



# The Application of Blended Learning's Station Rotation Method in Elementary School's Science Education to Improve Higher Order Thinking Skills

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## ABSTRACT

This study developed a knowledge assessment instrument of three tier diagnostic tests based on higher order thinking skills (HOTS) which aims to diagnose students' understanding in higher-order thinking and reduce misconceptions. The research method uses ADDIE (Analysis-Design-Develop-Implement-Evaluate) and the subject is class VII junior high school students with 2017 odd semester curriculum materials. This study used HOTS-based knowledge assessment instruments of three tier diagnostic tests of 20 items. The results of the instrument expert validation test based on aspects of content, construct, and language assessment have an average score of 90, 88, and 89 with a proper assessment. The data were analyzed using rasch model and the item reliability index was 0.89, the reliability index of the respondents was 0.91, and Cronbach's alpha value was 0.93, which meant the reliability of the questions obtained was good. The results of the students' answer patterns are six criteria: understanding concepts, misconceptions (+), misconceptions (-), misconceptions, guessing/lack of confidence/luck, and not understanding the concepts used to diagnose learners' understanding in measuring high-level thinking skills (HOTS) which is integrated with the dimensions of factual, conceptual and procedural knowledge. Misconceptions that occur in students have three criteria, namely misconception (+), misconception (-), and misconception, and the most experienced by students is a misconception (-) in the C4 cognitive level which is integrated with the conceptual knowledge dimension on the substance characteristic material. This misconception (-) can be reduced through the correct concept with the right reasons.

**Keywords:** blended learning rotation, higher order thinking skills, elementary school

## INTRODUCTION

Some studies about Station rotation as one of blended learning which combines technology and traditional instruction classroom proves it is able to reach high performance in students' learning outcome. Truitt claimed in her case study, in consistently application of station rotation with strong classroom management was able to meet all students learning needs in 3<sup>rd</sup> grade elementary [1]. The public schools in Colombia redesigned their teaching method with Station rotation, improved their state scores in reading comprehensive and mathematics [2]. The case study about proof point of blended learning was revealed by many researcher. One most important part is the role of the people especially the teachers who relate well to their students. The new culture in education which combined the technology in traditional instruction needs strong leadership. The teachers must have various skills responsible in caring, willingly to serve, having ability to create, inspire the students and the

colleagues. One of the proof points in blended learning, it is give a large space to personalize students' learning needs [3].

In the first day of school, there was a discussion between teacher and the students in the classroom. One of the topics was about the favorite subjects. Science is one of the favorite subjects in researcher's classroom. Students' testimony give information to the teacher that they love to have a lot of experiment in this subject. It should be a great driven purpose in learning process. Students have a great motivation come from themselves to do all learning because they love this subject. In fact, they love Science because in the previous grade they always work in a group. That's a good point too, cooperative learning method is good to build social skills among the students and promote personal responsibility in learning [4]. After 3 weeks of learning process, some students got remedial in Science formative test. Only 30% got above 80. The problems consist higher order thinking study case. However, they enjoyed the learning and the subject but something wrong happened. They started complaining about the complexity in learning problem. They was exhausted because the task too complicated and they often did the same model task for many times. They had some ideas, why the teacher didn't allow them to choose the task, to choose the way they learn, and another about choosing. Another students had no complain about it. They enjoyed it. It sounds one group wants to run away from the complexity that they should bear in the higher level in their grade now. But this is something important that the researcher really take it seriously. Why doesn't the teacher allow them to choose? Is "to choose" really the way to escape from their responsibility or is it the path to reach understanding and perhaps it will promote their higher order thinking skills?

The researcher started to observe and analyze teaching and learning method that have a lot of chance to let the student to choose. It started with literature study. The researcher chose Station Rotation learning method to solve the problems. How does the station rotation method promote the students higher order thinking and bring a good environment in learning process so the students have an enjoyable and meaningful learning process?

#### *The Station rotation Method Give Choices to the Students.*

The Station Rotation method is one of the blended learning model which is utilizing ICT (Information and Communication Technology) in one of its station. It is hybrid learning. Hybrid learning is a combination online technology and all the benefits in traditional classroom [5].

ICT provides a lot of information that students needs as their learning sources even the information by design for instruction or they can explore information by utility in cyber world. According to the study it serves students learning needs.

