Understanding Students' Motivation Factors in Learning Science as the Way to Nourish Elementary School Teacher's Creativities in Teaching Science

Lily Barlia

Universitas Pendidikan Indonesia Kampus Serang

Abstract

This study investigated motivational factors that are related to elementary school students' in learning science. While previous studies have recognized the resistance of students' scientific conception to change because of lack of motivation to learn. Few have investigated the role that non-cognitive factors might play when students are exposed to science instruction. Two research questions were examined: [a] what instructional strategies did the teacher use to increase students' motivation to learn science? [b] What individual elementary school student profiles can be constructed from the four motivation factors [i.e., goals, values, self-efficacy, and control beliefs] and how are these profiles linked to elementary school student engagement [i.e., behavioral and cognitive engagement] in learning of science? Eleven fourth grade students and the teacher of the public schools in Cilegon District, Banten, were selected. Data collection for this study included student's self-reported responses to the Motivated Strategies for Learning Questionnaire [MSLQ] that are translated to Bahasa Indonesia and modified to the fourth grade students developmentally appropriate, classroom observation of students and teacher, and structured interviews. Analysis of these data resulted in a motivational factors for each student and cross case analysis for entire group. Results from this study indicate that each student has different motivation factors that are mostly influenced to students' engagement in learning science. Among these motivation factors, task value and control beliefs were the most important for students to engage in learning science. Furthermore, for most of students included in this study, their motivation to learn science was also influenced by other factors that are not directly related to the four motivational factors assessed by the MSLQ, these factors included: [a] preparation for the next education [Junior high school and beyond] as well as future career, [b] personal interests to learn science, and [c] the course [science] is required for graduation. The implications of these findings are that the teachers need to create teaching learning strategies that can encourage students to develop learning strategies for understanding of science contents. The conclusions drawn from this study are that the elementary school teachers have to be aware of the importance of student' motivation factors to learn science in order to develop his/her creativity in conducting of science teaching and learning process in elementary school.

Keywords: Motivation, Student's motivation, Motivation factors, Student learning science, Elementary school student science, motivation to learn science

Introduction

Research on elementary school students' learning in science suggests that students at all grade level are not learning science concepts well. Evidence from various sources [i.e. Anderson, 1987; Barlia, 2009, 2010, 2014; Duit, 1993; Yager & Hofstein, 1986; Yang, 2007] indicate that students are not learning enough science and do not understand important scientific concepts at a depth that would allow them to be considered scientifically literate. Past research on students' learning science, also claimed that problems of student motivation were largely attributable to the nature of traditional curriculum materials and instructional practices [Anderson, 1987; Barlia, 2009, 2010, 2014; Dweck, 1986; Heese & Anderson, 1988; Roth, 1985]. The findings indicate that traditional curriculum materials and instructional practices do not provide opportunities for students to learn science content in meaningful ways. In these cases, a student's decision not to learn science is a rational choice, since the curriculum materials and instruction do not motivate him or her to achieve a new scientific understanding as better alternative to other existing conception.

The aim of this study is to understand student' motivation factors to learning science. The specific goal of this research is to investigate the relationship between motivation factors and students engagement in learning science. It can be assumed that motivation is essential to the process of the elementary school student in learning of science. In other words, if we want to understand how students come to engage in learning science, we need to understand which factors motivate them to learn science.

Theoretical Background

Assessing motivation is crucial for researchers and practitioners who are concerned with understanding the ways to improve the effectiveness of teaching and learning process, and optimize learning outcomes. Motivation can affect both new learning and performance of previously learned skills, strategies, and behavior. Motivation can influence what, when, and how students learn [Barlia & Beeth, 1999; Pogue,

& AhYun, 2006; Schunk, 1991]. Students motivated to learn about a certain topic offered by a teacher are likely to get involved in activities they believe will help them to learn. Students who are motivated to learn are characterized as actively engaging in classroom activities, mentally organizing and rehearsing the learning materials. For instance, students who are motivated to learn are more likely to take notes, to check their level of understanding frequently, and to ask for help when they know that they do not understand the materials [Wigfield, Eccles & Rodriguez, 1998; Zimmerman & Matinez-Pons, 1992]. In other words, inferring the present of motivation recognized in the classroom activities as students' task engagement [Lee, 1989; Lee & Anderson, 1993: Lee & Brophy, 1996] is crucial for teacher who willing to develop appropriate teaching strategies.

