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Elementary School Students' Motivation Profiles in Learning Science for Conceptual Changing

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Abstract: ***This study investigated motivational factors that are related to students' engaging in learning science for conceptual change. While previous studies have recognized the resistance of students' scientific conception to change. Few have investigated the role that non-cognitive factors might play when students are exposed to conceptual change instruction. Three research questions was examined: (a) what instructional strategies did the teacher use to both promote elementary school students' learning for conceptual change and increase their motivation in learning science? (b) what are the patterns of elementary school students' motivation to engage in conceptual change learning?, and (c) what individual elementary school students profiles can be constructed from the four motivational factors (i.e., goals, values, self-efficacy, and control beliefs) and how these profiles linked to engagement (i.e., behavioral and cognitive engagement) in learning of science? "Eleven sixth grade students of the 2012-2013 academic year and the teacher of a Public Elementary School in Serang District, Banten - Indonesia, in which conceptual change approach to teaching was used in daily activities were selected. Data collection for this study included student's self-reported responses to the Motivated Strategies for Learning Questionnaire (MSLQ) translated to Bahasa Indonesia and adapted to the sixth grade developmentally appropriate, classroom observation of students and the teacher, and structured interviews. Analysis of these data, resulted in a motivational factor profile for each student and cross case analysis for entire group. Results from this study indicate that each student has different motivation factor profile that is mostly influenced individual student to learn science. Among these motivation factors, task value and goal orientations were most important for students. The implication of these findings are that teachers need to encourage students to find learning for conceptual change a valuable task as the way to reach the goals that the students aimed that is passed the national examination (UASBN), and that students belief if they worked hard in science class is the best way to find applications for their new conceptions within their everyday life. Furthermore, students' motivation to learn was also influenced by other factors that are not directly related to the four motivational factors assessed by the MSLQ such as the acceptability of the teacher by the class had positive influenced on the students learning. The Overall conclusions drawn from this study are that the elementary school teachers have to be aware of the importance of these students' motivational factors to learning of science for conceptual understanding.***

Keywords: Student's motivation; Motivation profiles; Student's learning science; Conceptual changing; Elementary students' science

1. Introduction

Research on elementary school student's concept learning in science has been conducted for several decades. From the research, a model of student learning that is Conceptual Change Model, was proposed by Posner et al., (1982). This learning model has been the focus of much attention and research in the science education community (Barlia, 2010, 1999; Barlia & Beeth, 1999; Beeth, 1998; Beeth & Hewson,1997; Duit, 1993; Hewson, Beeth & Thorley, 1998; Pintrich, Marx, & Boyle, 1993; Yang, 2007). The authors of the Conceptual Change Model (hereafter referred to as the CCM) look to an analogy between student's conceptual learning in the classroom and the process of conceptual change in the science community. The CCM views student learning as the rational process, analogous to the way in which many contemporary interpretations in history and philosophy of science picture change in the knowledge of the scientific communities. So that, scientific knowledge is built based on a learner current understanding of a phenomenon and the impacts of new information or new ways of thinking about existing information that bear on a concept.

In spite of the fact that the CCM has had considerable influence in science education research, elementary school science educators are still confronted with students who are unwilling to work hard toward achieving scientific conceptual understanding. Many students spend time and effort focusing on less important learning outcomes, such as memorizing science vocabulary/factual information, or drilling and memorizing clue answers of science task books, rather than trying to achieve conceptual understanding (Anderson & Roth, 1989; Barlia, 1998, 1999, 2010, 2011; Blumenfeld & Meece, 1988; Tobin & Gallagher, 1987; Brozo, 2005; Thalib et al, 2009; Tobin & Gallagher, 1987). These students also rely on inadequate learning strategies for science concepts by distorting scientific knowledge to fit their existing knowledge, mindlessly answering questions, or copying answers from their text or peers (Anderson & Roth, 1989; Barlia, 2004b, 2010; Blumenfeld & Meece, 1988; Chinn & Brewer, 1988). This raises a concern among elementary school science teachers about how to stimulate student motivation to learn science for conceptual understanding.

A number of criticisms have been directed at the conceptual change model. Pintrich, Marx, and Boyle (1993) focus on one specific criticism of the CCM is that it lacks attention to affective aspects of learning, including motivational constructs that should lead to change in a conception. They argue that the CCM presents a highly rational view of learning (being driven solely by logic and scientific thinking) with little or no reference to motivational constructs such as goals, value beliefs, or self-efficacy beliefs. In fact, given the CCM's reliance on rational mechanisms for learning (i.e., similar to change within the scientific community) one might argue that there is one single de facto motivational construct in the model: disequilibration. Indeed, Strike and Posner (1992) in a recent response to Pintrich, Marx, and Boyle's criticism of the CCM indicated that affective factors are an important area that should be investigated.

Pintrich, Marx, and Boyle (1993); Boyle, Magnusson, and Young, 1993; Anderman and Leake (2005); Barlia, (2004b, 2009); Schunk and Pajares (2002); Reeve and Jang (2006) believe that student motivation is still the important factor that can lead to raising or lowering the status of a conception. For instance, accepting the fruitfulness of a new conception implies a role for student's value judgments about the applicability of a conception as well as his or her goals for learning, such as how new information might help in attaining a desired end (i.e. passed on the National Examination-UASBN). On the other hand, learning portrayed by the current CCM focuses only on student cognition without considering students' motivational beliefs about themselves as learners and their roles in the classroom community. This limited view of learning does not offer a complete picture of the process of conceptual change learning in science. Thus, the importance of considering student motivational beliefs in the process of student learning is essential to engaging students in conceptual change learning. This is to say that the process of conceptual change is influenced by personal, social, historical, and motivational process (Barlia, 2010; Cobb, 1994; Driver, Asoko, Leach, Mortimer, & Scott, 1994; Pogue & Ah Yun, 2006; Rost, 2006; Tuckerman, 2003; Weins et al., 2003).