#### *The Station Rotation Method Promote Higher Orders Thinking Skill*

The two main things in the learning goals are to improve memory and improve delivery (both of these will emerge and as a sign that the learning is meaningful). Memory requires the ability of students to remember what they have learned, while the delivery of learning is not just a reminder but also gives meaning and ability to apply or use what students have learned. [7]. The ability of learners in thinking rationally and doing reflection to be focused when making decisions that they will believe or what they will do. [6]. In the category of problem solving are these two definitions: "A student gets a problem when students want to achieve a certain outcome or goal but do not automatically recognize the path or the right solution to use to achieve it. The problem that must be solved is how to achieve the desired goal. Because a student cannot automatically recognize the right way to achieve the desired goal, he must use one or more higher order thinking skills. This thinking process is called problem solving. The problem solving model can be applied to each of these problems. . . to help you continue to learn on your own." (Bransford & Stein, 1984: 122) [6]. Higher Order Thinking (HOT): the ability to think critically about existing information through deciphering sentences, evaluating, inferring, shifting perspective, and transferring. HOT is also the ability to think creatively about information that has been created by imagining, translating or synthesizing, inducing or making theory, reframing, and producing new things. [8]. According to Anderson and Krathwohl, a revision of Bloom's taxonomy, high order thinking skills on the level ability to analyze, evaluate, and create. [7]

Students practice higher order thinking problems to aim the higher order thinking skills. The teachers do drilling then assessing them. As a teacher, we should remember higher order thinking skills is not only solving the written problems but it's more important to prepare them to face the real problems in their real life. The way we teach them and the process of learning drives the students to develop their thinking skills. Learning and teaching is a process to nurture students' ability. When we talk about the process, we need to build habit 'well prepare' in our teaching. Well prepare to response students' problems then well prepare to do innovation in our teaching. It's not only concern with the methods but let the teaching method become the medicine for learning

problems. Tomlinson revealed that to achieve learning objective, learning should respond to the needs and to the differences of students. [9] What will we respond? Their needs in learning, the way they access the information, their readiness to face the new knowledge, their learning profile, culture background, and their diversity in characteristics. These need to be responded well. It needs teachers' awareness to trace all of them. How we can know them all? Thru learning activities among the students and teacher will grow a good relationship to know their uniqueness and more over a creative activities stimulate their creative ideas.

Station rotation is one of the teaching method that allow the student access the information according to their profile learning. This learning method is differentiated instruction. Station rotation give a large space for the teachers and students creativities. Students have a chance to choose and it motivates to explore the information and deep learning. Station Rotation as a differentiated learning is "organic" learning, which is learning that evolves on an ongoing basis. Teachers and students are joint learners. Teachers in learning differentiated learning will still be aware of the dynamic growth of students and continue to think of learning strategies in fulfilling each style / way of learning that is different in each student [10]

In order to measure students' higher order thinking skills, the teacher must certainly pay attention to the taxonomy mentioned above. Brookhart classified it as follows [6]:

- (a) The ability to analyze. Students are encouraged to focus on key questions or ideas, analyze arguments or theses. Compare and contrast the material they get.
- (b) The ability to evaluate. The teacher gives some material and asks students to rate it for a purpose. Their statements are supported by evidence and logic.
- (c) The ability to create. Students' assignments are presented through the process of solving problems, generating solutions, planning procedures to achieve certain goals, or producing something new. This process is called synthesis.
- (d) The ability to reason and think logically. Assessments are carried out using the rubric with the criteria for induction or deduction from a case. Ability in reasoning is supported by the ability of students to analyze and evaluate.
- (e) The ability to consider (discerning). Students are able to apply judgments that are right on target or be wise in a situation. This type of assessment includes evaluating the credibility of the source of information, identifying assumptions implied in that information, and identifying rhetorical and persuasive methods.
- (f) The ability to solve problems. Brookhart cites Bransford and Stein (1984) that the ability to solve problems can be summed up as **IDEAL**, which includes stages of **I**dentify the problem, **D**efine and represent the problem, **E**xplore possible strategies, **A**ct on the strategies, **L**ook back and evaluate the effect of your activities. To assess whether students can solve problems involving certain content and concepts that the teacher has taught, the teacher can use a rubric based on the **IDEAL** criteria.
- (g) Creativity and the ability to think creatively. Assessment requires students to produce new ideas, choose material that is related to the purpose of learning and display performance with the criteria that students try to achieve.