Research on student motivation also has found that student motivation involves a complex interplay of curriculum, instruction and student characteristics [Barlia 2010, 2014; Brophy, 2004; Dweck & Elliot, 1983; Lee, 1989; Lee & Brophy, 1996; Hong, & Milgram, 2000]. Researchers of student motivation indicate that motivational problems result when students' decision making processes are not entirely rational. Pintrich, Marx and Boyle [1993], and Wigfield, et al. [1998] describe four factors that are crucial to student motivation to learn. These individual student motivational factors include goals, values, self efficacy, and control beliefs. For that reason, researchers of motivation argue that students' beliefs about expected learning outcomes and characteristics of learning strategies, play an important role in the decisions students make about whether they will achieve scientific understanding. Thus, research on motivation claims that to understand the problems of student motivation, educators need to examine why [i.e., goals] and how [i.e., strategies] students decide to learn while engaging in everyday classroom tasks [Barlia & Beeth, 1999; Brophy & Merrick, 1987; Lee, 1989].

Most professionals agree that inferring the present of motivation is recognized in classroom activities as student task engagement [Hong, & Milgram, 2000; Lee, 1989; Lee & Anderson, 1993: Lee & Brophy, 1996]. The quality of student task engagement is characterized by several indices. Prntrich and Schunk [1996] describe four indices of motivation: [1] choice of task, [2] effort, [3] persistent, and

[4] achievement. These indicators of motivated behavior in student learning will be documented during observation of classroom activities. Lepper, Greene, and Nisbett [1973] conducted research on choice of task or interest with preschool children during free play. The research concluded that the expected award condition decreased motivation. Students' motivation to learn are apt to expend effort to succeed even when learning is not easy. Corno and Mandinach [1983] stated that when skill learning is involved, cognitive effort is an appropriate index of motivation.

Anderman and Leake [2005]; Barlia and Beeth, [1999]; Schunk and Pajares [2002]; and Reeve and Jang [2006] suggest that student motivation is an important factor that can lead to raising or lowering the status of a conception as the crucial process of conceptual changing. Thus, student motivation to learn science is a complex phenomenon influenced by many factors including curriculum materials, teaching strategies and the teachers, and individual student characteristics [Blumenfeld & Meece, 1988; Blumenfeld, Mergendoller, & Swarthout, 1987; Corno & Mandinah, 1983; Doyle, 1983; Lee, 1989; Lee & Anderson, 1993; Lee & Brophy, 1996].

Research Methodology

This research attempted to understand student's motivation in elementary school students' learning of science with a specific goal is to investigate the relationships between motivation factors and the students' engagement in learning science. Two research questions were examined in this study: [1] what instructional strategies did the teacher use to increase students' motivation to learn science? [2] what individual elementary school student motivation profiles can be constructed from the four motivation factors [i.e., goals, values, self-efficacy, and control beliefs] and how are these profiles linked to elementary school student engagement [i.e., behavioral and cognitive engagement] in learning science?

The study was conducted for two months during the months of October and November 2015 at a public school located in Cilegon District, Banten, where the teacher implemented science teaching instruction through her daily classroom

activities. Eleven fourth grade students were selected for this study represented three academic achievement levels [i.e., high, middle, and low], and both genders.

Data collection for this study included student's self-reported responses to the Motivated Strategies for Learning Questionnaire [MSLQ] that are translated to Bahasa Indonesia and modified to the fourth grade students developmentally appropriate, classroom observation of students and teacher, and individual structured interviews. The MSLQ is a self-report instrument. It has been under development formally since 1986 when National Center for Research to Improve Post-secondary Teaching and Learning was founded. The MSLQ that was used in this study is the version in which the Cronbach's alphas are robust, ranging from .52 to .93 [Pintrich, Smith, Garcia, & McKeachie, 1991]. These indicate that data obtained on the MSLQ have reasonable factors validity. The part of the MSLQ that is intended to assess students' motivational factors [goals, values, self-efficacy, and control beliefs] was used in this study. This was administered to the all of the eleven fourth grade students one week prior to beginning observation of instruction and interviewing of students.

