The Application of Contextual Teaching and Learning in Natural Science to Improve Student’s HOTS and Self-efficacy

Putri Chandra Haryanto* and Indiyah Sulistyo Arty
Yogyakarta State University, Indonesia

*Email: putrichandra26@gmail.com

Abstract. The development of science and technology effects in education. Now the world of education is becoming increasingly urgent and full of competition in all aspects of life. One of the skills in the field of education that are needed in the 21st century is high order thinking skills and rational thinking skills. Learning that is related to the real life context can provoke students to think high-level. Contextual Teaching and Learning (CTL) learning is a whole learning process that aims to teach students to understand learning that is related to the real life. This research aims to study of application Contextual Teaching and Learning (CTL) to improve the student’s HOTS and self-efficacy. This research used a literature review method. Based on the study of literature that has been done can be concluded that contextual teaching and learning is a learning approach that can be applied as an effort to improve high-level thinking skills and self-efficacy of students. Learning is done by linking material with real life contexts, so that students are able to analyze, evaluate, and create. The ability of students to solve problems in life can then improve self-efficacy.

Keywords: CTL; HOTS; Self-efficacy.

1. Introduction
The development of Science and Technology in the 21st century that increasingly rapid, guiding individuals to have diverse skills and abilities, both of hard skills and softskills. These skills are used to face the global competition with other countries. The creation of quality human resources is very important, to face the global competition. The rapid development of Science and Technology also causes the information flow quickly to various parts of the world, so there are no more restrictions to access information from various countries.

The rapid development of science and technology, also affects in education. Now the world of education is becoming increasingly urgent and full of competition in all aspects of life. According to The North Central Regional Educational Laboratory (US) [1], there are a number of skills in the field of education that are needed in the 21st century, namely having digital literacy, having the ability to think creatively and innovatively, having high order thinking and rational thinking skills, having the ability to communicate effectively, and have high productivity. Changes in the world of education need to be implemented to deal with the global challenges of the 21st century which continue to grow rapidly. Education needs to emphasize the mastery of skills and good attitudes, in addition to mastering knowledge in the learning process.

Changes in the world of education to deal with the development of the 21st century make the role of the teacher no longer the main learning source, but as a facilitator. Now the learning paradigm is no
longer teaching but learning. The teacher can raise the problems that exist in life as a source of learning. Problems raised from life can then be analyzed by students so that students are able to solve these problems. This makes students not only understand the theory presented by the teacher but also able to apply the theory to solve problems in their lives. The ability of students to analyze problem, evaluate, and create new ideas to solve problems in life is one of the abilities expected in the 21st century, namely high order thinking skills.

Learning that is raised from the problems that exist in life is Contextual learning. Such science learning can train students to improve high-level thinking through the problems that exist in their lives. Contextual learning is learning that links material with the real-world conditions of students, so that students can use their knowledge to solve everyday problems that exist in the family, community, or at work [2]. Contextual learning involves seven main components of learning [3], namely: constructivism, questioning, inquiry, learning community, modelling, reflection and authentic assessment. Through contextual learning, students can actively create and participate in the effort to find new knowledge that can open up the students' knowledge as broadly as possible.

The ability of students to solve problems then can increase self-efficacy. Self-efficacy according to Bandura [4] is an individual's confidence in his ability to carry out tasks or actions taken to achieve certain results. Someone with self-efficacy believes that they are able to do something to change the events around them, while someone with low self-efficacy considers himself basically unable to do everything around him. In difficult situations, people with low efficacy tend to give up easily. While people with high self-efficacy will try harder to overcome the challenges. Self-efficacy can be grown and learned through four main sources of information, namely the experience of success, other people's experiences, verbal perceptions, and physiological conditions.

The rest of this paper is organized as follow: Section 2 describes the proposed research method. Section 3 presents the obtained results and following by discussion. Finally, Section 4 concludes this work.