2. Research Methodology

This study is descriptive case study, attempted to bring together research on student's motivation with research on conceptual change learning in science with a specific goal is to investigate the relationships between motivation factors and students engagement in conceptual change learning in science. The research questions that were examined in this study: (a) what instructional strategies did the teacher used to both promote elementary school students' learning for conceptual change and increase their motivation in learning science? (b) what are the patterns of elementary school students' motivation to engage in conceptual change learning of science? (c) what individual elementary school student profiles can be constructed from the four motivation factors (i.e., goals, values, self-efficacy, and control beliefs) for the eleven elementary school student participants in this study, and how are these profiles linked to their engagement (i.e., behavioral and cognitive engagement) during conceptual change learning in science?

The study was conducted in a public elementary school in the greater Serang district, Banten- Indonesia that was prepared to be the National Standard School (SSN = *Sekolah Berstandar Nasional*). Data gathered from the school principal indicated that the total numbers of students for the 2012-2013 school year in all six grades was 259 with nine certificated teachers. The student population consisted of 100% Asian (Indonesian). In general, most students came from low class family. A majority of the parents of these students were middle and high school-educated people.

The study was conducted for nine weeks (42 days) during the 2012-2013 school year in the classroom of Mrs. Novy. She is an outstanding teacher. She is an experienced elementary school teacher with more than twenty years of the classroom teaching experience. Her preferred methods of instruction, parallel those described by Hewson and Hewson (1988) for implementing the conceptual change model. All of the participants were six grade students of the elementary school, ranging in age from 11-12 years old. Eleven of these students were selected for this study represented three academic achievement levels (i.e., high, middle, and low), and both genders. And curriculum covered during the period of this study was mostly review and wrap-up of the contents offered before, and drilling of the tests prepared to the national examination (UASBN)

Data collection for this study included student's self-reported responses to the Motivated Strategies for Learning Questionnaire (MSLQ) that were translated to Bahasa Indonesia and modified/adapted to the sixth grade developmentally appropriate, classroom observation of students and teacher, and structured interviews. The MSLQ is a self-report instrument. It has been under development formally since 1986 when NCRIPTL (National Center for Research to Improve Post-secondary Teaching and Learning) was founded. The MSLQ that was used in this study is the final version in which the Cronbach's alphas are robust, ranging from .52 to .93 (Pintrich et. al., 1991). These indicate that data obtained on the MSLQ show reasonable factors validity. The first 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 all eleven students one week prior to beginning observation of instruction and interviewing of students.

Direct observation of teaching strategies and student's behavioral engagement in learning science was focused on (1) the sequence of events that the teacher presented to students, the strategies that teacher uses, and the materials presented during science lesson, (2) students' responses to the teacher instruction, and (3) instances when motivational behaviors were present. Interviews were guided by a structured format. Each interview was conducted individually once a week lasting between 15 minutes and half an hour focused on (1) obtaining information on motivational factors that are not elicited through the self-report questionnaire (i.e., student's specific goals orientation of learning science), and (2) validating findings that result from student's self-report and observations.

3. Processing and Analysis Data

The data analysis procedures are intended to summarize information related to the research question. Three general steps of data analysis are used: (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. These three steps of data analysis took more than one cycle (i.e., revision) to produce the final case study.

The analysis based on researcher's intuitive reasoning was researcher's reading of the entire data set. This reading included data from students' responses to the MSLQ, classroom observations, and structured interviews, in order to become familiar with the general feature of student motivation to engage in conceptual change learning in science. The second step in the analysis data was using a rating or frequency count. In this step, student motivational profiles based on MSLQ scores were calculated. Systematic analysis of MSLQ data were made using frequency counts in order to classify students based on response to the four sub scales of the MSLQ.

In analyzing data related to student engagement in learning activities, three key aspects of engagement described by Lee (1989) and Lee and Anderson (1993) were used as the focus of analysis, included: (a) self-initiated cognitive engagement (present when a student explains his or her thinking or expresses his or her ideas that are not solicited by the teacher but reveal cognition going beyond lesson content), (b) cognitive engagement (present when a student actively constructs his own knowledge as he tries to integrate personal knowledge with scientific knowledge) , and (c) behavioral engagement (present when a student is attentive and involved in class activities, like listening to the teacher or other classmates during class discussion, not talking to others inappropriately, and following the teachers directions.

Categories of students involvement in classroom when learning science were developed based on the key aspects described above. The following coding system was developed to identify patterns of student's involvement in conceptual change learning in science. The coding system, which incorporates the key issues (frequently, sometimes or seldom existence) of task engagement, included three categories:

Category 1: (a) frequent self-initiated cognitive engagement
(b) Frequent cognitive engagement
(c) Frequent behavioral engagement

Category 2: (a) some self-initiated cognitive engagement
(b) Frequent cognitive engagement
(c) Frequent behavioral engagement

Category 3: (a) little or no self-initiated cognitive engagement
(b) Some cognitive engagement
(c) Frequent behavioral engagement

The final step in data analysis procedures was to develop the case study. Development of the case studies specified links between student motivational factor profiles (motivation) and student engagement (i.e., behavioral and cognitive engagement) in conceptual change learning in science. Finally, Analysis of these data resulted in motivational factor profile for each student and cross case analysis for entire study participants.

