ELSII LEARNING MODEL BASED LOCAL WISDOM TO IMPROVE STUDENTS' PROBLEM SOLVING SKILLS AND SCIENTIFIC COMMUNICATION

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Abstract: The development of information and communication technologies have strategic role in the 21st century. Student must have problem solving skills and good communication to be able to compete and contribute in the 21st century. The ELSII learning model based on local wisdom is a learning innovation in Indonesia. Model ELSII provide opportunities for students to be able to achieve the goal of learning as a preparation to face the next life by referring to the cultural values of the region. ELSII learning model based on local wisdom through the adaptation of environmental conservation values contained in the social life of the community, are expected to develop problem-solving skills, scientific communication, and caring attitude to maintain the environmental balance.

Key words: *ELSII learning model, local wisdom, problem solving skills, scientific communication.*

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A. INTRODUCTION

Competency framework in the 21st century to be the basis of Curriculum 2013 (i.e. curriculum in Indonesia). To support the curriculum in Indonesia required learning supports creativity that emphasizes personal experience through the problems solving process. Peng (2004) explains that the problem-solving skills are regarded as the most complex intellectual function. Students need problem solving skills in order to compete globally, helping students make the right decisions, careful, systematic, logical, and consider the problem from different angles (Ayogdu, 2012; Temel, 2015). Students not only have to have problem solving skills, but also must have good communication skills to be competitive in the 21st century. The competitive advantage created by a human being who is not only able to solve problems in the world real, but also be able to communicate what has been gained (Bender 2012; Erozkan, 2013). Students required communication skills to explain the valid conclusion based on the evidence of science in solving the problems (Joseph & Adeoye, 2012).

One of the events or phenomena or the most famous objects in every area, even across countries and regions is the local wisdom, especially with regard to the peculiarities of local culture. The development of science and technology caused the cultural degradation (Mungmachon, 2013). The values moral and socio-cultural degradation occur in the community (Ardan, Ardi, Hala, Supu & Dirawan, 2015). The cause of moral degradation, as following: 1) increasingly waning native culture that has noble values and the influx of foreign culture that is not in line with our own culture, 2) including a lack of support and community spirit to maintain, preserve, maintain and develop local technology and local knowledge (Suastra 2010; Wagiran, 2011). Disclosure of the idea of community that is local regionalism, can strengthen the nature of meaningful learning, and encourages every student in the school to be wise, full of wisdom so as to resolve the problems of life (Santrock 2011: 177). Local Wisdom can be either local knowledge, local skills, local intelligence, local resources, local social processes, values or local norms and local customs (Wagiran, 2011). Community tradition of Sasak etnic in Lombok in the preservation of ecosystems is a form of local wisdom that characterizes the lives of people. However, reality has shown that the functioning of ecosystems has been lost due to the utilization of natural resources exceeded the limit. Environmental balance disrupted due to the destruction of nature in the form of pollution of water, soil and air due to biotic and abiotic elements. As a result of nature shows wrath in the form of disaster that threatens human life. The emergence of environmental problems indicate the inability of the community to develop a caring attitude that environment is part of the value of local wisdom.

Learning in school, especially science would be very nice if presented in the context of a fun, such as: regional local wisdom. Material science is known to be quite difficult and is often considered complex because many contain symbols, mathematical equations and concepts in the form of microscopic and macroscopic and scientific language that is not familiar with the students is very appropriate if brought closer to the local potential area known or experienced students. During these potentials are rarely used in science learning but only in the dimension of social and civic life. The importance integrated local wisdom in learning science, especially in Lombok, Indonesia. One of them by developed an innovative learning model that can not only improve the competence of the 21st century, but also to maintain the nation's cultural values. Therefore, researchers developed a ELSII learning model based on local wisdom. ELSII learning model is expected to provide opportunities for students to be able to improve problem solving skills and scientific communication in Indonesia.

