

The Motivation Level of Learning Chemistry among Secondary School Students

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Abstract

Students enrolment in chemistry course are decreasing from elementary school towards higher education level. Studies made by some researchers issues several factors that lead to student's motivation towards the subjects itself. Many researchers found out that, the lack of motivation among students are oriented in cognitive, affective and conative aspect. Students are not cognitively motivated if they're facing the lack of understanding in the content and purpose of the activity done in the learning process. An affective motivation in learning are referring to the emotional and value of the subject learned whilst conative aspect are more focusing on willingness and effort made by students in achieving their target in their learning process. All of these three aspect of motivation must not been taken for granted in order to enhance students interest in chemistry subject not just in school but also towards higher education level.

Keywords: students motivation, cognitive, affective, conative, chemical education

1.0 Introduction

Students' enrolment in science stream course, particularly in Chemistry continued to decline until 2012 (Razali et al, 2013). In fact, according to a report by the Ministry of Education (MOE, 2013), the situation is more worrying in higher education. According to a study done by Fatin et al (2010), among the factors contributing to this problem is related to students' internal motivation and external motivation. The internal motivation is related to the students' interests, self-learners attitude and efforts which also involves in students' understanding of subject content. It turned out that, internationally the lack of motivation factor is the main cause of the deterioration of the enrolment in Chemistry subject or even a career in a related field as mention by Salta et al (2012) in Greek case, Smith et al (2014) in

USA, Potvin & Hasni (2014) in Canada, Guvercin et al (2010) in Turkey, and by Devetak et al (2009) in Slovenia. On the other hand, the external motivation involves the encouragement of parents, exposure to careers especially in the field of chemistry and the school infrastructure especially in rural areas. However, this research study is focusing more in internal motivation factor whilst the external factor are considered as the manipulated variable is the urban and rural school's status.

2.0 Motivation

The term of motivation derives from the Latin root which means Stimulate. According to Pakdel (2013) motivation is behaviour that cannot be observed directly which consist of justify the behaviour and purpose of a behaviour with appropriate consuming energy. Furthermore, motivation is often considered as an inner drive for behaving or acting in a certain manner and it has been repeatedly reported as a key element for students' success in learning (Jovanovic & Matejevic, 2014).

Other than that, motivation is also seen from several different aspects of physiological, social, psychological and learning. Motivation from the physiological aspects are related to the satisfaction of biological needs such as the need for food and drinks in which an individual will be motivated emotionally if requirements are met (Bradley, 2000). Whilst Motivation from the social aspect refers to the satisfaction of an individual's social network in terms of obtaining a good colleague, friendly manager and also occupy the rightful position will make an individual more motivated at work (Forgas et . Al, 2005). Next, motivation of the psychological aspect refers to the attitude and the desire of individuals in achieving something desired (Huitt, 2011). Last but not least is motivation from the aspect of learning which refers to the internal attitude and role of an individual student satisfaction in learning that can be achieved apart from the influence of external factors.

3.0 Motivation in Learning

Learning is basically hard work which requires a person to push his brain to its limits, and thus can only happen with motivation (Wieman, 2013). Highly motivated students will learn enthusiastically, while unmotivated students will learn very little and generally feel the teaching and learning process are painful and frustrating (Chang & Chang, 2012, Mohd Aderi et. al, 2013). Consequently, internal motivation involved is consistent with the factors mentioned by Huitt (2011), that the lack of motivation in learning is oriented from the cognitive, affective and conative aspect.

3.1 Cognitive Aspect

Cognitive term is related to the word cognition which represent a mental action or process of acquiring knowledge and understanding through thought, experience, and senses. The term used in the world of cognitive psychology and also means the same that it is the study of thought processes and basic mental events (Wikibooks.org, 2013) . In the concept of learning motivation, the cognitive theory pioneered by Jean Piaget around the year 1920. He suggested that an individual has an internal motivation to learn without the need for external motivation boost from others (Tollefson, 2000).

One of the theory that explains the motivation cognitive motivation is the expectancy theory that introduced by Vroom (1964). Vroom suggested that the motivation is explained by the following equations :

$$\text{Motivation} = \text{Perceived Probability of Success (Expectancy)} \times \\ \text{Connection of Success and Reward (Instrumentality)} \times \\ \text{Value of Obtaining Goal (Valance, Value)}$$

According to the formula, if one of the factors value (of 3 factors to be multiplied) is low, then the motivation will also be low or vice versa. Therefore, in order to ensure the resulting motivation is high, these three factors should have a high value. In other words, if a student does not have the confidence or expectations of success or couldn't see the connection between the activities undertaken by the success or the student couldn't evaluate the results from the success, it is likely to reduce the student engagement in learning activities (Huitt, 2011).