2. Research Method

This research used a literature review method. Literature review is an objective research, comprehensive summary and critical analysis of research or non-research that is relevant to a topic being studied [5]. The researcher studied literatures, articles, books, and other sources such as dissertations, conferences and processes relevant to a particular problem, field of research or theory provides descriptions, summaries and synthesizes data. This study examines the application of Contextual Teaching and Learning (CTL) approach in natural science to improve student's high order thinking skills (HOTS) and self-efficacy.

3. Result and Discussion

This section presents the results obtained and following by discussion.

3.1 Contextual Teaching and Learning

Contextual Teaching and Learning (CTL) is one of the approach in learning. Contextual teaching and learning (CTL) is a concept that helps teachers relate subject matter to real world situations [1]. The CTL motivates learners to take charge of their own learning and to make connections between knowledge and its applications to the various contexts of their lives: as family members, as citizens, and as workers. Contextual Teaching Learning (CTL) is a holistic learning process that aims to teach students to understand meaningful learning that is linked to real life contexts both related to personal, religious, social, economic, cultural environments, and so on so that students gain knowledge and skills that can be applied and transferred from one context of problems to another [6]. The CTL is a learning approach that emphasizes the process of full involvement of students to be able to find material that is learned and relate it to real life situations so as to encourage students to be able to apply in their lives [7]. Meanwhile, according to [8] states that CTL learning is a learning strategy that emphasizes the process of full involvement of students in order to find material and its relationship to
the reality of social life. CTL included a collaborative interaction with students, a high level of activity in the lesson, a connection to real-world contexts, and an integration of science content with other content and skill areas [7]. Furthermore, the CTL strategies were best implemented when teachers used them in conjunction with sound classroom management techniques. Based on the understanding of CTL above, it can be concluded that CTL learning is a whole learning process aimed at teaching students to understand learning that is related to the real life context both in relation to person, religious, social, economic, cultural, and so on, so that students gain knowledge and skills that can be applied in his life. The position of the teacher in CTL as a facilitator whose job is to create a pleasant learning atmosphere.

According to [1] [7] [9] [8] [6], learning contextual involves seven main components of learning, namely: constructivism, questioning, inquiry, learning community, modelling, reflection, and authentic assessment.

a. Constructivism
The meaning of constructivism is that students construct / build their own understanding of new experiences based on initial knowledge through the process of social interaction and assimilation-accommodation. The implication is that learning must be packaged into a process of "constructing" rather than receiving knowledge.

b. Inquiry
The essence of inquiry or investigating is the process of moving from observation to understanding. Therefore, in this activity students learn to use critical thinking skills.

c. Asking
Asking or questioning in contextual learning is done by both the teacher and students. The teacher asks is intended to encourage, guide and assess students' thinking skills, while for students to ask as an important part of inquiry-based learning.

d. Learning Community
The learning community is a group of people (students) who are bound in learning activities, exchange experiences, and share experiences, in accordance with the theory of constructivism.

e. Modeling
Modeling is the process of displaying an example so that other people (students) imitate, practice, apply to other situations, and develop it. According to Albert Bandura, learning can be done by modeling this.

f. Reflection
Reflection in principle is to think about what has been thought or learned, in other words an evaluation and evaluation of the learning activities he has done.

g. Authentic Assessment
Authentic assessment is intended to measure and make decisions about the authentic knowledge and skills of students (in fact). In order to be able to assess the reality, authentic assessment is done in various ways such as evaluating product ratings, performance appraisals, portfolios, relevant and contextual tasks, self-assessment, peer assessment and so on.

According [10] learning carried out using contextual methods has the following characteristics:

a. Learning is carried out in an authentic context, meaning that learning is directed so that students have the skills to solve real problems faced.

b. Learning provides opportunities for students to do meaningful assignments.

c. Learning is carried out by giving meaningful experience to students.

d. Learning is carried out through group work, discussion and mutual correction.

e. Togetherness, cooperation, and understanding one another in depth is an enjoyable aspect of learning.

f. Learning is carried out actively, creatively, productively and in cooperation.

g. Learning is carried out in a fun way.