B. DISCUSSION

1. Problem Solving Skill

The problem is when one is aware of the gap between what he wanted and that happened, but he did not know how to address these gaps (Gupta, 2012). Problems have initial state, goals, and the way to achieve that goal (Woolfolk, 2009). The problem occurs when there is a certain statement, the statement of interest must be achieved, and there are no method available solutions (Mayer, 2003). The next process to change certain statements into the desired goal, defined as problem solving (Lovett, 2002). Santrock (2011) describes the problem solving skills is the ability to find a solution through a process which involves obtaining and organizing information. John Dewey (1910) suggests solving a deliberate process consisting of the problem; develop a hypothesis to solve the problem, test different hypotheses, and selecting the most appropriate alternative (Moreno, 2010). Problem solving skills can be defined as individuals or groups attempt to find answers based on the understanding that has been held previously in order to meet the demands of the situation is not normal (Hardin, 2002).

Factors affecting the problem solving are the structure of the knowledge of the students and the character of the problems indicated by the representation format questions presented (De Cock, 2012). The difference between the students who have low ability (*novice*) and high (*expert*) in problem solving is how students organize and use knowledge, as well as linking one concept to another (Singh, 2008; Mason & Singh, 2011; Shih & Singh, 2013) is referred to as individual constructivist. Individual constructivist in inspired by the work of Piaget. Individual constructivist focus on how individuals construct knowledge in his mind. Characteristics of constructivist learning methods actively connect students with the experience to develop a meaningful understanding (Moreno, 2010). Students in trying to understand the constructivist learning new knowledge with existing knowledge through active mental activity (Redish, 2004). Students who have high ability in problem solving tend to use qualitative arguments based on the concept of science that underlies the problem, evaluate solutions, and tend to use the tools of representation. The opposite, students who have a low ability in problem solving IPA tend to recognize the problem based on the grain issue and did an evaluation (Mason & Singh, 2011; Savelsbergh, et al, 2011).

Theory of information processing shows problem solving skills based on general problem solving skills and artificial intelligence. Cognitive psychology shows problem solving as a process that includes introspection, observation, and the development of heuristics. Developing cognitive psychology as a discipline, interest and effort geared toward the mental processes of learning and

problem solving. An early cognitive approach to problem solving is to identify mental stage and continued with the problem solving (Hardin, 2002). Learning problem solving depends on the processing of students in four process comprises: (1) attention, the process of allocating cognitive resources on the stimulus or task exists and is a necessary condition for the transfer of information to be learned into the working memory, (2) retention, process given the observed behavior and then transferred to the working memory, students need to encode information by creating a visual representation of verbal or experience in long-term memory, (3) production, converting a mental representation that is created during the encoding into motor activity. This process is done by splitting the procedure is learned to be steps smaller and provides many training opportunities are accompanied by feedback to guide, and (4) motivation, students need to be motivated to learn from the model and to reproduce what they have learned (Moreno , 2010).

Learning the characteristics of problem solving is to use realistic problems, emphasizing multiple perspectives, and help scaffolding through the nearest development zone (zone of proximal development) them (Schunk, 2012). Vygotsky idea of zone of proximal development states that learners are helped to lead to higher levels of performance through support from friends or from teacher (Santrock, 2011: 50). At first, what students can do depends on the teacher, but the more independent after mastering the task of learning and gain control over new functions. The task of the teacher is to provide an environment and conditions that allow students to learn to master new skills and learn new things. One of the ideas associated with the ZPD is the concept of scaffolding. Scaffolding is a technique to change the level of support for learning. A more skilled (teacher or student) adjust the amount of guidance in order to comply with the required student (Santrock, 2011). Technic of scaffolding will provide support when needed, but the guidance is eliminated gradually. For the scaffolding technique often used to assist students in reaching the upper limit of ZPD. Giving guiding question is one form of scaffolding that can be used to help students learn and develop thinking skills. Some other forms of scaffolding is to divide a task into steps simpler, reminded the students on learning objectives, and provide feedback (Moreno, 2010).

Learning science that aims to develop problem solving skills based on the theory sosio-cognitive. Albert Bandura focuses on learning is the result of observing others or to observe the consequences of other people's behavior. Various things can happen in a social context one has learned by observing and imitating the behavior of others (Moreno, 2010). Students can evaluate the learning progress by setting a self-regulated learning, the student's ability to control all aspects of

their own learning, from initial planning to evaluate the performance achieved (Moreno, 2010). Such learning is expected to achieve the goal of learning science.

