Original Research Article

Quality Effectiveness Analysis Assessment of Physics Teaching Materials-Oriented ICARE Method on Student Cognitive Mastery Based Experiment Skill Level

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ABSTRACT

Aims: The aim of the study was for quality effectiveness analysis assessment of physics teaching materials-oriented ICARE methods on student cognitive mastery-based experiment skill levels.
Study design: Teaching materials accompanied by ICARE-oriented worksheets are printed learning materials that are packaged in the form of books in which each subject matter is arranged sequentially: discussion of important concepts, sample questions, cognitive questions, and worksheets arranged systematically in the order of introduction, connecting, applying, reflecting, extending (ICARE) to hone students' science process skills. The method is done by dividing students based on experiment skill level from the results achieved by the cognitive mastery test. Each group is given 3 subjects to work on based on the ICARE Stage and is guided by physics teaching materials-oriented ICARE method.
Place of Study: Sample: Department of Physics Education, Universitas Negeri Medan, Medan, Indonesia.
Methodology: Science Process Skills Students are divided into 3 main indicators in the experiment namely Problem / Case Identification (Observation, Problem Formulation, & Create Hypothesis); Experiment (Verifications, Variable Manipulation, Data Collection); & Evaluation (Interpretation, Data Analysis & Theory, Create A Scene). The three main indicators in Experiment are adjusted to the ICARE Stages.
Results: From the results of the study, the use of physics teaching materials-oriented ICARE methods used at Universitas Negeri Medan was more effective with the Intermediate level group. Conformity is due to habit factors that are carried out during learning. It is very important to improve and develop the physics teaching materials-oriented ICARE method in its use in learning. It is necessary to add strict instructions as facilitators at the ICARE stage and some improvements to the structure of submitting assignments that are directive and important to keep on doing.
Conclusion: This is very necessary to direct the activities of students and the creativity of thinking of students without ignoring some of the stages possessed by physics teaching materials-oriented ICARE method.

Keywords: ICARE, Assessment, Level Thinking, Cognitive Mastery

1. INTRODUCTION

Teaching materials used in teaching the 2013 curriculum must be in accordance with five Stages of learning: to observe, ask, try, reason, and presentations. In the course curriculum in 2013, there were

several problems regarding the provision of teaching materials, including a lack of books that referred to the scientific approach to the 2013 curriculum, it can be known through books provided by the government with books sold in public places. In addition to the lack of teaching materials based on scientific approaches, we have challenges in the 2013 curriculum, where students use electronic technology/media as support learning. In developing teaching materials that are used in the 2013 curriculum must use a scientific approach and students use technology as learning support (Abadi, 2017). Skills in the 2013 curriculum conception that use a scientific approach are observing, asking, trying, reasoning, and presenting (Kusmaryono & Suyitno, 2015). Akinbobola & Afolabi (2010) Science Process Skill is a mental, physical, and competency capability used for tools needed in effective science and technology learning such as problem-solving, individual development, and social development. Learning design using a scientific approach is very focused on the process rather than the results obtained by students. That is, during the process of searching, collecting data, analyzing, concluding what is being studied, students also learn about character. Character learning is integrated with the scientific process (Musfiqon & Nurdyansyah, 2015).

In learning using a scientific approach, teachers need to develop good science learning tools so that Student can develop students' science process skills (Sukarno, Permanasari, & Hamidah, 2013). Chabalengula, Mumba, & Mbewe (2012) there are two abilities in science process skills namely basic ability (observation, measuring, communicating, classifying, concluding, and predicting) and integrity ability (able to make operational definitions, controlling variables, formulating hypotheses, designing models, interpret, conduct experiments). Science process skills are used to conduct scientific investigations. The science process skills used in conducting scientific investigations need to use a method known as the scientific method (scientific method). The term (scientific process skills and scientific methods are often used in the same meaning, as well as between the scientific inquiry and the scientific method, although scientific inquiry is more flexible than the scientific method (Carni, Maknun, & Siahaan, 2017; Septiani & Rustaman, N, 2017; Mahdian, Almubarak, & Hikmah, 2019).