4. Students' Responses to the Teaching Instruction

The instruction strategies used by Mrs. Novy in teaching science, exemplified in her stated teaching goal "to help students understand science and passed the National Examination (UASBN)", did influence students in this classroom perceived their learning. Her conceptual change 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 similar to the principles of conceptual change instruction suggested by Hewson and Hewson (1988) with one notable exception. Mrs. Novy's instructional strategies are combined with her ability to successfully develop a personal relationship with each student. While she was successful in implemented conceptual change instructions in her daily teaching activities, Mrs. Novy also possessed a great personality and low profile as perceived by her students, and was highly dedicated to teaching science well.

In her students' eyes Mrs. Novy was a nice and creative teacher. The conceptual change instruction employed by Mrs. Novy in daily activities, her low profile, and her personal approach to the students, affected their motivation to engage in conceptual change learning. They learned not only to express their thoughts on science contents but they also developed scientific understanding and considered the applications of those ideas to prepare for national examination-UASBN and to daily life. Thus, the conceptual change instruction used by Mrs. Sophi, her personality, her low profile, and her dedication to teaching motivated students to engage in learning for understanding. This suggests that public school teachers who teach science need to create a teaching-learning climate that accommodates students learning science content in ways that are meaningful for students to reach their expected goals. Therefore, a major finding of this research is that students' motivation to engage in conceptual change learning in science is influenced by the teacher's personality, the teacher's low profile, the acceptability of the teacher by students, instructional strategies, and students' goals. Students in Mrs. Novy's classroom engaged in conceptual change learning for all of these reasons.

5. Patterns of Students' Motivation to Learn Science

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, 1999, 2004a, 2010; Lee, 1989; Lee & Anderson, 1993; Lee & Brophy, 1996). 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 and to prepare for the national examination-UASBN. 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. These students (Nurul, Ahmad, Lina, Fitri, Irma, Amiroh, Wawan, Rohadi, Putri, Irfan and Imas) 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. They also applied these ideas to understand and explain phenomena found in their immediate surroundings. Students extrinsically motivated to learn to fulfill an academic requirement and to pass the National Examination (UASBN) are described as the students' major goal in learning of science mainly to fulfill graduation requirement. These students (Nurima, Masriah, Siti, Anis and Irfan) seemed tried 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 conceptual change learning. This goal played a crucial part in the decisions these students made about whether they would achieve scientific understanding. This conclusion is supported by Lee's (1989); Barlia's (1999, 2010), 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.

6. Student Motivational Factor Profile in Learning Science

Student motivational factor profiles were constructed from responses to questions on the seven point Likert-scale MSLQ instruments that was translated to Bahasa Indonesia and modified/adapted to the sixth grade student developmentally appropriate. 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). The score for each motivational factor (i.e., goals, values, self-efficacy, and control beliefs) was transferred to create a profile for a student. A motivational factor profile was generated for every student. 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 = 5.4 -- standard error 0.16). 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 sixth grade students of Mrs. Novy's class. This suggests that students are motivated to learn science because they want to pass in the national examination (UASBN), and they believed that working hard in science lesson will lead them to fulfill one of the graduation requirements. In addition, the instructional tasks offered by the teacher as being applicable to their real lives. The implications of these findings are that teachers need to encourage students to learn science for understanding comprehensively preparing to the national examination (UASBN), and connect the science concepts taught in the classroom with students' daily lives.

Together, instructional strategies and students' motivational factors contributed to their engagement in learning for understanding. Instructional strategies that were implemented based on conceptual change teaching 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 those traditions, student's motivation and conceptual change approaches to learning science; have important implications for those who wish to improve science teaching/learning (i.e. Barlia, 1999, 2010, 2011; Lee, 1989; Margolis & McCabe, 2006). Teacher's interaction with the individual students in ways that would help student 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 other words, it is crucial to bring together issues of student motivation and conceptual change learning as suggested by Barlia, (2009), and Pintrich, Marx, and Boyle (1993). In summary, student motivation can be a crucial factor that should be considered to maximize student engagement in learning for conceptual understanding. The followings are three examples of student motivational profiles to learn science based on the MSLQ data.

6.1. Putri.

Putri has a mean total motivation score of 5.3. For the sub-scale factors Putri's average is: 6.9 for goal orientation, 4.2 for task value, 4.4 for self-efficacy, and 5.7 for control beliefs. Putri's total motivation to learn science consists of 32% goal orientation, 20% task value, 21% self-efficacy, and 27% control beliefs. Goal orientation is the higher portion of Putri's overall motivation score (see Figure bellow). This means that goals are the most important factors for her when learning science. On the other hand, task value comprises the smallest portion of Putri's motivation factor.

Compared to the overall class score, Putri's motivation score is slightly below that of the class (5.3 for Putri compared to 5.4 for the class). However, her task value is far below that of the class average. Based on the MSLQ data, this means that Putri is less sure of the important of the conceptual understanding of science. This means that her learning of science is just to match her goal to pass in the national examination (UASBN).