Direct observation of the student's behavioral engagement in learning science was focused on [1] students' responses to the teacher instruction, and [2] instances when motivational behaviors were present. Interviews were guided by a structured format. Interview was conducted individually once a week lasting between 15 minutes and half an hour that are focused on [1] obtaining information on motivational factors that are not elicited through the self-report questionnaire, and [2] validating findings that result from student's self-report and observations.

The procedures of analysis data included analyzing information related to the research questions. Three general steps of data analysis, there are: [a] analysis based on researcher's intuitive reasoning from a complete reading of data, [b] analysis using a rating or frequency counts, and [c] developing case studies. Analysis of these data resulted in motivational factor for each student, other findings related to motivational factor that are not directly related to the four motivational factor assessed by MSLQ, and cross case analysis for entire study participants.

Analysis Data

Data analysis begins with an analysis of the teacher's instruction and the aspects of that instruction on student learning with respect to the research question: what instruction strategies did the teacher use to increase students' motivation to learn science? The data selected to address this question are taken from summaries of field notes, individual structured interviews with students and the teacher, and transcripts of discourse classroom activities. Following, a description of students' motivational patterns to learn science in the classroom is presented by analyzing video tapes of classroom instruction, field notes, and student responses to the structured interview questions to support claims of the research questions.

Further, analysis of profiles constructed from MSLQ's four motivation factors [i.e., goals, values, self-efficacy, and control beliefs] and the links of these profiles to their engagement in the process of learning science are described. This analysis focused on student behavioral and cognitive engagement in learning science in order to address research question two: What individual elementary school student profiles can be constructed from the four motivation factors [i.e., goals, values, self-efficacy, and control beliefs] and how are these profiles linked to elementary school student engagement [i.e., behavioral and cognitive engagement] in learning of science? Finally, a cross case analysis of all student motivation factor profiles is presented.

Discussion of the Research Findings

Description of Instructions

The instruction the teacher' used is generally consistent with the general features of science teaching strategies outlined by Hewson and Hewson [1988]. Based on my observation, the teacher's instruction generally followed a regular sequence of science teaching activities. She began instruction with bringing students to learning situation by having exploration their intuitive understanding of significant conceptual ideas prior to presenting instruction that addressed further learning about a topic. Further, the teacher together with her students, developed ideas that

were important to support the overall conceptions they were studying. During discussions, students were required to provide some indications of the reasons underlying their ideas. Daily class activities were dominated by classroom discussion, problem solving, and hands-on experiment that allow students to express, comment, and elaborate their idea for conceptual understanding.

The following is the teacher's ideas of using her selected science instructions that encouraged students to get involved in the process of learning. "*My goal of using science teaching strategies is to gain insight of what students' current understanding on the concept is so that I know what approach to take to my presentation on the concept. If I don't know what they are thinking, I won't know to emphasize certain aspects of the content. By asking them to address their ideas about certain concepts, it makes them aware of their current understanding. If their understanding doesn't coincide with the science perspective, then a conflict exists. From here they have to have situations that cause them to feel comfortable in exchanging their current ideas with the scientific ideas—so that in the end they adopt the correct idea. It is up to me to provide situations that will help them to make change"*. [The teacher]

The teacher success in implementing science teaching instruction was evidenced by her students' engagement both physically and mentally in learning activities and their ability to relate science concepts to everyday life. In daily classroom activities, the teacher applied a variety of teaching approaches that invited her students to learn for understanding. Among these approaches were helping each student learn by visiting his/her table, visualizing problems through videos, and creating a classroom environment conducive to learning [i.e., competing activities with science—related toys, developing personal relationships with students, and relating science materials offered to daily or life situations].

Instruction in this class was meaningful to the students as indicated in the following students' statements: "*The teacher does a very good job of taking things in science and explaining it in ways that we understand. She really knows how to relate to us and how to make science fun and interesting"* [Dw]. Another student seems very

happy engaging in science class, as she explain that "*The teacher is positive and energetic. She makes learning easy and fun. She encourages us to learn the information. When stuff gets hard, she does something fun to keep us positive by playing with toys or watching videos etc"* [El]. In another statement, she explains that she always get involves seriously in science class because she likes the teacher's teaching style: "*Science has always been an interest of mine. I always get involved in science class seriously because I enjoy them….I am taking science class because the teacher is teaching it and I enjoy her teaching style"* [El].