Results of research Aydogdu, Guven & Aka (2012), Angawi (2014), Temel (2015) and OECD (2013) states that learning and assessment of the problem solving skills is indispensable and is driven by the need for students at the school level and careers that require ability to work and apply problem-solving skills that they have in real situations. Economic measurement of routine and non-routine tasks from the year 1969-1998 showed a significant decrease, while the higher-level thinking skills and complex communication has increased from year to year (Levy & Murname, 2004). Higher-level thinking skills including problem solving and complex communication is very important to have students as a provision in the face of world competition work. Based on the scope of materials science payload on the content standards that competence must be achieved through science teaching include problem solving competence (Kemendikbud, 2014: 19). This shows the importance to practice the problem solving skills in science teaching in junior high school students. One way to teach problem-solving skills to students is through providing experiences that require different strategies from one issue to another issue. To introduce a specific strategy to students required careful planning. Ommundsen (2001) problem solving solution includes a four-step completion. The first step is to understand the problem. Without the understanding of the given problem, students will not be able to resolve the issue properly. After the students can understand the problem correctly, then they should be able to plan a resolution. The ability does this second phase depending on their experience. The plan problem solving has been made. Further of problem solving in accordance with the plan. The last step is to check on what has been done from the first to the last step. Think about or examine the steps that have been made in solving the problem is a very important activity to improve students' skills in problem solving. The results of the study (Angawi, 2014) showed that reconsider the settlement process which has made a very significant factor to improve students' skills in problem-solving process.

2. Scientific Communication Skill

Humans communicate with other humans to use language to communicate ideas, thoughts, and feelings verbally and nonverbally. Communication easier for students to obtain information or new ideas that can help them understand a concept or problem with either (McNeill, 2011) as well as increase knowledge for students who submit ideas. Bailey (2005) describes the communication information transmitted through a verbal or nonverbal message, and the process by which

information is exchanged between individuals through a common system of symbols, signs and behaviors. Sources of information (sender information) in the communication process should have informed and able to deliver it accurately while the recipient must be able to describe and interpret the meaning of information and must provide responses/reactions that can be accepted by the sender information. The communication process is a continuous and dynamic interaction; both affect and are affected by many variables (Ediger & Rao, 2007) including the sender, code / password, channel / media, and receiver.

Adler and Rodman (2006) mentions types of communication consist of verbal communication (words) and nonverbal communication (without words). Verbal communication included in vocal communication (voice) is the spoken language, being classified in the non-vocal communication (without sound) is a written language. Verbal and nonverbal language, both have a holistic nature, that individual cannot be separated. For speaking skills, students should be able to demonstrate proficiency in selecting and using words or phrases that information or ideas that communication accepted easily by the listener (Kayi, 2006).

The involvement of communication in science learning can also be studied from constructivist learning theory. Constructivist learning theory developed the theory sosio-cognitive with a focus not only how a person builds knowledge in itself, but also how they built together knowledge with others. Simpson explained the essence of the idea of constructivism is active students build their knowledge of their personal experiences with others and the environment (Moreno 2010). The thought process occurs individually and collaboratively, so that test a variety of opinions is necessary so that the ideas of individuals can develop better. It is certainly very supportive in practice the verbal communication skills which include Google, ask questions, respond to, and be a good listener.

Communication skills are based on social constructivist learning theory of Vygotsky (1978). The theory of social constructivism emphasizes the social context of the rules in building knowledge through social interaction with teachers or other students (Santrock, 2011: 334; Arends, 2012: 401). Learners divide individual perspectives with others to build a common understanding that not be done alone. Vygotsky not only insists on rules that facilitate social interaction in cognitive development of learners but also consider the situation of learning in a culture of learning (Schunk, 2012). This is because the learners bring experience, values and knowledge is different. Social constructivists believe that each student will build knowledge that is different from the material the same instructions. Learning science should involve ways of thinking and explain the

nature, explains knowledge to others for specific purposes, how to look, and how to support the claims of knowledge (Driver, Asoko, Leach, Mortimer & Scott, 1994). Explain the process knowledge to others will involve social activities where ideas are explored through dialogue, involving collaborative group discussions.