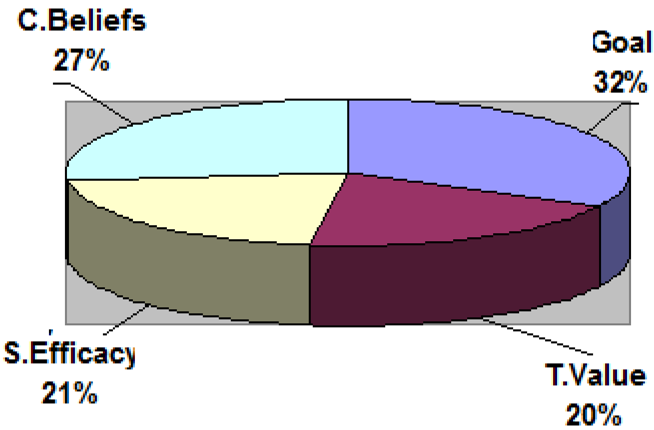
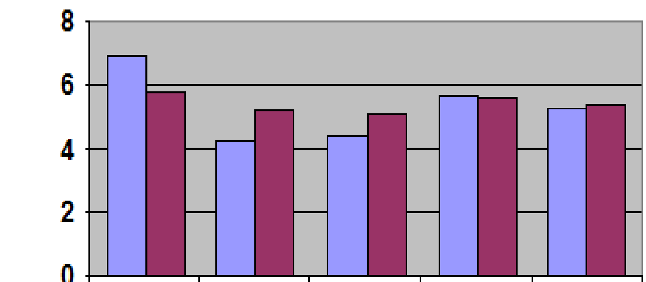


Figure 1: Putri's Motivational Factor Profile

According to Printrich et al., (1991), Putri's motivation factor profile is located in the middle 50% of the scale for the class. Her scores on goals and control beliefs (6.9 for goals and 5.7 for control beliefs) all are higher than those are for the class. This is interpreted to mean that Putri is concerned with the degree to which she perceives herself to be participating in a task for reasons of a goal all to itself as well as a mean to achieving this goal.

Her goal score of 6.9, a score that is far above that of the class, can be explained by the fact that Putri strongly perceives science course materials as interesting, important, and useful to her. For example, it can be inferred from Putri's response below that she found science is very important to her because she plans to continue her education to the favorite junior high school and she learn science well to prepare a national examination (UASBN).



	Goal	T.Value	S.Efficacy	C.Beliefs	Mean
Putri	6.9	4.2	4.4	5.7	5.3
Class	5.8	5.2	5.1	5.6	5.4

Figure 2: Putri's Motivational Factor Scores compared to those of the class

I study science because it is one of courses that are offered in the National Examination (UASBN). So I have to learn science very hard, because I don't want to fail on it. Also, I would get a good grade in science, if I don't my parents would be quite upset. (Pt-1)

Putri connects everyday phenomenon with the science she is learning. This may fertilize her curiosity and lead to more involvement in conceptual change activities such as getting involved in classroom discussion, problem solving, hands-on experiments, and other learning inquiries. She is motivated to learn science because she understands that a good grade in science will bring her easier accepted at the favorite junior high school she dreamed.

For Putri, getting a good grade, rewards, positive evaluation by her parents, other students, and competition with peers are not her concerns. She learns science for conceptual understanding. The following she indicates which grade she expects to receive for this science class.

I am hoping to receive a "B" at least for this course [science course]. If I could get an "A" would have it but I understand that the course material is a lot harder than some other courses. I will try doing of my best in this course and no matter what grade I get I knew I tried hard. With courses like this I don't think the grade is as important as learning and understanding the material. (Pt-2)

Putri is a quiet student in class and rarely participated in social conversations, even with student sitting next to her tried to engage her. In the group activities, like hands-on experiments, she worked with her group-mates, Nurima and Amiroh. Putri set up the equipment for the group and the group always worked together quietly. Putri also believes that her effort to learn will result in positive outcomes as indicated by her high score on control beliefs. In daily class activities, Putri is one of the most active students asking questions for clarification, giving her ideas, getting involved in class problem solving, and discussing science topics with her classmates. Twice she was the first student to volunteer for science demonstration and hands-on experiment.

Based on her profile, Putri is behaviorally and cognitively engaged in learning. She is intrinsically motivated to learn science. Planning to continue her education at the favorite junior high school, she believes that science affects her daily life and her efforts are leading to positive outcomes. She also recognizes the stake her parents have in her learning well in elementary school. Thus, she is concerned with doing well in the future as well as her current science course. In other words, Putri's motivation to learn science is dominated by the motivation factors of goal orientations and control beliefs—factors that are important reinforcement for her as she participates in learning science.

6.2. Nurul

Nurul has a mean total motivation score of 6.3. Nurul's average on individual motivation factors are 5.9 for goal orientation, 6.7 for task value, 7.0 for self-efficacy, and 5.5 for control beliefs. Nurul's total motivation to learn science consists of 24% goal orientation, 27% task value, 27% self-efficacy, and 22% control beliefs. Self-efficacy and task value comprise the largest portion of Nurul's motivation scores (see Figure 3). Compared to the overall mean for the class, Nurul's motivation score is at the top for this class (see Figure 4). This means that Nurul is more motivated than any other students in this class. From the four motivation factors, her self-efficacy score is also the highest score in the class (7.0) followed by her task value score, the second high score for the class (6.7).

Her self-efficacy score of 7.0 means that Nurul strongly believes in her ability to master science tasks. She is

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confidents in her own ability in be successful when learning science and her ability accomplish a task well. The following statement typified her beliefs about her ability to be successful when learning science.