The teacher minimized factors that lead to trivial learning such as memorizing vocabulary and formulas. She encouraged students to think about what they already knew, why something happens, and how their ideas related to their daily lives. These instructional strategies engaged students mentally in learning for understanding, as a student stated: "*My teacher is able to discuss both what happens and why this happens. She presents the formulas and other ideas in a simple manner. She also realizes why we have trouble with difficult ideas"* [Rv]. The student who seats next to Rv also supports his statement, he said that "*I like my teacher teaching because she makes you think about what you already know, and relates it to our lives. I learn a lot from her"* [Rd].

In daily teaching activities, the teacher frequently explained to the students that her teaching goal was to "*help students learn to understand science, not teach them science".* She highlighted this goal often because she believed that knowing how to learn science was a crucial foundation for students to understand science. Her daily teaching activities stressed on central science concepts. For instance, when presenting the topic of circular motion, the teacher began with the concept of motion and related it to daily life like a moving car, torque, and turning a door handle.

Teaching activities observed during this study included problem solving, student/teacher demonstrations, student presentations, and hands-on experiments. In all of these activities, the teacher encouraged students to actively construct their own knowledge by implementing a variety of learning strategies, giving students opportunities to get involved in problem solving processes, and providing extensive

supports to them. The teacher also reduced the demands of classroom tasks on students by clarifying the tasks or simplifying them into smaller steps.

One of the most important characteristics of the teacher's instruction is that she facilitates classroom dialogue by giving students a change to discuss the problems. During this time students are encouraged to express and exchange their ideas. For instance, in daily class activities the teacher lets students brainstorm to stimulate questions that lead to the best answers and solutions of the problem. When doing so, she provides feedback to students that help them elaborate their conceptual understanding. The following students' statements indicate how the teacher's instruction motivated some students to learn. *"The teacher uses a lot of examples or visual aids to help us learn new things. She also has us participate in these examples to help us visualize better what we are learning. She also has us figure out problems and experiments and have us start them on our own"* [Nr]. *"The teacher lets us come up with the answers ourselves and it is easier to understand things when we have worked through the problems ourselves—when we not only see how to do it and why but also why not"* [El]

From the statements above, it can be inferred that when facilitating classroom dialogue, students were encouraged to express and exchange their ideas. Discussion like these provided feedback to students so they could elaborate on their understanding. This teaching strategy motivated students to physically and mentally engage in instructional activities [Thalib, SuLuan, Azhar, & Abdullah, 2006]. It is clear that the teacher tried to help students construct their own knowledge through active engagement, instead of presenting information directly to students in the forms of lectures.

Motivation Factors to Learn Science

The purpose of this section is to provide data that can answer research question two: what are the patterns of students' motivation to engage in learning of science? The analysis of data presented here focuses on description of motivational patterns of the eleven students in the study. Three key aspects of students' task engagement

[self-initiated cognitive, cognitive, and behavioral engagement] were selected as the categories for determining the patterns of a student's motivation to engage in learning science [Barlia, 2010; Lee, 1989; Lee & Anderson, 1993; Hong, & Milgram, 2000; Lee & Brophy, 1996; Rost, 2006; Yang, 2007]. These three key aspects of students' engagement are based on Lee's [1989] descriptions as follows: Self-initiated cognitive engagement is defined as when a student explains his thinking or express his/her ideas that are not solicited by the teacher. Cognitive engagement is defined as when a student actively expresses his own knowledge as they try to integrate personal knowledge. Behavioral engagement is defined as when a student appears attentive and involved in class activities.

In light of these three key aspects of student's task engagement, three patterns of student engagement in learning science were identified: These patterns included [1] intrinsically motivated to learn, [2] intrinsically motivated to learn but not consistently engaged each day, and [3] extrinsically motivated to learn to fulfill an academic requirement. Intrinsically motivated to learn, and intrinsically motivated to learn but not consistently engaged each day are described as the students seemed to be motivated to learn science because they found learning science as intrinsically interesting and enjoyable.