Communication skills can help in the process of preparing the mind, connecting an idea with another idea (Groba & Al-Mahmood, 2004). Duran (2014) adds the communication is also possible to obtain information or new ideas that can help understand the problem well. The ability to communicate depends on scientific talent, but the literature on communication shows that communication skills can be learned through a learning process (Kayi, 2006; Levy, Eylon & Scherz, 2008; Lee & Jang, 2010). A person who interacts with the environment, the environment can affect the way or pattern of communication that have been owned previously (Adler & Rodman, 2006). Communication has patterns that have been studied when applied to the communication situation every day, so naturally our communication skills can be improved. Yusuf & Adeoye (2012) states that to teach communication skills to students, teachers should use the activities that give students the opportunity to negotiate and interact with other people, one of which is to communicate.

3. ELSII Learning Model

One of learning model that has been designed to fill the needs and challenges faced by the students in the 21st century is a model of inquiry learning. Inquiry model is able to develop problem solving skills and processes of science students (Tatar 2006; Padaste, Maeots, Siiman & de Jong 2015; Duran, 2014). Syntax inquiry model as following: 1) Exposes the problem; 2) Collect data for verification; 3) Data collection; 4) Organize and formulate an explanation; 5) Process Analysis inquiry. However, laboratory inquiry was limited to the increase in non-verbal communication skills (McNeill, 2011), while exchanging opinions skill attainment results are still in the low category (Brickman, 2009; Duran, 2014). In addition, it takes a lot of time to observe the activities, drawing, and writing (Ayse & Sertac, 2011; Duran, 2014). Zawadzki (2010) have applied Proces-based learning-Oriented Guided-Inquiry-Learning (POGIL) in the activities in the laboratory. Syntax POGIL models as following: 1) Identify the need for learning; 2) Connecting to prior knowledge; 3) Exploration; 4) Understanding and concept formation; 5) Practice, apply knowledge, 6) Apply the knowledge in a new concept; 7) Reflection in the process. The results showed that the highest academic grades are dominated by students who are actively involved in exploratory activities. POGIL models have been widely used to improve problem solving skills (Kolopajlo 2009;

Wiliansom, Metha, Willison & Pyke, 2013; Villagonzalo, 2014), self-confidence, and a student's academic value (Gale & Boissalle, 2015). However, in implementation, not all students benefit from group work, because students do not need to be clever interactivity groups to learn (Vanags, 2013). Meanwhile research Taylor, Smith, Stolk & Spiegelman (2010) concluded that POGIL can be used to develop problem-solving skills, but it takes a lot of time to discuss the question.