So far, I never really get discourage trying to learn new ideas in science. I never faced difficulty in solving science problems; my grade is always an "A". Once, when I was missed 3 days of class, at first, I was confused, but I caught on towards the end of experiment. I just relax and try to understand it, because I know that I will understand it eventually. I think once we know how we were going to gather the information; the actual gathering was pretty easy. (Nr-1)

Nurul perceives that everything she does in science will end with a positive outcome, including a good grade. She believes that of her success in learning science is because of her ability. She never faced any serious difficulties in understanding science concepts presented by Mrs. Novy. Nurul's task value score was 6.7, score that is also far above that of the class (see Figure 4). This can be explained by the fact that Nurul strongly perceives science course materials as interesting, important, and useable. For instance, during a class discussion about a science fiction film entitled "Back to the future" she became actively engaged in the discussion. Once, she came to the conclusion that "science and technology are ways of life for modern people" (Nr-2).

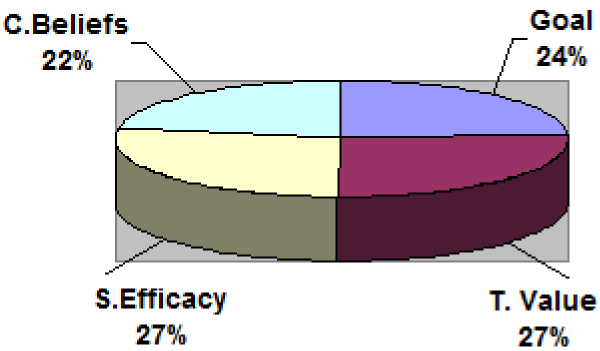


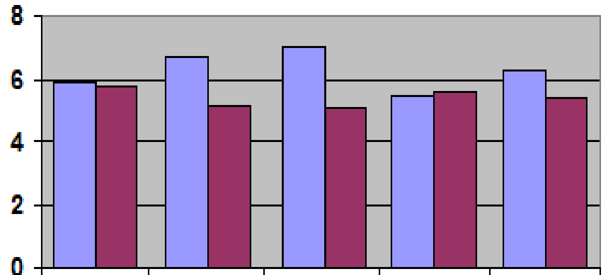
Figure 3: Narul's Motivational Factor Profile

Furthermore, she explained that one of the disadvantages of science and technology to human beings is that "people become lazy and depend on technology" (Nr-3). She was always interested in discussing science and technology related topics. Nurul's perception of science course materials as interesting, important, and useable may lead her to become more involved in the conceptual change learning activities presented by Mrs. Novy. It also can be inferred from Nurul's response below that she found the material for this course to be interesting, important, and useable in her daily life.

I like all of science topics, but I like in somehow the kinetic motion pretty well. It is pretty important for me because we deal with this every day, it is a part of our everyday lives. I like to learn new ideas in science. You know, my motivation come from myself, trying to constantly betters myself and obtains more knowledge.(Nr-4)

Nurul's intrinsic motivation to learn science is indicated in her statement of how important science is for her. He indicated that science is very important for her because she plans to continue to senior high school or higher education in science related major, and she plans to pursue an occupation in science related career.

I love learning science, because it helps to increase my knowledge for future learning experiences. I also study science to help myself to prepare for my future education. You know, in the future I want to continue to medical college, my father hoping me become a medical doctor! (Nr-5). In daily class activity, Nurul was cognitively and behaviorally engage in daily class activities. She was consistently involved in the assigned activities. She frequently raised her hand



	Goal	T.Value	S.Efficacy	C.Beliefs	Mean
Nurul	5.9	6.7	7	5.5	6.3
Class	5.8	5.2	5.1	5.6	5.4

Figure 4: Narul's Motivational Factor Scores compared to those of the class

To answer questions proposed by the teacher, asked her for clarification, and freely contributed her ideas. The teacher and other students readily accepted her ideas. When doing written work such as quizzes or tests, she generally finished before other students in the class. According to Mrs. Novy, Nurul was the best student in her science course offered and she is also one of the top ten academically in the sixth grade class. Nurul is intrinsically motivated to learn science. She believes strongly that her ability will lead to successful learning. Her judgments about her own ability to accomplish s task, as well as in her skills to perform in that task, are important reasons why she motivated to learn.

6.3. Irfan

Irfan has a mean total motivation score of 4.8. Irfan's average on individual motivation factors is: 3.9 for goal orientation, 3.2 for task value, 6.5 for self-efficacy, and 5.5 for control beliefs. Irfan's total motivation to learn science consists of 20% goal orientation, 17% task value, 34% self-efficacy, and 29% control beliefs (see Figure 5). Self-efficacy comprises the largest portion of Irfan's motivation score.