According to [11], contextual learning comprises the following:

a. emphasizes problem solving
b. knowing teaching activities occurs in various contexts such as home, community and workplace.
c. help students learn how to monitor their learning so that they become independent individual
d. emphasize teaching in the context of students’ lives
e. encourage students to learn from one another and learn together.
The principle of contextual learning activities above is basically directed so that students can develop their own learning methods and always relate to what is in society, namely the application of the concepts they learn. Whereas according to [12] explained that in the learning process contextually, students will go through one or more forms of learning, namely as follows:

a. Relating (associating): learning in the context of connecting or relating new knowledge to life experiences.
b. Experience: learning in the context of discovery (discovery), and invention (invention).
c. Applying: the use of learning contexts, knowledge, or information can be used in various situations.
d. Cooperating: contextual learning connects or associates new knowledge with shared life experiences.
e. Transferring: learning in the context of existing knowledge or fostering from what is already known.

3.2. High Order Thinking Skills

High Order Thinking Skills (HOTS) are thought processes that not only memorize and re-convey known information [13]. High-level thinking ability is the ability to connect, manipulate, and transform knowledge and experience that is already owned to think critically and creatively in an effort to determine decisions and solve problems in new situations. Higher order thinking skills is an important aspect in teaching and learning. Thinking skills are fundamental in educational process. A person thought can affect the ability of learning, speed and effectiveness of learning. Therefore, thinking skills is associated with learning process. Students who are trained to think demonstrate a positive impact on the development of their education.

The Cognitive processes dimension on Bloom's taxonomy [14] are as follows: (1) remember, (2) understand, (3) apply, (4) analyze (analyze), (5) evaluate (evaluate), and (6) create (create). The dimensions of the cognitive process are arranged hierarchically from the level of low thinking to the level of high thinking. Remembering is the lowest level of thinking, while creating is the highest level of thinking. High-level thinking is at the top 3 level of analyzing, evaluating, and creating.

a. Analyze
   Analyzing involves the process of dividing material into small parts and determining how the relationships between parts and between each part and the overall structure. The cognitive processes included in analyzing include detecting, solving, associating [14].

b. Evaluate
   Evaluating is defined as making decisions based on criteria and standards such as quality, effectiveness, efficiency and consistency. The cognitive processes included in the evaluation category are criticizing, namely the process of evaluating a product or process based on external criteria and standards [14].

c. Creative
   Creating / creating involves the process of arranging elements into a coherent and functional whole. Cognitive processes that are included in the category of creating inter-process describe the problem and make choices or hypotheses that meet certain criteria (formulate), the process of planning a problem-solving method that matches the criteria of the problem, namely making a plan to solve the problem (plan) and process implement plans to solve problems that meet certain specifications (produce) [14].

The successful implementation of the process for the development of higher level thinking skills requires the thoughtful consideration of current instructional techniques and the commitment to an active, student centered learning environment. Potential roadblocks in the application of this process
can be overcome with some planning and creativity [22]. Thinking process requires a lot of effort, learning in the classroom should be organized so that it can train students to think with a clear framework or routine frame of mind. To be able to infuse the performance of the brain, the teacher must create conditions such as asking good questions, providing facts that invite students' thoughts or facts that are different from the logic of students' thinking. If learning is directed to encourage high-level thinking processes, the learning process must stimulate the work of the brain.

3.3 Self-efficacy

Bandura's social cognitive theory [4], known as the term self-efficacy which influences the choice of activity and one's effort in completing the tasks at hand. Self-efficacy makes students choose to work or avoid learning activities. With regard to self-efficacy, Bandura in [4] said that self-efficacy is defined as, people judgments of their ability to organize and excite courses of action required to design types of performances. The purpose of the statement is, Self-efficacy is a person's assessment of their ability to regulate and carry out the actions needed to achieve goals. Santrock in [15] Argues that self-efficacy is the belief that a person can master the situation and produce positive results. Meanwhile, Ghufron and Rini in [16] stated that self-efficacy is one's belief in ability. Scheerens and Bosker in [17] explains that Self-efficacy is a belief in a person who is oriented in the future, about how he will play a certain time. Alwisol in [18] revealed that self-efficacy is a self-assessment whether it can perform good or bad, right or wrong, can or cannot work as required.