Teaching materials play an important role in making the teaching-learning process in the Social Sciences program efficient, by presenting signs and explanations to students and making students understand these signs and explanations. Teaching materials provide a lot of convenience in the ability of teachers to convey messages to students accurately, precisely, clearly and understandably, in shaping abstract knowledge so that students can understand complex ideas through simplification. One of the most important tasks of the teacher regarding teaching materials is to present experiences that will enable students to obtain educational attainments on certain topics. Therefore, in carrying out the teaching and learning process, teachers are expected to prepare well in advance and mature, using the materials and methods to be used. An important part of the process is that the teacher can obtain and use teaching materials and methods that are appropriate to the characteristics of students who will be taught and the achievements and subject matter of a particular subject (Ibrahim, 2011).

Akpinar & Simsek (2007) investigate the use of various media by teachers to support student learning. Although there are many new tools and settlements in the technology and specifications to learn, there has been a heated debate over Student learning and development. Student examined the effects of the teacher's pre-service experience on the use of information and communication technology in the development of learning objects. Student have found a meaningful correlation between the use of several learning object components.

Student worksheets are one of the teaching materials used to achieve success in physics learning. Student worksheets are learning materials that have been packaged so students are expected to be able to learn certain learning materials independently. The Student Worksheet in learning will be the teacher acts more than a facilitator, and one of the teacher's tasks is to provide learning tools.

Teaching materials in the form of worksheets used are ICARE-oriented Worksheets. ICARE-oriented teaching materials are printed learning materials that are packaged in book form where each subject matter is arranged in sequence: discussion of essential concepts, examples of questions, practice questions, and student worksheets that are arranged systematically in an Introduction, Connect, Apply, Reflect, Extend (ICARE) to be able to train student science process skills. The ICARE learning strategy emphasizes active, creative, and joyful learning (Ardiyani, Darmawiguna, & Sindu, 2017; Asri & Rusdiana, 2017; Wahyudin, 2010). The following is a review of the stage of ICARE learning:

1. **Introduction**
   at this Stage, the teacher sets the contents of the lesson to students. This must include an explanation of the goals and objectives that are expected to be achieved during the lesson. At this Stage, the teacher introduces students to events or physical phenomena that have been designed for contextual learning. Then, students observe the physical phenomenon, and Student have the opportunity to ask questions about the phenomenon being displayed. In addition, motivation must also be given at this Stage to make students interested in the material that will be given in the learning class.
2. **Connect**
   at this Stage, the teacher tries to connect new knowledge with something that is already known to students from learning or experience. In the classroom, the teacher shows material, and there are a question and answer session that makes students tell what Student remember from previous learning experiences. The most important thing at this Stage is the investment of the concept by inviting students to plan and carry out several activities independently or groups that conduct examples in real-world context based on the investigation.
3. **Apply**
   the application Stage is the most important Stage of learning. After students gain knowledge or skills from the new connection Stage, Student must be given the opportunity to carry out knowledge and skills in the activities Student do at school. This learning application Stage requires a long time in the learning process because students are required to experiment or to apply knowledge in the context of the real world. And this is different from the sample application that was carried out in the previous Stage, the Connection Stage.
4. **Reflect**
   reflect learning Stage is a resume of the overall learning activities. Students have the opportunity to reflect on the learning Student have done before. Reflection or continuing activities can be done with group discussions where the instructor asks students to make presentations or demonstrations about the knowledge student have gained in learning. Alternatively, Student can make individual writing activities where is write a summary of learning outcomes. In addition, continuing activities can also be a quick quiz where the teacher gives several questions based on the contents of the object. The important thing in the reflection process is that the teacher needs to provide opportunities for students to express the knowledge which have gained in class.
5. **Extend**

Although learning activities are complete, it does not mean that all students are able to use what Student have learned. In this case, the teacher must carry out continuing actions that support advanced learning from students who are models of extended learning. Strengthening activities carried out can be in the form of a teacher directing students to access several internet sites to be able to resolve the problems discussed in learning. In accessing these sites can be done outside of classroom activities, so as to provide reinforcement of the knowledge possessed by students.