Six students showed patterns of intrinsically motivated to learn science [see figure 1]. This group of students demonstrated self-initiated cognitive engagement in most activities such as classroom discussion, problem solving, and hands-on experiments, without solicitation by the teacher. They got involved in learning primarily because they wanted to learn. One student belongs this group illustrates why she wanted to learn science: *"I also do the work in science because I need to. I need to do it so that I can understand material. If I don't do the work, the class would be pointless. In addition, I study science because I enjoy it and because I understand it. I like science because it is logical thinking, and that's how my brain functions"* [As]. Personal interest toward science is an important feature for students in this category. All students in this category become involved in classroom activities because the activities themselves were enjoyable and this motivated them to learn for conceptual understanding. They learn mainly to

understand and elaborate the science concepts by actively constructing their own knowledge as they tried to integrate their existing ideas with scientific ideas.

The second category describes a group of students who demonstrated self initiated cognitive engagement in a number of class activities, but not all. They were sometimes difficult to distinguish from the previous group. Their inconsistency in engagement during some tasks became the distinguishing feature. They were generally successful in integrating their personal knowledge with scientific knowledge, and applied this knowledge to explain phenomena found in everyday life. However, in some instances they did not actively participate in class activities and exhibited behavior such as drawing pictures, engaging in social conversation with other students, or laying their head on the table. For instance, one of students belongs to this group said: "*…only when it is fun do I like to study science"*[Fn]. Another feature of students belonging to this category is that while they did demonstrate cognitive engagement in classroom activities, their ideas were limited only to the content being taught. Questions that they asked generally revolved around definitions or clarifications of an assigned problem.

The specific difference between this group and the first is that this group of students sometimes did not demonstrate any ideas or thinking beyond the immediate content of what was taught. Generally, they only became involved in classroom activities if the content presented was unclear to them. They also seemed trying to integrate their existing ideas with scientific ideas and apply these ideas in order to explain and understand phenomena found in the everyday lives. Understanding science concepts is also a major goal for the students belong to this category, although it is not the first priority. Thus, overall conclusion for this pattern of student motivation is that learning goals play an important role in motivating them to engage in learning science. This goal played a crucial part in the decisions these students made about whether they would achieve scientific understanding.

Students extrinsically motivated to learn to fulfill an academic requirement and to pass the government administered tests are described as the students' major goal in learning of science in this category. Three students were identified as belong to this

group (see Figure 1). Comments from these students were mostly limited to the material being taught and the teacher actively solicited their thinking and ideas by calling on them during class. While they did become involved in class activities, their involvement in asking questions, giving ideas, and voluntarily answering questions was not as frequent as students in the first or second categories. The most important feature of this group of students is they got involved in class activities because the course was needed to complete a school requirement. The following is the statement of students belong to this group: *"I study science because it is a required course to take in order to graduate here at [the school]. If it wasn't required, I probably would not be taking it"* [Dw]. This conclusion is supported by Lee's [1989]; Barlia's [2010, 2014], and McInerney [2000] findings that students who are motivated to learn engage in classroom tasks with the goal of achieving scientific understanding, and they activate strategies associated with achieving this goal.

Motivation	Student	Key aspects of student's engagement		
		Self-initiated Cognitive Engagement	Cognitive engagement	Behavioral engagement
Intrinsically motivated to learn	Rn	frequently	frequently	frequently
	As	frequently	frequently	frequently
	Ny	frequently	frequently	frequently
	Ri	frequently	frequently	frequently
	El	frequently	frequently	frequently
	Rd	frequently	frequently	frequently
Intrinsically motivated to learn, but not engaged consistently each day	Is	sometimes	frequently	frequently
	Fn	sometimes	frequently	frequently
Extrinsically motivated to learn to fulfill requirement	Nr	seldom	sometimes	frequently
	Dw	seldom	sometimes	frequently
	Ry	seldom	sometimes	frequently

Figure 1. Summary of student motivation patterns to learn science

Student motivational factor profiles were constructed from responses to questions on the seven point Likert-scale of the Motivated Strategies for Learning Questionnaire [MSLQ] instrument. In the MSLQ, students rated themselves on a seven point Likert scale from [1] *not at all true of me* to [7] *very true of me*. In

scoring the MSLQ, scales were constructed by taking the mean of the item that makes up the scale. For example, intrinsic goal orientation was evaluated by four items. So, individual's score for intrinsic goal orientation was computed by summing the four MSLQ items and taking the average. Raw scores on the seven-point scale were as follow: score 4, 5, 6, or 7 were higher than score of 1, 2, or 3 [Pintrich at al., 1991].