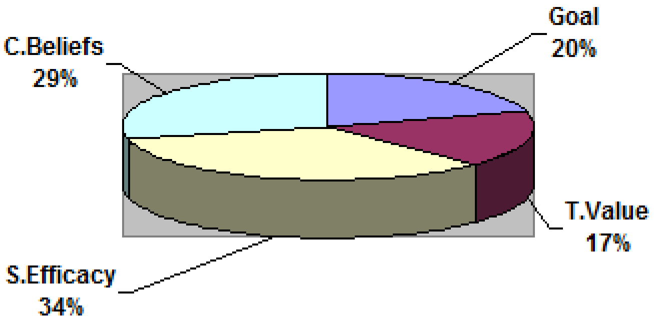
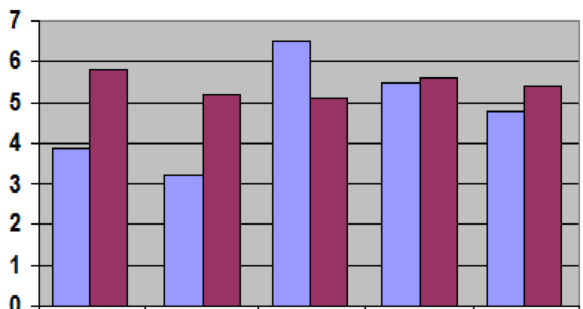


Figure 5: Irfan's Motivational Factor Profile

Compared to the overall class, Irfan's motivation score is far below that of the class (4.8 for Irfan compared to 5.4 for the class). Of the four motivational factors, three of them (goals, task value, and control beliefs) are quite far below those of the class (see Figure 6). According to Pintrich et al., (1991), a motivation factor profile like Irfan's can be interpreted to mean that his motivation is in the bottom 25% of the class. Irfan's lack of intrinsic motivation to learn science is indicated in his statement of how important science is for him. He indicated that science is not very important for him because he doesn't have any plans to continue to senior high school or higher education in science related major, and he doesn't have any plans to pursue an occupation in science related career.

There are no science topics that more important than others we learn about. All of them are the same for me. I am not too interested in science because I do not plan to continue to senior high school/higher education in science related major or plan to pursue occupation concerning science, the topics covered are not very important. Although, science materials are not so interesting to me, I aim to get good grades in science course more than anything else (If-1)



	Goal	T.Value	S.Efficacy	C.Beliefs	Mean
Irfan's	3,9	3,2	6,5	5,5	4,8
Class	5,8	5,2	5,1	5,6	5,4

Figure 6: Irfan's Motivational Factor Scores compared to those of the class

However, getting a good grade is a major concern for Irfan as indicated in his response to why he studies for this course. He beliefs that learning in elementary school (public school) can be an important foundation for his future education (junior high school, senior high school, and even in college).

I study science because I am forced to study it. If I don't, I will not understand the materials and do poorly on tests. If I do poorly on tests, I will receive poor grades; possibly low enough to cause me fail the national examination (UASBN). I try to earn a good grade and to understand material as well. If I want to do well in junior high school and beyond, I feel that I should do well in elementary school. (If-2)

Although, Irfan doesn't really like science, he does put forth the efforts necessary to learn the concepts Mrs. Novy taught. The personal relationship he has with Mrs. Novy is an important reason that motivates Irfan to put forth his best effort. The following statement indicates how important this personal relationship with the teacher is to Irfan.

Mrs. Novy's enthusiasm helps me to stick in science lesson. She helps me to learn. Her low profile and readiness to help her students anytime also encourage me. She demands the best we can give. We develop such personal relationships with her. We love her and we don't want to let her frustrated. (If-3)

In class, Irfan seldom was involved in the activities. But, one he offered an idea to the class or answered a question; it was readily accepted by his peer and the teacher. The following is his response as to why he rarely expressed his idea in class. I try to come upon a correct answer before I contribute a response to the class. Most students would agree that it is rather pointless to answer a question, which you do not know the answer to. Before I choose to speak, I decide how logical my response is and whether it is correct or not. Ideas, which are different from numeric solutions, are different. I try to give ideas which might help further the lesson. If I do not quite understand the lesson, I most likely will not contribute an idea because it will not further the lesson. (If-4)

From the statement above it can be inferred that although he doesn't actively get involved in classroom discussions, this does not mean that Irfan was not involved cognitively. He does offer his idea when he believes that his ideas will further the conversation. Thus, Irfan's low score on the MSLQ does not accurately depict his level of effort in the class.

7. Cross Case Analysis of Students' Motivational Factor Profiles

In the analysis presented the profiles for each student have been described and analyzed. The profiles provide a picture of the kinds of motivational factors believed to contribute to a particular student's learning in science. However, the need for a cross case analysis of the data emerged as the individual student profiles were identified. 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 for conceptual understanding, six trends not directly related to MSLQ factors were identified as the reasons students mentioned for engaging in Mrs. Novy's science lesson in the class. These factors were obtained through student interviews included: (a) the course was required for graduation and will be offered in the national examination (UASBN) (b) preparation to the future study (junior high school)--future career, (c) personal interests to learn science, (d) the content of the course was important/useful to student's daily life, and (e) teacher's personality (Barlia (2010), and (f) teacher's acceptability by students.

The course will be offered in the national examination--UASBN was found to be the most crucial contribution to motivating student. All of students participating in this study mentioned their expectation to pass on the national examination--UASBN as the most important factor for them to get involved in the science learning process. They agreed that involving in learning science seriously, helps them to reach their goal—passed the national examination (UASBN) as the preparation to the future study (Junior High School). This finding suggests that teaching science for conceptual understanding, especially in practicing problem solution in science and solving science item tests became a powerful extrinsic motivation for students to engage in science teaching-learning process in Mrs. Novy's class.