The ICARE strategy is designed for online learning. But there are many obstacles when ICARE learning that is designed for online learning is not supported by the existence of adequate tools and systems to access the internet so that learning using this strategy is very difficult to implement. Usually, in learning using ICARE strategy Online learning is done at the connect stage, meaning students are given instructions to connect the subject matter to the problems discussed in the lesson with the help of accessing the internet. As previously explained that it is very difficult to do when in school or on a campus it does not have an adequate support system such as in rural areas that are very difficult to access the internet, do not have the tools or devices that will be used to access the internet and school culture that severely limits the use of gadgets in learning (Koçak, 2015; Genlott & Gronlund, 2016; Trust, Krutka, & Carpenter, 2016; Barr, 2017; Saß, Schütte, & Lindner, 2017; Lei & Chan, 2018).

Based on these constraints, ICARE learning referred to in this study is the provision of teaching materials accompanied by ICARE-oriented Worksheets. ICARE learning provides opportunities for teachers to make special modules (teaching materials) depending on the consideration of students' abilities. Teaching materials that have been developed are arranged the characteristics and needs of students. The instructional materials that have been prepared are intended to overcome the connect stages so that with the teaching materials students no longer have difficulties in learning. With the teaching materials students no longer need to access the internet because when learning using the ICARE Worksheet is done especially at the connect stage, students are directed to be able to connect the knowledge Student have using teaching materials that have been prepared by educators. The ICARE Worksheet is structured systematically so that student learning is more structured. At each stage of learning using the ICARE Worksheet will provide a learning experience for students to understand essential concepts and train students' science process skills. So that the learning that is carried out in accordance with ICARE principles is to present essential material for each topic.

2. METHODOLOGY

Quality assessment of physics ICARE teaching materials-oriented methods on student cognitive mastery based on the success of developing the level of science process skills of students. Science Process Skills Students are divided into 3 main indicators in the experiment namely Problem / Case Identification (Observation, Problem Formulation, & Create Hypothesis); Experiment (Verifications, Variable Manipulation, Data Collection); & Evaluation (Interpretation, Data Analysis & Theory, Create A Scene). The main indicator in Experiment is adjusted to the ICARE Stages. Assessment of the relationship between learning objectives and teaching materials is carried out an assessment of the descriptive analysis of each activity material proposed on physics teaching materials-oriented ICARE method. The assessment is carried out with a percentage of the overall value of each skill expected in students. The percentage of skill indicators illustrates the effectiveness of the main indicator sub-section in the experiment that students do in learning. The research sample amounted to 180 students divided into 3 groups based on level of expertise (45 Student as Elementary Level; 90 Student as Intermediate Level; 45 Student as Expert). Expertise level was assessed based on Student cognitive mastery obtained from cognitive test results. In the implementation of physics teaching materials-oriented ICARE method it was given to three groups and each was assessed based on the main

indicators. The percentage of achievement of each group for each indicator shows the suitability of physics teaching materials-oriented ICARE method for the ability of each group.

3. RESULTS AND DISCUSSION

Based on the physics teaching materials-oriented ICARE method in 3 subjects proposed about Mechanics for the three groups can be seen in Fig. 1; Fig. 2; and Fig. 3. Overall Intermediate Level is the only one that shows the effectiveness of using physics teaching materials-oriented ICARE method. In the use of physics teaching materials-oriented ICARE method for the three subjects, it shows the suitability of each indicator that belongs to each group. This means that the use of physics teaching materials-oriented ICARE methods can be standardized in learning. The stages of ICARE that are applied in learning have really shown the differences from each group in solving the problems raised in each subject. Thus, the level of validation of physics teaching materials-oriented ICARE methods for use has been proven.