Based on the above description, it can be concluded that self-efficacy is a belief that is owned by each individual of his ability to carry out an action or task with a goal to be achieved. People are more likely to engage in certain behaviors when they believe that they will be able to carry out these behaviors successfully, therefore, self-efficacy does emphasize the self-confidence that exists in someone. The beliefs of each individual are different. Students with a low level of self-efficacy will avoid many tasks that are particularly challenging and difficult, while students who have a high level of self-efficacy will diligently try to master the learning task [19]. Therefore, someone with the same level of intelligence makes it possible to get different results because of the level of self-efficacy they have. Bandura in [4] States that there are three aspects to self-efficacy. The aspects are as follows:

a. Difficulty (Level)

This aspect is related to task difficulties. If the tasks charged to individuals are arranged according to the level of difficulty, the differences in individual self-efficacy are limited to simple, medium, or high tasks. Individuals will carry out activities that they feel are capable of being carried out as well as tasks that are estimated to be outside the limits of their abilities. The higher the level of difficulty of the task, the higher the demand for self-efficacy.

b. Strength

The level of strength in this case is closely related to the strength of the beliefs held by individuals. This strength includes perseverance in learning, perseverance in completing tasks, and consistency in achieving goals. Individuals who have a strong belief in self-efficacy will certainly try and strive to achieve the goals they want to achieve. But for individuals who do not have strong beliefs, the individual will easily give up and falter to try to achieve the goals set.

c. Generalization

The aspect of generalization in this regard relates to areas of individual achievement such as mastery of tasks, mastery of subject matter, and how to manage time. Not all individuals are able to perform tasks in certain fields, but individuals who have high self-efficacy tend to master tasks from different fields. Meanwhile, for individuals who have low self-efficacy tend to only master tasks from certain fields.

After looking at the description above, it can be concluded that self-efficacy has 3 important aspects. The three aspects are a) level of difficulty, b) level of strength, c) generalization. These three aspects can be used to measure the high and low self-efficacy possessed by a person. Yee, et al. in [20] Argues that there are several factors that influence the development of one's self-efficacy, including the following:
a. Previous Learners' Successes and Failures

Learners are more likely to believe that they can succeed in a task when they have succeeded in the task and other tasks that are similar in the past [4]. Even so, there are possible differences in each student's self in seeing how far they consider previous failures and successes. Students will develop higher self-efficacy when they successfully perform challenging tasks. If students have developed high self-efficacy, occasional failures will not reduce their optimistic attitude. When students experience a setback in the process of achieving success, students learn that they will achieve that success if they try. Experienced failure will also provide useful information to improve its performance so that as in Bandura [4], they have developed resilient self-efficacy (strong and resilient self-efficacy).

b. Message from Others

Limbach, et al. in [21] an increase in self-efficacy of students can be done by giving them reasons to believe that they can succeed in the future. When communicating confidence in the ability of students, it should offer concrete improvement suggestions because sometimes the message given by someone is implied instead of being stated directly. Based on the description above, it can be concluded that there are two factors that influence the development of one's self-efficacy, among others,

1) Success and failure of previous learners,
2) Message from someone else. Both of these factors do have an important role in the development of one's self-efficacy.