In scoring the MSLQ, the mean of the items that make up a scale were calculated for the individual and the class as a whole [Pintrich et al., 1991]. Pintrich et.al., [1991] indicate that, in general, a higher score such as a 4, 5, 6, or 7 is better than a score below 4. Thus, if a student's score is 4 or above, the student is motivated to learn. Pintrich et al., [1991] also described the interpretation of individual scores in relation to the class average for the MSLQ. If a student's score falls in the bottom 25% of the class, this means that most of students in the class are more motivated than this student. If a student's score falls in the middle 50%, then this student is similar to the most students in the class. If a student's score is in the top of 25%, the student is more motivated than other students in the class.

Students	Score of motivational factors				Mean
	Goals	Values	Self-efficacy	control beliefs	
Rn	4.2	6.8	4.4	5.8	5.3
As	4.8	6.3	6.0	7.0	6.0
Nx	6.4	6.3	5.0	6.0	5.9
Ri	6.3	6.5	6.1	6.3	6.3
Ella	4.9	6.3	6.8	6.2	6.1
Rd	5.9	6.7	7.0	5.5	6.3
Is	5.2	5.3	4.5	6.3	5.3
Fn	5.6	5.7	6.4	5.3	5.8
Nr	5.1	4.7	4.0	4.5	4.6
Dw	5.2	5.7	4.6	5.3	5.2
Rx	3.9	3.2	6.5	5.5	4.8
Class mean	5.2	5.8	5.6	5.8	5.6

Figure 2. Overall student motivation score based on MSLQ

The overall results as measured by the MSLQ instrument show that all of the students in the class were motivated to learn science [class average of MSLQ score = 5.6 -- standard error 0.16]. Individual student motivation scores ranged from 4.6

to 6.3 [see Figure 2]. The range between the lowest and the highest scores is not widely different [1.7], this means that based on the MSLQ data, all of the students participating in this study are not significantly different in terms of their overall motivation to learn science, because the lowest student motivation score average is 4.6, it can be concluded that all of students in the class are motivated to learn science.

According to Pintrich et al., [1991], it can be inferred that these students have high motivation to learn. This claim supported by the teacher's statement that all of these students were highly motivated to succeed and very much wanted to succeed. In other words, students who are highly motivated to learn science may get involved actively in learning science-related courses. The following is the teacher's statement about how her motivated students were to learn science. "*The students in my science class are quite unique. Great mix of students. These students were highly motivated to succeed and were gifted with great personalities that just clicked. They were all not best friends, but they were pals---no enemies, they were very personable and very much want to succeed"*.[The teacher]

The overall composites for sub-scale scores ranged from 5.2 to 5.8—goal orientation [5.2], task value [5.8], self-efficacy [5.6], and control beliefs [5.8]. Of the four motivational constructs, task value and control beliefs were the most important factors for these students to learn science indicated by the scores on these constructs [see figure 2]. This means that students are motivated to learn science because they value the instructional tasks offered by the teacher as being applicable to their real lives, and they believe that they can control their learning outcomes by actively engaging in learning activities and developing appropriate learning strategies for conceptual understanding.

A cursory analysis of the MSLQ data also indicated that the motivational factor profile for each student was unique. Each student had MSLQ profile that was different from all other students. These differences create individual profiles portrayed different motivation factors that impact on an individual's learning. Furthermore, scores on goal orientations and control beliefs sub-scales indicated

that these factors were most important to the fourth grade students. This suggests that students are motivated to learn science because they want to pass in the government administered tests, and they believed that working hard in science lesson will lead them to fulfill one of the graduation requirements.

Students' motivational factors contributed to their engagement in learning for understanding. Instructional strategies that were implemented and student's motivational factors such as goals, values, self-efficacy, and control beliefs provided crucial effect on the quality of student engagement in learning activities. The findings suggest that research traditions on student's motivation and science teaching have important implications for those who wish to improve science teaching/learning [i.e. Barlia, 2010, 2011; Lee, 1989; Margolis & McCabe, 2006]. Teacher's interaction with the individual students in ways that would help students to be more motivated to engage in learning within social contexts of the classroom seemed to be the important factor to be considered by the teacher in daily teaching-learning activities. In summary, student motivation factors can be a crucial factor that should be considered by practitioners and the teacher in order to improve their creativities for maximizing student engagement in learning science.