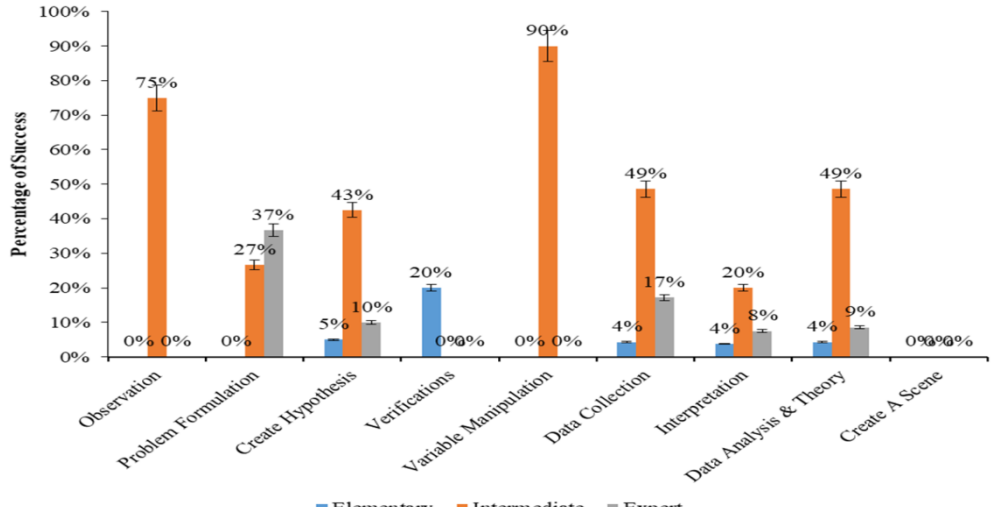

Figure 1. The level of success of the group in the subject I

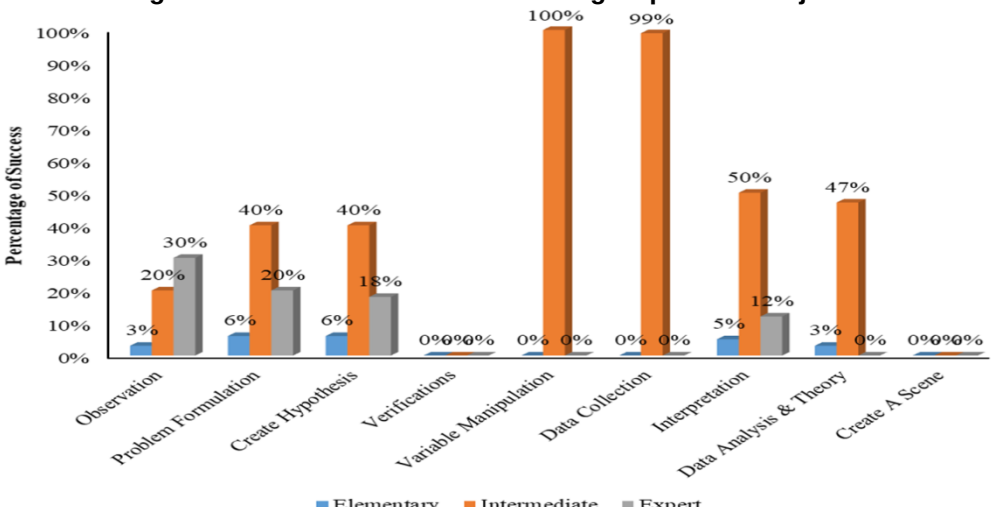

Figure 2. The level of success of the group in the subject II

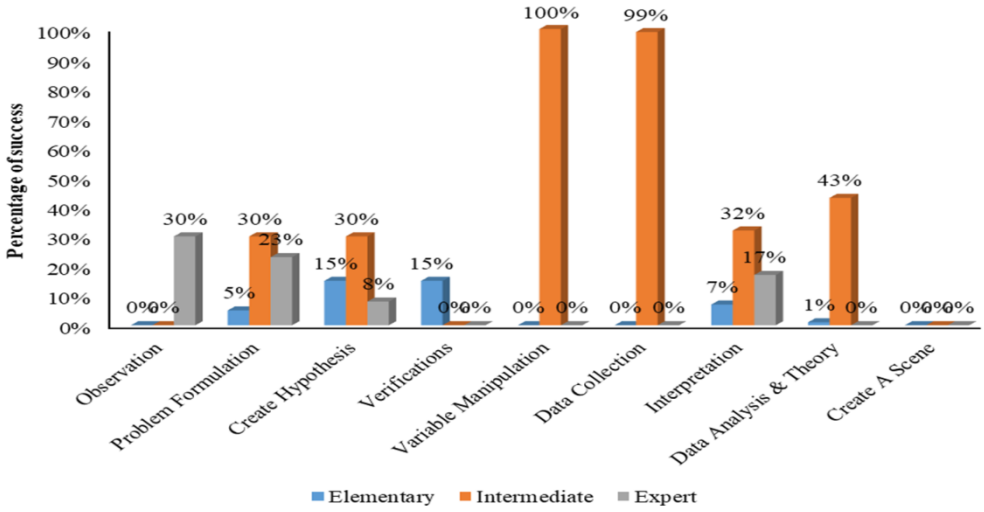

Figure 3. The level of success of the group in the subject III

In learning, students make physics teaching materials-oriented ICARE method as a guide and instruction to learn and find solutions to the problems raised. The stages ICARE make students more focused on achieving the targets in learning. Although this only applies to certain groups. The suitability of the implementation based on the ICARE stage shows the level of ability of the science process of each Student (Carni, Maknun, & Siahaan, 2017; Septiani & Rustaman, N, 2017; Mahdian, Almubarak, & Hikmah, 2019). This is the starting point in the effectiveness of physics teaching materials-oriented ICARE methods that are used as learning materials.

The impact can be attributed to the use of physics teaching materials-oriented ICARE methods for each group based on Fig. 1-3 is not very clear between Elementary and Expert. However, it is different from the Intermediate Level. In this group, the percentage of success was better than the other two groups. Although in some indicators there are still no changes and not seen as instructional or nurturant effects. The main indicator of the experiment which is an indicator of science process skills shows the habits of each student in solving the problems posed through the experiment does not fulfill each indicator as a whole. This is due to differences in various thoughts based on the level of expertise possessed. This difference can occur because of the freedom to solve the problems posed as students' thinking creativity which is part of the ICARE stage.

