particularly developing countries. Based on UU 20/2003 (Depdiknas, 2003) the government construct curriculum to produce human resources who are productive, creative, inovative, and affective througout attitude, skills, and knowledge in integrated manner. Those potency can be materialized if the science learning process can grow students' critical thinking and science process skills, so do chemistry as a part of science.

Recognizing the importance of the development of critical thinking and science process skills, lately several studies that are related to that have been done. The reasearch

conducted by Rahma (2012) has established that students in SMAN 2 Semarang have low critical thinking skills. Besides, according to a research conducted by Sukarno (2013), the training for the development of science process skills of students at school is a necessity. In Jambi, training and development of students' science process skills in science teaching and learning activities are still relative low. Research has repeatedly shown, however, that students and teachers can be excited by chemistry activity involving creativity, problem solving, modelling, and interest-led projects (Howes, 2013). This trends raises issues about how chemistry is taught in schools.

Getting students to think critically and act in accordance with science process skills that students have will improve their cognitive and skill aspects, hence it is important for teacher to be able to create assessment and questioning strategies. In general, current assessment practices do not fit the needs and demands of today's information and knowledge societies (Birenbaum, 2011). Furthermore, current assessments is not enough because more focus on cognitive than skill aspect. It will become a great step to develop an instrument that can measure critical thinking and science process skills in integrated manner. Therefore, this study literature focuses on integrated assessment. Thus, the purpose of this study literature is to find why integrated assessment is needed to measure critical thinking and science process skills in integrated manner.

DISCUSSION

Students should be prepared to cope with this world with higher level skills involving critical thinking and science process skills, so that they can solve problems in education learning and other fields. In other words, Aktamis (2008) argued that the purpose of science education is to be able to define the problems around them, to observe, to analyze, to hypothesize, to experiment, to conclude, to generalize, and to apply the information they have with the necessary skills. Besides, the main reason is those skills should not be separated. In science process skills, students are demanded to solve problem requiring thinking critically. Critical thinking and science process skills are both essential for students in all aspects of science studies. Students must be capable of knowing, doing, and thinking. They should possess the dispositions and thinking skills necessary to work with and solve problems. However, Rollins (1990) conveyed that to apply the principles of critical thinking requires a level of competency over and above knowledge themselves.

The characteristic of critical thinking skills have been described in various perspectives by scholars. Ennis (1993) defined critical thinking as the upper three levels of

Blooms' taxonomy of educational objectives (analysis, synthesis, and evaluation). Furthermore, Moore (2010:6) explained those three levels: (1) analysis is breaking information into parts and examining those parts by looking for relationship, (2) synthesis is taking something apart and creating something new, (3) evaluation is judging something based on a set of criteria. Piaw (2010) declared that in Bloom's taxonomy of higher thinking, the evaluation skills is the highest level of effective learning and thinking processes. Other scholars (Beyer, 1995) offered the simple definition of critical thinking: critical thinking means making reasoned judgments on statements, new ideas, arguments, research, etc. Critical thinking is an element and has a central role in education (Moon, 2008:7). Based on the theories and researches evidences documented by scholars, we describe that critical thinking plays a role major in education and can lead students to solve problem by making reason critically.

Other main skills that students should have to develop their fundamental scientific understanding is science process skills. Sukarno (2013) declared that in science teaching and learning activities, it is important to develop science process skills to ensure that students master the concepts taught well. Science process skills include skills that every individual could use in each step of his/her daily life by being scientifically literate and increassing the quality and standard of life by comprehending the nature of science (Aktamis, 2008). Therefore, these skills affect the personal, social, and global lifes of individuals. The science process skills is the process of doing science that scientist use in the process of doing science. Since science is about asking questions and finding answers to questions, these are actually the same skills that we all use in our daily lives as we try to figure out everyday questions.

Assessment and learning are two sides of the same coin. Assessment provide an operational definition of standards, in that they define in measurable terms what teacher should teach and students should learn (National Academy of Sciences, 1996: 5). Teacher should constantly and consistently be assessing what they teach. Otherwise how will teacher know whether the students have learned what has been taught. Unfortunately, those students' ability is not balanced with the current assessment. The prior assessment should be changed to integrated assessment that provides a framework for assessing both students' critical thinking and science process skills. As a consequence teacher should be able to construct accurate assessment for measuring those skills. The engagement of critical thinking and science process skills opens opportunity integrated assessment to measure those skills in integrated manner.

Current assessments in chemistry learning focus on cognitive skills rather than process

skills. Meanwhile the nature of chemistry is defined as a body of knowledge, a way of investigating, and a way of thinking. Mutisya (2014) argued that those are connected each other because science process skills promotes development of the students' cognitive domain. Thus, integrated assessment is a good tool to assess students' skills. The teacher should realize that integrated assessment focuses on assessment of learning rather than assessment for learning. Birenbaum (2011) declared that they are limited in scope and lead to teaching for assessment, not teaching for learning. However, it is a big deal to assess both critical thinking and science process skills.

Critical thinking can be very difficult to measure in part, this is because critical thinking is an ongoing process rather than a recognizable outcome. Brookfield (Askins, 2006) stated that critical thinking means that an individual is continually questioning assumptions, considering context, creating and exploring alternatives and engaging in reflective skepticism. The science process skills might become difficult aspect to assess because it ensures that students master concepts taught well. Fortunately, tools have been developed to capture this difficulty, such as California Critical Thinking Skills Test (CCTST), Critical Thinking Rubric used by Northeastern Illinois University (NEIU), Science Process Skills Performance Test (SPSPT), and many others. However, in our country such instrument is not developed well.

Chemistry is fully understood or not is determined through measuring critical thinking and science process skills. It is because curriculum in Indonesia (K-13) demands students to get involve in engagement between cognitive and process skills. Thus, the teacher is expected can assess comprehensively. On the other words, the assessment includes many aspects in learning competency in accordance with the context, wheter process or result evaluation. Basically, assessment is teacher's activity to find the level of success that student has been achieved. It must be remembered that the purpose of assessment is not only to rank the students' performance, but to improve their learning (Hunter, 2003). The issues in reality is that teacher is tend to be assessing cognitive than science process skills. Those should be changed, so that the goal of chemistry learning can be reached.

It has been said by one of the UK Examination Boards that,

“assessment can be used as a means of selection, as a way of diagnosing strenghts and weakness, and to assisst with evaluation. Its most important use, though, is for judging performance in education and training so that qualifications may be awarded”
(Scottish vocational Council [SCOTVEC], 1993).

Therefore, Hunter (2003) stated that as an Examination Board SCOTVEC use assessment as a

means of awarding qualifications. The instrument integrated assessment has function to provide advanced assessment and to provide information for the teacher (van der Sluijs, 2002). In integrated assessment, each question have two indicators: critical thinking and science process skills. It means that the integrated assessment is multi dimensional assessment. Besides, it can benefit for students because they are given a chance to answer the question independently, as a result teacher can investigate the student's ideas. Basic content knowledge can be assessed through multiple choice, but critical thinking and science process skills is effectively assessed through essay. This can promote student growth in variety of dimension and develop their ideas.

CONCLUSION AND SUGGESTION

This study concludes that assessment instrument should balance with the students' cognitive and process skills. Hence integrated assessment should be developed in order to measure critical thinking and science process skills in integrated manner in chemistry learning.

Further studies could construct valid and reliable integrated assessment measuring critical thinking and science process skills in integrated manner in chemistry learning. In addition, the integrated assessment can be applied as an accurate assessment tool in right condition.

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