Cross Case Analysis

The cross case analysis of all students was implemented by grouping data across eleven students involved in the research. The descriptions that follow illustrate common characteristics across all students, and identify distinctive elements for individual subjects. From the cross case analysis, students' motivation to learn science, three trends that are not directly related to MSLQ factors were identified as the reasons students mentioned for engaging in the teacher's science lesson in the class. These factors were obtained through student interviews included [1] preparation for Junior high school and future career, [2] personal interest toward science, and [3] the course is required for graduation.

Preparation for future career

Most students in the class plan to continue their education to favorite junior high school and plan to pursue science related careers. As a group, they believe that taking and understanding science will provide a valuable foundation for future learning. In other words, they understand that if they want to do well in junior high school and in the future [college], they should learn science well since the elementary school. This claim is clearly described in students' statements. "*I study science to help increase my knowledge for future learning experiences. I also study science to help myself in the college course in the future that I will be taking"* [Is]. "*I didn't have to take science or anything, but I took it because I thought it would be fun and interesting and because I believe that shouldn't slack off at the junior year because if you don't when you get to high school or college you will be in trouble because math won't be fresh in your mind and that goes for science too. This is why I took math and science class seriously"*. [Rn].

The statement above, confirms that these students are highly motivated to learn. Their concerns with being successful in junior high school and beyond motivate them to work hard in their elementary school science class [Yang, 2007]. In doing so, they engage cognitively in the learning activities the teacher presents. Among these activities were classroom discussions, problem solving, and outside of school study increased their understanding. For instance, once in the classroom discussion about "living in space", the teacher asked her students to analyze the application of science concepts to support human life in space. The teacher expected her students to apply their science knowledge to generate logical ideas to address the problem offered. Furthermore, to increase student's conceptual understandings of science, the teacher solved this problem in class, by encouraging all of her students to get involved in the thinking process. Daily classroom activities were student centered, in that the teacher and students together became active learning in science. Thus, the myth that science is hard course, for her students is refuted by their commitment to do of their best.

Personal interest toward science

Personal interest toward science also plays an important role for students to get involved in this science course. As Schiefele [1996] describes, personal interest is strong indicator of a deep level of learning. Personal interest including recall of main ideas, coherence of recall, responding to deeper comprehension questions, and representation of meaning are crucial to student's learning for understanding [see. Thalib et al., 2009]. The following is student statements indicate their motivation to learn science by getting involved in daily classroom activities. "*I study science for many reasons. One of the most important to me is because I like it. I motivated to do well in this course by my interest in the subject and my will to understand what is happening in the world and why it happens*" [Rn] "*Science has always been an interest of mine. I have taken a science class since 1st grade and I enjoy it*. [Ella]. *I study it (science) because I enjoy it and because I understand it. I like science because it is logical thinking, and that is how my brain functions!"* [As]

From the statements above, it can be inferred that these students' personal interest toward science invite their curiosity to learn, and motivate them to get involved actively in learning. In fact, they enjoy class activities such as doing individual or group projects, presentations, discussions, hands-on experiments, and problem solving that helps them learn for conceptual understanding. Thus, students' personal interests toward science are a necessary reason for them to get involved in the science lessons.

Course required for graduation

As mentioned before, science is one of the courses required for elementary school students' graduation. This claim is clearly supported in the following students' statements. "*My motivations are myself and always trying to do the best I can do, and the fact this class [science class] is a required course for me to graduate*" [Is]. "*I study science because it is a required course to take in order to graduate. If it wasn't required, I probably would not be taking it*" [Dw]. "*I study science because it is a required course to graduate, but I really don't like science"* [Nr]. "*Right now, I study science to fulfill my required credit in order to graduate*"(Fn). "*Along*

with this science class being one of the required courses I must take to graduate, I might go into a future career dealing with science"[Rn].