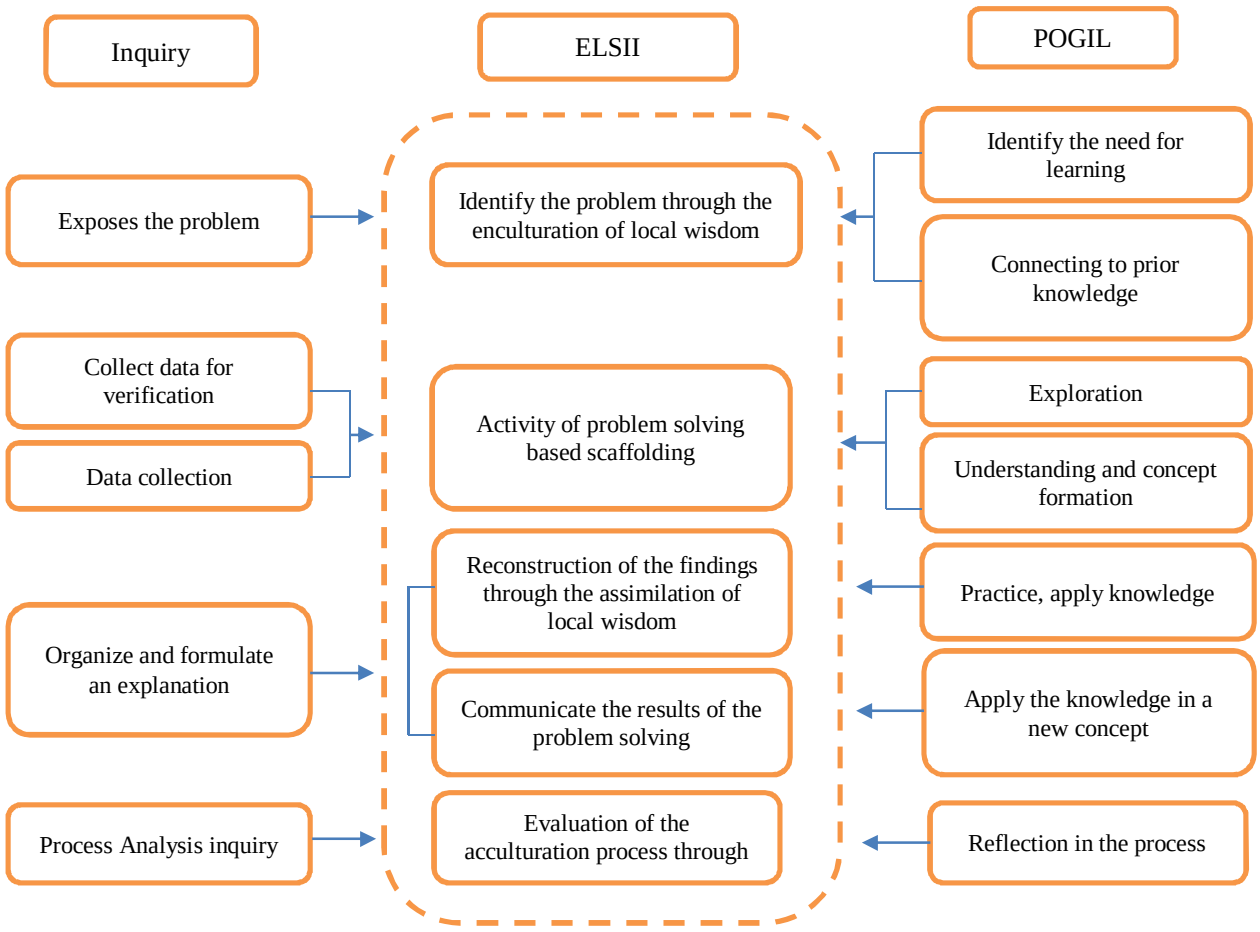

Figure 1. Comparison between the syntax of inquiry, POGIL, and ELSII model

Learning model developed referring to the inquiry model (Joyce, et al, 2009) and models POGIL (Hanson, 2006). By looking at the potential of local wisdom in the 21st century as it has been stated above, then integrating the values of local wisdom becomes important as one of the nation's cultural wealth and forming filtered from outside cultural influences. ELSII learning model based on local wisdom is a learning innovation in Indonesia. Integration of local wisdom (Aikenhead, 2006) shown in Figure 1. The syntax of the ELSII learning model based local wisdom as following: 1) Identify the problem through the enculturation of local wisdom; 2) Activity of

problem solving based scaffolding; 3) Reconstruction of the findings through the assimilation of local wisdom; 4) Communicate the results of the problem solving; 5) Evaluation of the acculturation process through local wisdom. ELSII learning model based local wisdom was development to improve problem solving skills and scientific communication. It provides opportunities for students to be able to achieve the goal of learning as a preparation to face the next life by referring to the cultural values of the region.

C. CONCLUSION

ELSII learning model is designed to integrate indigenous local communities through enculturation, assimilation and acculturation. ELSII learning model based on local wisdom through the adaptation of environmental conservation values contained in the social life of the community, are expected to develop problem-solving skills, scientific communication, and caring attitude to maintain the environmental balance. Suggestions for further research, the ELSII learning model developed is still theoretical, so it needs to be tested and implemented in the classroom.

REFERENCES

Adler, R & Rodman, G. (2006). *Understanding Human Comunication*. New York: Oxford University Press.

Aikenhead, G, S. (2006) *Science Education For Everday life: Evidence-based practice*. Teachers College Press.