The second approach known as cognitive theory in which the theory of cognitive dissonance introduced by Leon Festinger (1957) is the same as the level of cognitive imbalance inherent in Piaget's theory of cognitive development (Huitt, 2003). This theory explains that an individual will act to find a solution when there is a conflict between the two faiths, two actions or between beliefs and actions . However, too much inequality will cause a change in attitude on the individual self and will result in changes to the mindset that will lead to more changes in attitude.

Generally, the ability to think critically and creatively and the ability to solve problems is an important component of learning. However, study shows that some students find learning activities are unrelated and unimportant in their daily lives (Muhamed Yusuf, 2011). The study also found that students are more motivated to do their school assignment when the assignment objective is in line with their needs, requirements, and expectations (Zins et al, 2002). In addition, students also face the lack of cognitive motivation when they do not believe or are not capable of achieving the desired objectives of the study (Wigfield, 2000). Furthermore, study also showed that the consideration of students and their confidence to do well in chemistry classes is declining over time (Salta & Koulougliotis, 2014).

In addition, the difficulties in learning Chemistry that also involves cognition process has been around for decades, especially for a topic that involves microscopic world like the concept of moles, atomic structure, kinetic theory of matter, ionic and covalent bonds and metallic bonds (Sirhan, 2007). This problem is usually consolidated with a misunderstanding or misconception of basic concepts such as the topic on the particle theory (Takbir Ali, 2012). More alarming, cognitive problems due to the difficulty of motivation for Chemistry will be prolonged up to the higher level as a result of students' failure in understanding the basic concepts in chemistry (Woldeamanuel, 2014). Obviously, the difficulty of the subject and the problems this misconception is geared to the characteristics of the cognitive deficits in motivation in Chemistry learning.

4.2 Affective Aspect

Affective is referred as an emotional demands and the reaction of an individual to a stimulus environment. In addition to the cognitive aspect, the affective values are more important in ensuring the effectiveness of the learning takes place. The affective value in learning motivation interact with perceptions, symbols, beliefs and needs of an individual (Akbaş & Kan, 2007). Properties of an affective attitude is governed by an individual organization's needs, goals, and satisfied feeling after completing a task or completing a learning process (Furtado & Ciarlini, 2002).

Theory related to affective aspect of motivation is related to the theory of social thinking. This theory suggests that the determination of reciprocity as a key factor in both learning and motivation (Huitt, 2006). According to this view, the environment, individual behavior and individual characteristics such as knowledge, emotions, and cognitive development are intertwined with each other. The theory was first introduced by Albert Bandura (1986) highlighted the effectiveness of self-belief which an individual can solve a problem in its own way and with determination and a strong will (Muhamed Yusuf , 2011) . According to this theory, the failure does not prevent these individuals in achieving the desired goal. This theory was later divided into three aspects of performance by Pintrich (2000), namely 1) mastery goal that refers to an individual's competency in mastering the new knowledge or skills; 2) performance goals, or also called as ego goal-participation which focused on achieving normal standard person where someone tries to do things better than others, or better without much effort; and 3) social objectives that focus on the relationship between the individual and those around him.

Recent studies show that enthusiasm, attitude and motivation towards science subjects (physics, chemistry and biology) has been declining as their age increases, especially in the middle ages of the lower secondary level (Potvin & Hasni, 2014). Even teaching approaches such as 'Context-based learning' in learning Chemistry are also unable to deal with this problem as a result of the dominance of teachers in the process of learning (Naor et al , 2014) as students doesn't have the freedom to express new ideas of their thoughts. Thus the motivations cause of the affective aspect to study Chemistry dwindling.

4.3 Conative Aspect

Conative is borrowed from the term conation which stems from the Latin, conatus. Conatus means that any natural tendency, impulse, striving, or directed effort. Conative is one of three parts of the mind, along with the affective and cognitive (Kolbe, 2002). It is also defined as a mental process that enables or directs the behavior and actions. Various terms are used to represent some aspect conative including intrinsic motivation, goal orientation, willingness, desire, self-direction and self-control (Huitt , 2005). Conative skills also refer to the ability to analyze the situation based on existing knowledge and how one feels and choose the appropriate action (Kivinen, 2003).