From all of statements above, it can be summarized that science courses are necessary for students to graduate. This graduation requirement is an important reason why students get involved in science lessons. It doesn't matter if they like science or not. In fact, in every science lesson, students get involved and learn hard to understand concepts of science offered.

C**onclusions of the Study**

The present study was conducted in the fourth grade students of Cilegon public school. The overall results, as measured by MSLQ, show that all of the eleven fourth grade students selected were motivated to learn science. According to Printrich et al., [1991], MSLQ scores of 4 or higher are interpreted as high in motivation to learn and each student in the study score above 4 on scale of 7[MLSQ score mean of the class = 5.4]. Sub scores on four factors contributing to the overall score [i.e., goals, values, self-efficacy, and control beliefs] were also obtained from the MSLQ instrument. Individual differences on these sub scales portrayed different motivation profiles that were used to infer what influenced an individual student to learn science for conceptual understanding. In addition to these four factors, students' motivation to learn science was also influenced by other factors not directly related to the four sub scales assessed by MSLQ. Obtained through student interviews, these factors included: [a] preparation for the next education [junior high school and beyond] and future career was a strong motivational factor for these students, [b] personal interests to learn science were important, and [c] the course [science course] was required for graduation.

From the data gained supports the conclusion that the instruction strategies used by the teacher in teaching science, exemplified in her stated teaching goal *"to help student understand science, not to teach them science"*, did influence how students in this classroom perceived their roles in learning. Her use of science teaching

strategies such as diagnosing students' thoughts on a topic, making provisions for student to be able to clarify their own thoughts through individual work or in group discussion, relating science concepts to everyday life, and creating a classroom environment conducive for students to learn are consistent with principles of science instruction outlined by Hewson and Hewson [1988]. The teacher also possessed a highly dedicated to helping students understand science concepts well. Therefore, a major finding of this research is that motivation to engage in learning of science is influenced by the teacher's instructional strategies as well as a student's individual interests and goals.

The conclusion that each of the students had a unique motivational factor profile, that is, each student a MSLQ profile that was different from all other students. Scores on task values and control beliefs indicate that these factors were most important to most students. This suggests that students are motivated to learn science because the value the instructional task offered by the teacher as being applicable to their real lives. In addition, the students believe that they can control learning outcomes by actively engaging in learning activities. The implication of these findings are that teachers need to encourage students to connect science concepts taught in the classroom with students' everyday lives and encourage students developing appropriate learning strategies for conceptual understanding.

Together, teacher's instructional strategies and students' motivational factors contribute to students' engagement in learning science for understanding. This finding suggests that both research in student's motivation and approaches to learning science, have important implications for those who wish to improve science teaching and learning. The teacher should consider that interactions with individual students in ways that help students become motivated to engage in learning within social context of the classroom are an important factor. In summary, student motivation is a crucial factor that should be considered by the teachers to strengthening his/her creativity in developing effective teaching strategies for maximizing students' engagement in learning.

From the cross case analysis of all students' motivational factor profiles, students' goal to pass in the national tests as the requirement for graduation, personal interest in science, and the preparation for future career was found to be the most significant factor in motivating students to learn science. In addition, all students participating in this study mentioned that their teacher's personality, and her creativities in teaching science as the most important factor for them to get involved in the learning science activities she offered. They agreed that the teacher's sincere regard for them as individuals was a powerful extrinsic motivator for them to learn for understanding. This finding suggests that strengthening teacher's teaching creativities and developing student-teacher interactions within the social context of the classroom are the crucial factors in teaching and learning process [Thalib, et al., 2009]. In other words, in teaching and learning process the teachers need to develop teaching creativity as well as interact with students in the ways that promote greater engagement with each other and with the science content to be learned.

Finally, science teachers should provide well-conducted teaching-learning strategies that accommodates every individual student needs. They should provide extensive support for individual student, especially for students who have less background of science knowledge and less intrinsic motivation to learn science for understanding. Science teachers need to pay more attention to individual needs and keep closely communicating with them accommodating for their learning. Helping students to reduce negative attitude toward science, science teachers have to determine the best way to implement teaching instructional strategies that develop quality of social environment in science classroom activities. Thus, in implementing science teaching strategies, teachers need to consider the affective aspects of students' learning including motivational constructs would lead to change in students' learning.

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