Angawi, R.F. (2014). "Using a Problem Solving–Cooperative Learning Approach To Improve Students's Skills for Interpreting H NMR Spectra of Unknown Compounds in Organic Spectroscopy Course." *J. Chem. Educ*. 2014,91,832-829.

Ardan, S,A., Ardi, M., Hala, Y., Supu, A., & Dirawan, G.D. (2015). Need Assessment to Development of Biology Texbook for High School Class X-Based the Local Widsom of Timor. *International Education Studies.Vol 8 No 4*

Arends, R. (2012. *Learning to Teach*: Fifth Edition. New York: McGraw-Hill, Inc

Aydogdu, M, Guven, E., & Aka, I.E. (2012). Effect of Problem Solving Method on Science Method on Science Process Skills and Academic Achievement. *Journal of Turkish Science Education Vol. 7 Issue 4, Desember 2010.*

Ayse, O. & Sertac, A. (2011). Overviews On Inquiry Based and Problem Based Learning Methods. *Western Anatolia Journal of Educational Science. Special Issues: 302-309.*

Bender W.N. (2012). *Convergence! Project Based Learning and the Common Core Standards* www.corwin.Press.com

Brickman, P (2009). Effect of inquiry based learning on students science literacy skill and confidence. *International Journal for Csholarship of teaching and learning Vol.3 No 2 Georgia Southerm University.*

De Cock, M. (2012). Representation Use and Strategy Choice in Physics Problem Solving *Physical Review Speciel Topics-Physics Education Reserach*, 8, 020117.

Driver, R., Asoko, H., Leach, J., Mortimer, E., & Scott, P. (1994). Constructing scientific knowledge in the classroom, *Educational Researcher, 23 (5), pp 5-12*

Duran, M. (2014). A study on 7th grade student inquiry and communication competencies. *Procedia-Social and Behavioral Sciences 116 pp. 4511-4516*

Ediger, M. & Rao, B. (2007). *Science curriculum*. New Delhi: Arora Offset Press.

Erozkan, A. (2013). The Effect of Communication Skills and Interpersonal Problem Solving Skills on Social Self-Efficacy. *Educational Sciences: Theory & Practice 13(2) 739-745*

Gale, de, S. & Boisselle, L, N (2015). The Effect of POGIL on Academic Performance and Academic Confidence. *Science Education International. Vol. 26 pp. 56-61*

Gupta, T. (2012). *Guided-inquiry Based Laboratory Instruction: Investigation of Critical Thinking Skills, Problem Solving Skills and Implementing Student Roles in Chemistry*. (Unpublished doctoral dissertation). Universitas Negara Bagian Iowa, Amerika Serikat.

Hardin, L, E. (2002). "Problem Solving Concepts and Theories". *JVME 30(3).*

Joyce, B., Weil, M. Calhoun, E. (2009). *Models of Teaching*. Alyn and Bacon: United State of America

Kayi, H. (2006) Teaching Speaking Activities to Promote Speaking in a Second Language. *The Internet TESL Journal*, 12(11) 33-49

Kolopajlo, Larry (2009). "Guided Inquiry Animations in General Chemistry". *The Scholarship of Teaching and Learning at EMU*: Vol. 1.

Lee, E.J. & Y.J. Jang. (2010). What do Others' Reactions to News on Internat Portal Sites tell us? Effects of Presentation format and Readers' Need for Cognition on Reality Perception. *Communication Reasearch*, 37: 825-846

Levy, D.H., & Murname (2004) The Skill Content of Recent Technological Change : An Empirical Exploration, *The Quarterly Journal of Economics, Vol 118, No 4. Pp. 1279-1333*

Levy, O.S, B. Eylon, & Z Scherz. (2008). Teaching Communication Skills in Science: Tracing Teacher Change. Israel: The Departement of Science Teaching. *The Weizmann Institute of Science Rechovot, 24: 462-477.*

Lovett, M. C. (2002). *Problem solving*. In D. Medin (Ed.). Stevens' handbook of experimental psychology: Memory and cognitive processes (pp. 317–62). New York: Wiley

Mason, A. & Singh, C. (2011). Assessing Expertise in Introductory Physics Using Categorization Task. *Physical Review Special Topics-Physics Education Research*, 7 010110.