Conative aspect of motivation is related to the attribution theory introduced by Weiner in 1974. This theory suggests that each individual has his own reasons for attribution or the success or failure in terms of whether they are external or internal, and in a controlled or uncontrolled conditions. The external attributions and uncontrolled motivation just due to luck whereas in a controlled external attribution, motivation is resulted from a difficult task.

In situations of teaching and learning, helping and encouraging students to develop their own attribution is important because it resulted from their efforts (internal, control). This is because, if attribution is resulted from a student's abilities (internal, external control), the student will reduce the styles that fit the attempt when facing difficulties in their studies. Table 1 shows more clearly on Attribution Theory.

Table 1: Attribution Theory (source: Huitt, 2011)

	Internal	External
No Control	Ability	Luck
Control	Effort	Task difficulty

Motivation from the conative aspect of a student is referred to the willingness or treatment done by the student in order to achieve their goals in learning (Corno, 2015). Conative aspect or willingness are to be formed after the goals and intentions have been established in which the commitment, effort and planning the appropriate strategies have been done to achieve those targets. Among the problems faced by students in terms of conative is students tend to learn individually led efforts to improve achievement in Chemistry was less successful hence decrease the motivation (Fullan & Langworthy, 2014). This is because, in order to master and understand the concept or the content of the abstract chemistry effectively, requires students to interact and communicate effectively with either a teacher or peers (Li et al, 2011). For example, discussions with teachers and peers about topics that elusive will help students learn chemistry better.

In addition, most students fail to associate the existing concepts or knowledge in Chemistry for instance, the corrosion processes with chemical equation (Bakar & Alias, 2011). The use of existing ideas and knowledge is very important and helps a student understand chemistry concepts and phenomena in order to solve the problem related to chemicals (Tsaparlis & Zoller, 2003). For example, the problems experienced by students in mathematics will be brought to the chemistry when it comes to problem solving through the calculation of the equation reactions and stoichiometry (Eriba and Ande, 2006). If students does not have the passion and unwilling to at least give a try to solve this problem or having low conative motivation, it will continue to interfere in students openness to study Chemistry as a whole effective. One of the most convenient way in engaging students as well as enhancing students' motivation toward Chemistry or generally in science education is by the hands-on activity (ACS, 2012).

5.0 Hands-on activity in Chemistry Education

Huitt (2004) in social learning theory suggested that emulating the model (imitating others) or vicarious learning (experience gained from reading or observation) is a key driver of the person's behavior. However, Huitt (2006) further streamline the social learning theory to social cognition theory linking the environment, individual behavior, with individual attributes (knowledge, emotional and cognitive development). This means that an active participation of students with direct experiences, helps students improve their learning motivation. Thus, a concept called 'Discrepant Events' or a surprising phenomenon that

based on the hands-on activity which requires student active involvement in the process (Chiapetta, 2006).

This study is intended to propose a module of one day event as a service learning program for school's students. This module are constructed using constructivist teaching method such as inquiry based learning and scenario based learning. However, all of the activity proposed in the module is basically based on a 'Discrepant Event' concept. According to cognitive theory introduced by Jean Piaget (1964), the thought process is resulting from the disequilibrium state of mind. This is applicable for an individual new learning and absorbed into the habit of thinking to achieve an equilibrium state of mind once again (Joubish & Khurram, 2011). This disequilibrium state will occur with the existence of conflicting or confusing phenomenon for a student which is known as 'Discrepant Events'. According to McComas (2014), cognitive dissonance occurs when a student experiences are expressed through their predictions (what should happen) does not match the reality (what actually happened). The researchers found that the concept of 'Discrepant Event' could create cognitive dissonance of a student in understanding a scientific concept (Hilario, 2015).

In addition to the 'discrepant event', the same concept is also known as 'conceptual conflict', 'cognitive dissonance' and 'cognitive conflict' by different researchers (Baddock and Bucat, 2008). But overall, the researchers focused on the same goal which is to attract and enhance the ability of students to think of their learning more meaningful, particularly in the field of science-based subjects like Chemistry.

8.0 Conclusion

Literally, students are facing the motivational issues in their learning especially in a critical subject like Chemistry. Subsequently, several research on Malaysian students motivation in learning have been done but plenty of them are focusing on Chemistry subject while students enrolment in the course related are deteriorating. Cognitive, affective and conative aspect of motivation is an important internal motivation aspect that would lead students to strive not only in their learning but mainly in their life. Thus, building these motivational aspect are in line with the education vision and mission in the National Education Philosophy and 21st century requirement to produce a successful, independence, critical and creative thinkers yet high in value individual.

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