In addition, the lack of information obtained and sought by each student as justification material became very important in decision making and strengthened the allegations and hypothesis proposed (Flyvbjerg, 2006; Iriss & Collins, 2011; Mehta & Kulshrestha, A, 2014). Based on the group level obtained, it shows that the lower the group level, the more neglected and diverse indicators are ignored. Even though with a higher level (Expert), this group shows science process skills effectively based on rational thinking so that some indicators that are considered insignificant are ignored.

This shows that Cognitive Mastery is an important basis for thinking in decision making. In solving the problems that are proposed, the suitability of each indicator is expected not to be possessed by every user of physics teaching materials-oriented ICARE method. The expected indicators are the basis that should be possessed for users of physics teaching materials-oriented ICARE methods. Each Indicator is part of the instructions contained in the ICARE Stages even though this also gives freedom of thought for Students to explore abilities and creativity in thinking and submitting solutions (Treffinger, Donald, 1995; Natadiwijaya, Rahmat, Redjeki, & Anggraeni, 2018). Both of these things can also be a boomerang in providing the nurturant effect experienced by students during learning.

In **Elementary Level**, Create Hypothesis and Verification has increased. Both of these indicators can increase due to the ICARE Stage, this group only focuses on 2 stages namely Connection and Apply. This happens because of habits in learning that only focus on solving mathematical problems and applying examples in textbooks. For this group, the emphasis is needed on strict instruction and guidance from the facilitator to keep directing students on the track (Reeve, 2006; Hickman, 2017; Mullins, Michaliszyn, Kelly-Miller, & Groll, 2019). In this group, it cannot be expected that creativity arises from solving problems. Thus, it is expected that physics teaching materials-oriented ICARE methods are specifically designed for Elementary Level based on work instructions with a focus on completion in the form of proof of theory or concepts in Physics.