The feeling of self-efficacy of students influences their choice of activities, goals, and efforts as well as their persistence in classroom activities [20]. Below are the things that show that self-efficacy affects behavior and cognition, namely:

a. Activity choice

The choice of activity referred to in this case relates to the selection of activities that will be undertaken by the individual. Individuals tend to choose tasks and activities that they believe will succeed and avoid activities and tasks that they believe they will fail.

b. Aim

Individuals will set higher goals for themselves when they have high self-efficacy in certain fields. [4] states that career choices and job levels indicate that they are have high self-efficacy in the field and not the other way around.

c. Business and Persistence

Individuals who have high self-efficacy are more likely to exert all their energy when trying new tasks. They are also more persistent and do not give up easily when facing challenges. But on the contrary, individuals with low self-efficacy will be half-hearted and easily give up when facing difficulties.

d. Learning and Achievement

Individuals with high self-efficacy tend to learn more and achieve better than individuals who have low self-efficacy. This is true even when the actual level of ability is the same [20]. Therefore, individuals who have the same ability, those who believe they can complete a task are more likely to complete the task successfully than those who are not sure of being able to achieve success.

3.4 Relation between CTL, HOTS, and Self-efficacy

The science learning process carried out by the teacher can raise the problems that exist in life. Contextual problems can be related to the material that will be conveyed by the teacher. Such learning is called Contextual Teaching and Learning (CTL). The CTL learning is a whole learning process that aims to teach students to understand learning that is related to the real life context both related to the personal, religious, social, economic, cultural, and so on, so that students get the knowledge and skills that can be applied in his life. Contextual learning involves seven main components of learning, namely: constructivism, questioning, inquiry, learning community, modeling, reflection, and authentic
assessment. The application of constructing or building knowledge by them self, makes students trained to reason and think higher level through inquiry activities or find problems by them self, freedomask (questioning), the application of the learning community (learning community) namely training students to work together, share ideas, share with each other experience, knowledge, communicating with each other so that interaction occurs positive between students and eventually students are actively involved in learning together [25]. This contextual learning strategy then make learning more meaningful and able to stimulate higher-order thinking processes [26].

To be able to infuse the performance of the brain, the teacher must create conditions such as asking good questions, providing facts that invite students 'thoughts or facts that are different from the logic of students' thinking. If learning is directed to encourage high-level thinking processes he learning process must stimulate the work of the brain [23]. Learning that is related to the real life context can provoke students to think high-level. Through the process of analyzing the problems presented by the teacher, it can be used as a better evaluation material so that it can reduce the problems that exist in life. Students can then deliver ideas as an effort to solve problems in their lives [24]. In accordance with the aspects of high-level thinking ability in Bloom's revised taxonomy, namely analyzing, evaluating, and creating.

The ability of students to solve problems can then increase self-efficacy. Self-efficacy according to Bandura is an individual's confidence in his ability to carry out tasks or actions taken to achieve certain results. The aspects of self-efficacy include three levels, namely the level of difficulty (level), level of strength (strength), and generalization (generality). A person with self-efficacy believes that they are able to do something to change the events around him, while someone with low self-efficacy consider himself basically unable to do everything around him. In difficult situations, people with low efficacy tend to give up easily. While people with high self-efficacy will try harder to overcome the challenges. Self-efficacy can be grown and learned through four main sources of information, namely the experience of success, other people's experiences, verbal perceptions, and physiological conditions.

4. Conclusion

Based on the study of literature that has been done, it can be concluded that contextual teaching and learning is a learning approach that can be applied as an effort to improve high-level thinking skills and self-efficacy of students. Learning is done by linking material with real life contexts, so that students are able to analyze, evaluate, and create. The ability of students to solve problems in life can then improve self-efficacy.