In addition, Mrs. Novy's sincere love for them as both students and individuals became a powerful extrinsic motivator for her students to learn for understanding. This finding suggests that developing students-teacher positive interaction within the social contexts of the classroom is crucial in the teaching-learning process. The power of developing positive relationship between teacher and students was that it contributed to motivating students to engage in conceptual change learning is clearly found in statements made by Irfan, Lina, and Imas. They were identified as students who do not really like science and placed a low value on the goal of scientific understanding. However, Mrs. Novy's success in developing positive personal relationship with these students helped them succeed in developing learning strategies for conceptual understanding. Their lack of interest toward science was reduced by their effort in daily science class activities to satisfy their teacher, "they don't want to let her (Mrs. Novy) frustrated" (Irfan's statement). These statements also can be inferred that Mrs. Novy as the teacher of the sixth grade students was accepted by her students. Consequently, the students were actively engaged in conceptual change learning in daily classroom activities and developed learning strategies such as study parties and after class discussions with the teacher to enhance their understanding of science concepts. This suggests that in the teaching learning process teachers need to interact with students in the ways that would promote greater engagement within each other and the science content to be learned.

Most students plan to further their education beyond junior and senior high school. Generally, they plan to continue their education to the college/university in science related field and pursues science related career. As a group, they believed that science lesson will provide a valuable foundation for future learning. They understand that if they want to do well in high school and college science related major, they should learn well in science lesson. This claim is clearly described such as in Nurul's statement (Nr-5):

I love learning science, because it helps to increase my knowledge for future learning experiences. ..to prepare for my future education,… in the future I want to continue to medical college, my father hoping me become a medical doctor! (Nr-5).

The statement above, confirms that these students are highly motivated to learn science. Their concerns with being successful in the next education level (junior/senior high school, and the college) that they planned to, motivate them to learn hard in science lesson. In doing so, they engage cognitively in the learning activities. Thus, the myth that science is hard course, for Mrs. Novy's students is refuted by their commitment to do their best in order to reach future career goals.

Personal interest toward science also plays an important role for students to get involved in science lesson. As Schiefele (1996), Brophy (2004), and Hong & Milgram (2000) describes, personal interest is strong indicator of deep level of learning. Personal interest consists of recall of main ideas, coherence of recall, responding to comprehension questions deeply, and representation of meaning. All of them are very important to student's learning for conceptual change. The following statements offered by Amiroh: "Science has always been an interest of mine. I have taken science lesson since I knew it and I enjoy it" (Am-4). Ahmad's statement also indicates their personal interest toward science:"I study science because I enjoy it and because I understand it. I like science because it is logical thinking, and that is how my brain function" (Ah-6).

From the statements above, it is clear that these students' personal interest toward science invite their curiosity to learn, and to motivate them to get involved actively in learning science. Thus, students' personal interests toward science are a necessary reason for them to get involved in the science lesson offered by Mrs. Novy.

The importance of science knowledge for daily life attracted students to learn science. Generally, they recognize that life could not be divorced from involvement with science and technology. Nearly all of the sixth grade students of Mrs. Novy's class argued that they were actively involved in learning science because of its usefulness in their daily lives (see Nurul's statement /Nr-4). Many indicated that almost everything happened in the world around them could be related to science. Thus, having knowledge about science can help them to understand phenomena found in the real world. The following statements indicate how importance science knowledge for daily life of these students. Such as Rohandi's statement: "I study science because it explains our everyday life. It explains why things in our world are the way they are" (Rh-8). Also, Fitri's statement quite the same ideas as that of Rohandi's: "Science applies to my everyday life, because almost everything I do has a science concept or idea behind it" (Ft-3). All statements above can be inferred that the usefulness of science knowledge helps students to understand phenomena found in the world around them. Thus, the usefulness of science knowledge is one of the reasons for students actively engaged in learning science.

As described earlier, science is required course to take for elementary school graduation. Science is one of the courses offered in the national examination (UASBN). Although, do not all of Mrs. Novy's students like science. They have to optimally prepare themselves before the examination, especially for students planning to high school (junior high school/SMP). This claim is clearly supported in the following students' statements. Such as Norma's statement: "I study science because it is a required to graduate, but I really don't like science" (Nr-4). Differ from Norma, Ahmad has high motivation to learn science, he knows science is required course to graduate. In science lesson, Ahmad was always actively engaged in learning science. In fact, he enjoys class activities such as doing individual or group projects, presentations, discussions, hands-on experiments, and problem solving that helps him learn for conceptual understanding. All of his engagement in science lesson are supported by his statement: "My motivations to learn science are myself and always trying to do the best I can do, and the fact science is required course to graduate, it will be offered in the national examination (UASBN)" (Ah-8).

From all of these students' statements above, it can be summarized that several credits in science courses are necessary for students who plan to continue their education to high school (junior high school and further). This graduation requirement is an important reason why students actively get involved in learning science. It doesn't matter if they like science or not (see Irfan's statement/If-1). In fact, during this study, the sixth grade students of Mrs. Novy's class, were always actively engaged in science lessons. Her conceptual change curriculum, her warm personality, and her supportive teaching style that helped them learn in meaningful ways.

8. Conclusions of the Study

The present study was conducted in the sixth grade students of a public school in the greater of Serang District, Banten-Indonesia where the teacher implemented principles of conceptual change instruction through her instruction. The overall results, as measured by MSLQ translated to bahasa Indonesia and modified/adapted to the sixth grade students developmentally appropriate, show that all of the students in the class 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 for conceptual understanding 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) required for graduation (science course is one of the courses offered in the national examination/UASBN, (b) preparation for further or future education, (c) personal interest, (d) the usefulness of science content for daily life, (e) teacher personality, and (f) the acceptability of the teacher by students. Therefore, the major finding of this research is that motivation to engage in conceptual change learning in science is influenced by student's individual goals, teacher's personality and the acceptability the teacher by students, as well as instructional strategies. The sixth grade students of Mrs. Novy's class engaged in conceptual change learning at least for these reasons.