In **Intermediate Level**, Verification and Create a Scene that did not increase. From the results achieved by students in basic abilities, it is clear that the majority who have the appropriate skills in the assessment indicators are spread on Intermediate Levels. This is because the habits in learning Physics are not focused on training in providing arguments, hypotheses, conclusions, even basic abilities do not necessarily guarantee that these skills are mastered (Martaida, Bukit, & Ginting, 2017; Suprapto, Chang, & Ku, 2017). Physics learning in Indonesia, especially in Medan, North Sumatra is more likely to train in solving equations and look for answers to mathematical calculations. In addition, students are more likely to work in groups by the division of tasks rather than by working together. Although Verification and Create a Scene are the most important things as a basis for implementation and development in accordance with the stages of ICARE. The two indicators are also proof that the ICARE stage still cannot be optimized. Nevertheless, it is necessary to do continuous learning using the ICARE stages to become a habit and develop students' abilities. Thus, it is necessary to hope that a teaching materials-oriented ICARE method is designed for various subjects so that students are familiar with the stages and practice abilities to develop better.

In **Expert Level**, Observation, Problem Formulation, Create Hypothesis, and Interpretation has increased of the four indicators, this group is more focused on Problem / Case Identification and Evaluation. In this group the stages of Apply and Extend that are carried out do not follow the instructions contained in the physics teaching materials-oriented ICARE method. Students tend to present more solutions based on theoretical studies and based on different intuition. Both of these can arise due to the very strong level of thinking and individualism in each person. For this group, the development of a scoring system that is flexible and focuses on creative thinking skills from students is needed (Koçak, 2015; Genlott & Gronlund, 2016; Trust, Krutka, & Carpenter, 2016; Saß, Schütte, & Lindner, 2017; Barr, 2017; Lei & Chan, 2018). The assessment given is not only fixed on the written design but

also has additional points for each proposed solution. This was done in order to improve the assessment system and the impact of the physics teaching materials-oriented ICARE method. Thus, it is expected that physics teaching materials-oriented ICARE methods are designed specifically for Expert Level based on creativity with a focus on the completion of higher order thinking.

The judging from several studies regarding the relationship of learning outcomes to the use or application of ICARE in learning (Ardiyani, Darmawiguna, & Sindu, 2017; Asri & Rusdiana, 2017; Wahyudin, 2010). It rarely shows clear indicators of the problems students get in using/applying them. The division of group work is very unexpected in learning because in the assessment not only on achievement to complete it but also to be able to adjust the procedure so that the optimization of the use of physics teaching materials-oriented ICARE methods can produce trained skills in students (Flyvbjerg, 2006; Iriss & Collins, 2011; Mehta & Kulshrestha, A, 2014; Ardiyani, Darmawiguna, & Sindu, 2017; Dewi, Ardana, & Sariyasa, 2019).

In general, the use of physics teaching materials-oriented ICARE methods conducted at Universitas Negeri Medan is more in line with Intermediate level. Conformity is due to habitual factors that are carried out during the learning and social relations of students. This becomes the rationale that shapes knowledge and skills to obtain solutions or solve mathematical problems. In the majority for heterogeneous classes, the use of physics teaching materials-oriented ICARE methods is very effective if applied as learning material for students. However, for the improvement and development of the physics teaching materials-oriented ICARE method in its use in learning, it is necessary to add explicit instructions as facilitators at the ICARE stage and some improvements to the structure of the submission of directional activities and important notes to be carried out. This is very necessary to direct the activities of students and the creativity of thinking of students without ignoring some of the stages possessed by physics teaching materials-oriented ICARE method.