Mayer, R. E. (2003). *Learning and instruction*. Upper Saddle River, NJ: Prentice Hall.

McNeill, K. L. (2011). Elementary Students views of explanation, argumentatation, and evidence, and their abilities to construct arguments over the school year, *Journal of Research in Science Teaching, 48(7), pp 793-823.*

Moreno, R. (2010). *Educational Psychology*. John Wiley and Sons.

Mungmachon, R (2013). Knowledge and Local Wisdom: Community Treasure. *International Journal of Humanities and Social Science*.Vol 2 No.13 July 2012 174-181

OECD. (2013). PISA 2012 Results : *What Students Know and Can Do Student Performance in Reading, Mathematics and Science ; (Volume I),* PISA, OECD Publishing,

Ommundsen, P. (2001). *Problem-Based Learning With 20 Case Examples*.

Padaste., M, Maeots, M., Siiman., L.A, & de Jong,,T (2015) Phases of Inquiry-Based Learning: Definitions and The Inquiry Cyle. *Educational Research Review* 14 (2015) 47-61

Peng, C.N. (2004). *Successful Problem-Based Learning for Primary and Secondary Classrooms*. Singapore : Federal Publications.

Redish, E.F. (2004). A Theoretical Framework for Physics Education Research: Modeling Student Thinking. *The Proceedings of the Enrico Fermi Summer School in Physics, Course CLVI, Italian Physical Society,*

Santrock, J.W. (2011). *Educational Psychology*. New York: McGraw Hill.

Savelsbergh, E.R, de Jong, T., & Ferguson-Hessler, M,G.M. (2011). Choosing The Right Solution Approach. The crucial Role Of Situational Knowledge in Electricity and Magnetism *Physical Review Special Topics-Physics Education Research.*

Schunk, D.H. (2012). *Learning Theories: An Educational Perspective; 6 th Edition*. Boston: Perason Education, Inc.

Shih, Y.L & Singh, C. (2013). Using an Isomorphic Problem Pair to Learn Introductory Physics: Transferring from a two-step problem to a three-step problem. *Physical Review Special Topics-Physics Education Research*, 9 020114.

Suastra, I W. (2010). Merekonstruksi Sains Asli (indigenous Science) Dalam Rangka Mengembangkan Pendidikan Sains Berbasis Budaya Lokal di Sekolah. *Jurnal Pendidikan dan Pengajaran* 38(3); 377-396

Tatar, N. (2006). The effect of inquiry-based learning approaches in the education of science in primary school on the science process skills, academic achievement and attitude. *Unpublished doctoral thesis, Gazi University*

Taylor, J.L., Smith, K., Stolk A.P. dan Spiegelman G.B. (2010). "Using Invention to Change How Students Tackle Problems". *CBE—Life Sciences Education* Vol. 9, 504–512.

Temel, V. (2015). The Problem-Solving Skills Of The Teachers In Various Branches. *Educational Research and Reviews. Vol 10(5) pp 641-647.*

Vanags, T., Pammer, K., Brinker, J. (2012). Process-Oriented guided-inquiry learning improves long-term retention of information. *Adv. Physial education. 37: 233-241*

Villagonzalo, E, C. (2014). "*Process Oriented Guided Inquiry Learning: An Effective Approach in Enhancing Students' Academic Performance"*. DLSU Research Congress

Wagiran. (2011). Pengembangan Model Pendidikan Kearifan Lokal Dalam Mendukung Visi Pembangunan Provinsi Daerah Istimewa Yogyakarta 2020. *Jurnal Penelitian dan Pengembangan, Volume III, Nomor 3. Tahun 2011, 85-100*

Woolfolk, A. (2010). *Educational Phycology*. USA: Pearson Educational International.

Yusuf, F.A & Adeoye, E.A. (2012). Developing Critical Thinking and Communication skills in Students skills in student: Implications for practice in education" *An International Multidiscplinary Journal. Ethiopia. Vol 6(1), Serial No 24*

Zawadzki, Rainer (2010). "Is process-oriented guided-inquiry learning (POGIL) suitable as a teaching method in Thailand's higher education?". *As. J. Education & Learning* 2010, 1(2), 66-74.