Finally, if conceptual change instruction is to become a widespread means of instruction, and becomes one of the alternative solutions to improve the quality of students' learning, it needs to be developed, ratified, socialized, and implemented to the elementary school. One of the possibilities introducing, developing, and implementing the CCM is by teaching it in pre-service and in service elementary school teachers at the teacher training college (PGSD).

9. Implication for Elementary school Science Teachers and CCM

The following discussion covers implication related to the findings of this study. This discussion is focused on implication of the study for elementary school science teachers interested in improving the quality of student engagement in conceptual change learning. Elementary school teachers' roles in teaching-learning process seemed to be the most significant factor to raise his/her students' motivation to learn in meaningful ways, especially for students who have low value in the goal of understanding, negative attitudes toward science, and low quality of task engagement. Although, they were reasonable successful in getting a good grade, for students who have been already intrinsically motivated to learn and high value in the goal of scientific understanding might have been successful without extensive support from the teacher (see Nurul's case). They could have demonstrated high quality of cognitive engagement in learning science independently. However, for students like Irfan, Wawan, and Lina (about 25% of the class population) who have low quality of task engagement, low value in the goal of scientific understanding, and negative attitudes toward science, require extensive teacher's supports necessary to energize their efforts to engage in learning for understanding.

If we look closely the public elementary schools in Indonesia, they are generally faced the same problems. The problems include class size (mostly between 40 to 50 students), more diversity students with different needs, short class session, unavailability of science teaching media, poorly teachers' knowledge and skills about environment as the very complete natural laboratory of science, including ill prepared and overloaded daily tasks and requirements that the teachers' have. In addition, teaching instructional strategies are sometimes not tied to real life (Barlia, 2011). All of these problems are reasonable reasons to create students who are lack of motivation to learn (science). Consequently, this affects on low quality of students' engagement in learning, especially for students who possess low value in the goal of scientific understanding and negative attitudes toward science. Further, these problems can be the potential source of creating more and more elementary school students who are lack of motivation to engage in conceptual change learning of science. This group of students has low expectancy of success in science lesson/course altogether if they don't receive proper intervention from the teacher.

Teaching instructional strategies based on conceptual change teaching and extensive teacher support to students as needed, seem to effectively help students' motivation to learn in the meaningful ways. The effectiveness of these two factors (conceptual change teaching and teacher support) is clearly described, for example in irfan's and Lina's case. This can be one of the valuable solutions to help these students population to increase their expectations to be accountable for their learning outcomes instead of just finishing the work or course assignment.

Furthermore, the implication of the result of this study for elementary school science teachers is to help his/her students to increase their motivation to learn for conceptual change through understanding and reducing factors that are identified as the constrains for students' motivation in the social contexts of classrooms. At least two factors related to students' motivation barriers to engage in conceptual change learning are identified. These constrains include students' lack of value in the goal of scientific understanding, and students' lack of interest in learning science.

To reduce these elementary school students' motivation constrains, elementary school science teachers have to help them to (a) realize that scientific understanding is a valuable goal as the first priority of learning science, (b) develop positive attitude toward science, (c) fertilize self confidence in learning science, (d) relate science contents to students' daily life, and (e) encourage them to offer their ideas.

Scientific understanding is a goal for scientifically society. It encompasses the ability to use conceptual knowledge of science. It entails the ability to distinguish between what is and what is not scientific idea. Understanding basic science concepts is required in the modern society, it becomes a major goal of elementary school science education today. To reach this goal, elementary school students need to learn science by engaging in learning activities that are interesting and meaningful for them. The important of scientific understanding for daily life has been recognized by most of students. However, they did not put it as the priority of their personal goal (e.g., see Irfan's case). In learning science they were more concerned with getting a good grade, fulfilling course requirement for graduation or sometimes just for competing goal (pass the national examination—UASBN). Lack of an intrinsic motivation to learn in meaningful ways seemed to be the major problem for them because they have low value in the goal of understanding.

Relating course materials and teaching strategies to real daily life can help students to realize the value of scientific understanding to their daily life. Elementary school science teachers have to place students in the process of learning science by giving them chance to explore the application of science and technology in their real life at the first hand---Students' active learning/child centered activities. This brings students to the conceptions that in the scientific society, daily life cannot be separated from science and technology. As students got experience the value of scientific understanding for everyday using, elementary school science teachers can guide them to internalize the goal of scientific understanding as the priority of students' personal goal as end of itself in learning science.

As described before, one of the elementary school teacher responsibilities is to help his/her students learn in meaningful ways. A lot of elementary school students do not really like science. Some of them develop negative feeling such as uninterested course materials, boring daily class activities, and uninterested teachers. Consequently, they thought science is a hard course. This can be some of the reasons for elementary school students to develop negative affective orientation toward aspects of a science class. These negative attitudes toward science can be the factors of elementary school students' motivation constrains in learning science for understanding.

To reduce students' negative attitude toward science, teaching instructional strategies should incorporate students' awareness of affective orientation in learning science. Elementary school 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. Elementary school science teachers need to put more attention to individual needs and keep closely communicating with them accommodating for their learning. Helping students to reduce negative attitude toward science, elementary school science teachers have to determine the best way to implement teaching instructional strategies (CCM) that develop quality of social environment in science classroom activities. Thus, in implementing CCM, elementary school teachers need to consider the affective aspects of students' learning including motivational constructs would lead to change in students' learning.

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