4. CONCLUSION

The use of physics teaching materials-oriented ICARE methods conducted at Universitas Negeri Medan is more effective with the Intermediate level group. Conformity is due to habit factors that are carried out during learning. It is very important to improve and develop the physics teaching materials-oriented ICARE method in its use in learning. It is necessary to add strict instructions as facilitators at the ICARE stage and some improvements to the structure of submitting assignments that are directive and important to keep on doing. This is very necessary to direct the activities of students and the creativity of thinking of students without ignoring some of the stages possessed by physics teaching materials-oriented ICARE method. Based on the consideration of all aspects of the three groups, the effectiveness of using physics teaching materials-oriented ICARE methods can be further enhanced with support from various courses, so it is very necessary to develop various courses to produce and use teaching materials-oriented ICARE methods.

REFERENCES

Abadi, M.K, (2017), Development of Teaching Materials Based Interactive Scientific Approach towards the Concept of Social Arithmetic for Junior High School Student, Journal of Physics: Conference Series, Vol.812 No.1

Akinbobola, A.O., & Afolabi, F. (2010). Analysis of Process Skills in West African Senior Secondary School Certificate Physics Practical Examination in Nigeria. *American-Eurasian Journal of Scientific Research*. 5(4): 234-240.

Akpinar, Y. & Simsek, H. (2007). Pre- service teachers' learning object development: A case study in k-12 setting. Interdisciplinary Journal of Knowledge and Learning Object, 3, 197-217.

Ardiyani, N. K. D., Darmawiguna, I. G. M., & Sindu, I. G. P. (2017). Penerapan Model Pembelajaran Icare Untuk Meningkatkan Hasil Belajar Pengolahan Citra Digital. *Kumpulan Artikel Mahasiswa Pendidikan Teknik Informatika (KARMAPATI)*, *6*(3).

Asri, Y. N., & Rusdiana, D. (2017). ICARE Model Integrated with Science Magic to Improvement of Students' Cognitive Competence In Heat and Temperature Subject. *Advances in Social Science, Education and Humanities Research (ASSEHR)*, *57*(ICMSEd 2016), 137–139.

Barr, M. (2017). Video games can develop graduate skills in higher education students : A randomised trial. *Computers & Education*, *113*, 86–97. https://doi.org/10.1016/j.compedu.2017.05.016

Carni, Maknun, J., & Siahaan, P. (2017). An Implementation Of ICARE Approach (Introduction , Connection , Application , Reflection , Extension) to Improve The Creative Thinking Skills. *IOP Conf. Series: Journal of Physics: Conf. Series 812 (2017) 012022*, 1–5. https://doi.org/10.1088/1742-6596/755/1/011001

Chabalengula, M.V., Mumba, F & Mbewe, S. 2012. *How Pre-service teachers' Understand and Perform Science Process Skill.* Eurasia Journal Of Mathematics, science & technology Education. 8(3) : 167-176

Dewi, N. P. R., Ardana, I. M., & Sariyasa. (2019). Efektivitas Model ICARE Berbantuan Geogebra Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa. *JNPM (Jurnal Nasional Pendidikan Matematika)*, *3*(1), 109–122.

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, *12*(2), 1–35. https://doi.org/10.1177/1077800405284363

Genlott, A. A., & Gronlund, Å. (2016). Closing the gaps e Improving literacy and mathematics by ict-enhanced collaboration. *Computers & Education*, *99*, 68–80. https://doi.org/10.1016/j.compedu.2016.04.004

Hickman, A. (2017). *Support Facilitation Model Effective Inclusion : A Collaborative Process*.

Ibrahim, H., (2011), An Investigation On Teaching Materials Used In Social Studies Lesson, *Turkish Online Journal of Educational Technology*, volume 10 Issue 1

Iriss, D., & Collins, E. (2011). *Decision making and social work in Scotland : The role of evidence and practice wisdom*.