#### *Science Characteristics*

Aubusson, Harirsson and Ritchie [10] explain and cite the opinions of some experts who explain the characteristics of Science education. Science is unique in its learning transfer and process of understanding. The characteristic of Science s education is that its learning materials are transferred through metamorphosis and analogy. The teaching of Science, both the theories and applications, when done through ways of metaphor and analogy can strengthen learning concepts, metacognition and communication. Taylor and Willison reinterpret constructivism as a metaphor and compare it to a competing metaphor like objectivism. Metaphor, as the main reference for an integral perspective on the teaching of science, challenges the dominant position of constructivism in science education by encouraging us to shift from the literal interpretation of learning and knowledge in Science (as objectivism or constructivism) to a metaphorical interpretation. Lakoff and Johnson (1980, p. 184) emphasize a series of "facts" about human understanding, two of which are: "that our conceptual system is inherently metaphorical"; and "that we understand the world, think and function in metaphorical terms". Therefore, in science, our understanding is filled with concepts, propositions, thoughts and mental models (present and past) that are represented in various ways. This representation of mental models (Harrison & Treagust, 2000) is metaphorical. Imagery varies but includes physical structures (for example, building helical DNA), verbal representations, diagrams and simulations. In schools, science education is full of such representations.

The achievement of mastery of student competence in working on high-level questions is certainly inseparable from assessment activities [24]. The main principle in assessing, namely assessing, not only used for something known to students but also used to assess something that can be done by students in learning [23]. Assessment is the most important part of the overall learning process, one of the main functions of the assessment is to open up the misconceptions that students have before learning [23].

Misconception is a mental representation of a concept that is incompatible with the scientific theory currently held [29]. Incorrect understanding of concepts results in students experiencing misconceptions. If the misconception that occurs in students is left, then it will result in increasing material that is not able to be fully understood and will ultimately affect student learning outcomes [21]. One form of assessment that can be used to assess students' misconceptions is diagnostic multiple choice tests.

One of the multiple choice tests that can assess students' understanding and level of thinking, namely the diagnostic three tier test. There are several studies and developments regarding the three tier diagnostic tests for various purposes including Pesman & Eryilmaz [20] and Bunawan [5]. This three tier diagnostic test is a diagnostic test composed of three levels of questions [20]. The first level of the problem (one-tier) is in the form of ordinary multiple choice, the second level of the question (two-tier) that is in the form of choice of reason, and the level of the third question (three-tier) which is a question of confirmation of the answers has been chosen at the level of questions one and two [4]. Through the above explanation, researchers are interested in conducting development research entitled "Development of Knowledge Assessment Instruments Three-Tier Diagnostic Test Based on higher order thinking skills".

## MATERIAL AND METHODS

### Methods

This experimental study is a classroom action research that aims to see whether the application of the station rotation method can improve the ability of high-level thinking students in Science learning. Kemmis and McTaggart, action research has stages of planning, implementation, observation, and reflection [11]. This research is One-Group Pretest-Posttest Design.

### Instrument

The research instrument uses rubric, observation sheets, questionnaires, formative and summative test. The subjects of the study were fourth grade students of Logos Christian School, Surabaya. . The researcher is a participant in this research.

### Data Analysis

Techniques for collecting data through observation, interviews, teacher journal notes, and student learning outcomes tests.. Data analysis using descriptive quantitative analysis techniques.

## RESULTS AND DISCUSSION

### Need Assessment

The first step is doing students' needs assessment. Their needs, their characteristics becomes the first priority. Preparing group with heterogeneous member according their characteristics. Heterogeneous members in a group is a good climate to grow the social skills among the students [4]. There will be 4 - 5 students in each group. Second, classroom management must be prepared well. Using moveable furniture to make mobile class. It means easily to arrange. Preparing lesson plan as a responsive teaching to meet students' needs [9]. Learning objectives must be clear to prepare learning sources. This station rotation is equipped by unlimited learning source using devices and utilization of ICT on one of the stations. Teacher had better choose the web address selectively relate to the learning objectives. In this experiment the teacher chose to utilize the ICT corner with offline information. The teacher downloaded a large information, such as videos, slide show, pictures, articles that all relate to the lesson.