References

[1] The North Central Regional Educational Laboratory, https://www.educationworld.com/ Retrieved 1 Agustus, 2018.
[2] Susan Sears, “Introduction to Contextual Teaching and Learning”, Phi Delta Kappa Educational Foundation, 2003.
[3] Jumadi, “Pembelajaran Kontekstual dan Implementasinya,” Makalah disampaikan pada Workshop Sosialisasi dan Implementasi Kurikulum 2004 1-10 (2003).
[4] Bandura, A., “Self-efficacy: The Exercise of Control,” W.H. Freemen and Company, 1997.
[5] Patricia Cronin, Frances Ryan, and Michael Coughlan,“Undertaking a literature review: a step-by-step approach”. British Journal of Nursing, vol 17 (1), pp. 38-43, (2008).
[6] Cucu Suhana, “Konsep Strategi Pembelajaran (Edisi Revisi),” Bandung: PT Refika Aditama, 2014.
[7] Endang Komara, “Belajar dan pembelajaran Interaktif,” Bandung: PT Refika Aditama, 2014.
[8] Rudi Hartono, “Ragam Model Mengajar Yang Mudah Diterima Murid,” Yogyakarta: Diva Press, 2013.
[9] Donni Juni Priansya, “Perencanaan dan Pengembangan SDM,” Bansung : Alfabeta, 2014.
[10] Krisnawati, Yulia. & Swarsih, Madya, “Pengelolaan Pembelajaran Bahasa Indonesia dengan Menggunakan Metode Kontekstual di SLTP Negeri 25 Surabaya,” Jurnal Penelitian dan Evaluasi PPS UNY (2004).
[11] Davtyan, Ruzanna. “Contextual Learning” ASEE 2014 Zone I Conference, University of Bridgeport USA, vol:3, No.5. (2014).
[12] Yulaelawati, Ella, “Kurikulum dan Pembelajaran Filosofi Teori dan Aplikasi,” Jakarta: Pakar Raya, 2004.
[13] Rofiah Emi, “Penyusunan Instrumen Tes Kemampuan Berpikir Tingkat. Tinggi Fisika Pada Siswa SMP”, Jurnal Pendidikan Fisika (2013).
[14] Anderson, Lorin W and David R. Krathwohl, “Kerangka Landasan untuk Pembelajaran, Pengajaran, dan Asesmen: Revisi Taksonomi Pendidikan Bloom,” New York: Addison Wesley Longman, Inc, 2001.
[15] Santrock, J.W. “Psikologi Pendidikan (edisi kedua)”, Tri Wibowo B.S, (2007).
[16] Nur Ghufron dan Rini Risnawita, “Teori-teori Psikologi” Yogyakarta: Ar-Ruzz Media, 2010.
[17] Scheerens, J. & Bosk, R. J, “The Foundation of Education Effectiveness”, New York: Pergamon Press, 2008.
[18] Alwisol, “Psikologi Kepribadian”, Malang: UMM Press, 2004.
[19] Ornmrod, Jeanne Ellis, “Psikologi Pendelikon: Membantu Siswa Tumbuh dan Berkembang”, Jakarta: Erlangga, 2008.
[20] Yee Mei Heong, Jailani Bin Md Yunos, Razali Bin Hassan, “The Perception of the Level of Higher Order Thinking Skills Among Technical Education Students”, International Conference on Social Science and Humanity, IPEDR vol 5 (2011).
[21] Limbach, Barbara, Wendy Waugh, “Developing Higher Level Thinking”, Journal of Instructional Pedagogies, page 7.
[22] Murni Ramli, “Implementasi Riset dalam Pengembangan Higher Order Thinking Skills pada Pendidikan Sains,” Makalah Utama in Seminar Nasional Pendidikan Sains V, ISSN: 2407-4659, (2015).
[23] Munzenmaier, Cecelia & Nancy Rubin, “Perspectives Bloom’s Taxonomy: What’s Old Is New Again”, The Learning Guild, 2013.
[24] Hasnawati, “Pendekatan Contextual Teaching Learning Hubungannya dengan Evaluasi Pembelajaran”, Jurnal Ekonomi & Pendidikan, Volume 3 no 1, April 2006.
[25] Fahmi, “Strategi Pembelajaran Contextual Teaching and Learning untuk Meningkatkan Keterampilan Berpikir Tingkat Tinggi” Prosiding Seminar Nasional Pendidikan IPA, ISBN: 978-602-60213-0-4, (2016).
[26] Glynn, Shawn, “Contextual Teaching and Learning of Science in Elementary Schools”, Journal of Elementary Science Education, Vol 16, No 2, pp 51-63, (2004).