Koçak, C. (2015). The Effect Of Cognitive Flexibility On Higher School Students ' Study Strategies. *Procedia - Social and Behavioral Sciences*, *191*(1987), 2346–2350. https://doi.org/10.1016/j.sbspro.2015.04.680

Kusmaryono, I & Suyitno, H (2015) The effect of constructivist learning using scientific approach on mathematical power and conceptual understanding of students grade IV, *IOP Publishing Journal of Physics: Conference Series*, 693 (2016) 012019

Lei, C., & Chan, C. K. K. (2018). Developing metadiscourse through re fl ective assessment in knowledge building environments. *Computers & Education*, *126*(July 2017), 153–169. https://doi.org/10.1016/j.compedu.2018.07.006

Mahdian, Almubarak, & Hikmah, N. (2019). Implementasi Model Pembelajaran Icare (Introduction- Connect-Apply-Reflect-Extend) Terhadap Keterampilan Proses Sains Pada Materi Larutan Elektrolit Dan Non Elektrolit. *Jurnal Penelitian Pendidikan IPA (JPPIPA)*, *5*(1), 92–97. https://doi.org/10.29303/jppipa.v5i1.184

Martaida, T., Bukit, N., & Ginting, E. M. (2017). The Effect of Discovery Learning Model on Student's Critical Thinking and Cognitive Ability in Junior High School. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, *7*(6), 1–8. https://doi.org/10.9790/7388-0706010108

Mehta, S., & Kulshrestha, A, K. (2014). Implementation of Cooperative Learning in Science : A Developmental-cum-Experimental Study. *Education Research International*, *2014*, 1–7.

Mullins, N. M., Michaliszyn, S. F., Kelly-Miller, N., & Groll, L. (2019). Elementary school classroom physical activity breaks : student , teacher , and facilitator perspectives. *Advances in Physiology Education*, *43*, 140–148. https://doi.org/10.1152/advan.00002.2019

Musfiqon & Nurdyansyah, (2015), *Pendekatan Pembelajaran Saintifik*, Sidoarjo: Nizamia Learning Center

Natadiwijaya, I. F., Rahmat, A., Redjeki, S., & Anggraeni, S. (2018). How to practice creative thinking skills through scaffolding on biotech content ? How to practice creative thinking skills through scaffolding on biotech content ? *IOP Conf. Series: Journal of Physics: Conf. Series 1013 (2018) 012011*, 1–6.

Reeve, J. (2006). Teachers as Facilitators : What Autonomy - Supportive Teachers Do Teachers as Facilitators : What Teachers Do and Why. *The Elementary School Journal*, *106*(3), 225–236. https://doi.org/10.1086/501484

Saß, S., Schütte, K., & Lindner, M. A. (2017). Test-takers ' eye movements : Effects of integration aids and types of graphical representations. *Computers & Education*, *109*, 85–97. https://doi.org/10.1016/j.compedu.2017.02.007

Septiani, A., & Rustaman, N, Y. (2017). Implementation of Performance Assessment in STEM (Science , Technology , Engineering , Mathematics) Education to Detect Science Process Skill. *IOP Conf. Series: Journal of Physics: Conf. Series 812 (2017) 012052*, 1–6. https://doi.org/10.1088/1742-6596/755/1/011001

Sukarno, Permanasari, A., & Hamidah, I. (2013). Science Teacher Understanding to Science Process Skills and Implications for Science Learning at Junior High School (Case Study in Jambi*). International Journal of Science and Research (IJSR),* 2(6), 450-454.

Suprapto, N., Chang, T., & Ku, C. (2017). Conception Of Learning Physics And Self-Efficacy Among Indonesian University Students. *Journal of Baltic Science Education*, *16*(1), 7–19.

Treffinger, Donald, J. (1995). Creative Problem Solving : Overview and Educational Implications. *Educational Psychology Review*, *7*(3), 301–312.

Trust, T., Krutka, D. G., & Carpenter, J. P. (2016). " Together we are better " : Professional learning networks for teachers. *Computers & Education*, *102*, 15–34. https://doi.org/10.1016/j.compedu.2016.06.007

Wahyudin, D. (2010). Model Pembelajaran ICARE pada Kurikulum Mata Pelajaran TIK di SMP (*ICARE based Instructional Model on ICT Curriculum in Yunior Secondary School*). *Jurnal Penelitian Pendidikan* Vol. 11, No. 1, 23-33 April 2010. UPI, Bandung.