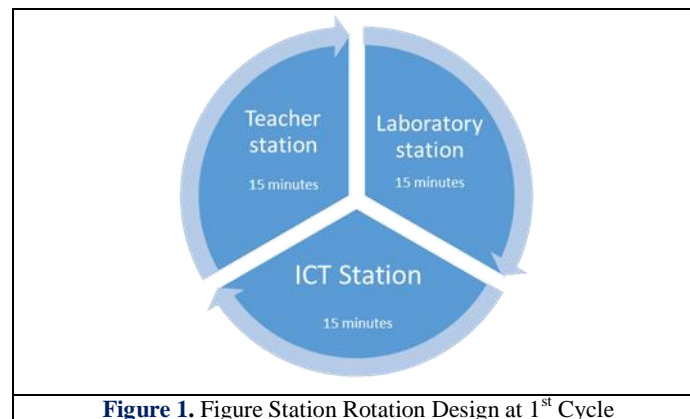
There are three stations; ICT station, mini laboratory station, and teacher station. Laboratory station consist materials and tools that the students need for doing experiment. The teacher station is giving a chance to the students to do confirmation about their understanding about the topic. The teacher also provides supplement books relate to the topic at this station. This station near by the library corner. The teacher also has a chance to assess where they have been doing and how far they get close to learning goals. Third, rules of the class must be clear and all the children willingly to obey it. Give them understanding why the rule is very important to keep the learning climate supporting all the activities well. Fourth, a good time management makes everything possible to do on time.

### Implementation

Science has 80 minutes times duration. The twenty first minutes at the first meeting, teacher explained about the learning objectives with the students. Teacher also gave the big picture of the topic. This moment is not only giving instruction what should they do but rather discussing the activities that they will do. Giving them a project and let them choose to express their understanding after exploring the sources, in ICT station and

laboratory station. It starts giving stimulus to challenge them learn more seriously but it's enjoyable learning. They started to imagine, design something in their mind, and did not want to wait any longer to explore. This discussion is very important. Teacher must open the eyes and ears to know their needs and it will send all the information that the teacher needs to be responded well. The guidance questions were given to direct their path. This classical teaching in the first step will decide the next step.

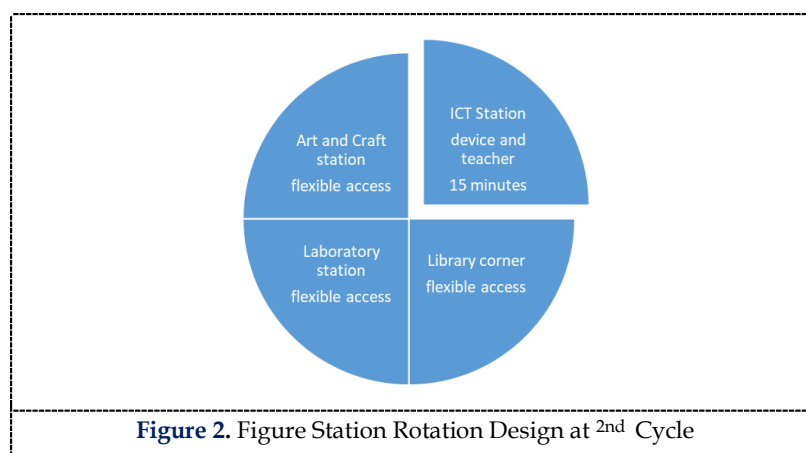
There will be 60 minutes ahead for the students in their group to rotate in 3 station. In the first cycle experiment, each group had 15 minutes to explore each station. We set the alarm so every time it rang, they had to rotate to another station. 15 minutes before ending the lesson, teacher did evaluation and reflection with the students about their learning. Figure 1 shows the rotation.



### Observation

During the learning process, I observed the first cycle run too fast. Every students seemed enjoy the activities but they were in a hurry while exploring in the ICT station and mini laboratory station. I noticed their sight sounded louder than the alarm when it rang. They took a rest in the teacher station then started complaining about the duration. Most of them complain the duration in mini laboratory is too short. One student said, "Miss, we need more time at mini laboratory to tailor our project." I got this message and keep it for improving the future learning. But they understood well if they have limited time in ICT station since we only have one laptop and one TV LCD. One of the group shared their experiment while exploring at ICT station, 4 children in their group shared the task to search and collect the information. One took a control to choose the other observe thru the TV LCD then discussed about it.

They gave solution, we should limit the time duration only when rotate at ICT station. They changed the ICT station as a station to consul and discuss with the teacher too. Teacher station changed to art and craft station. They also asked me to add one more stations, library corner. The students access the library corner without limit but they gave the rule of thumb in borrowing the book. Since we need book as the source, on each group only two books will stay in their place. Figure 2 shows the second cycle.



At the second cycle, we had better learning process activities. They were happy they had a lot of choices and

chance to explore the lesson independently. Even though, at the first cycle they asked many times confirmation about what should they do and is it the right thing to do or no. This is the process they built their confidence, they tried to liberate their idea freely without afraid of being wrong to choose. The students' testimony about station rotation very positive. They enjoyed their leaning. They said "This is awesome learning, I do what I can do. I do what I like. I do what is important. I do not waste my time. I remember all what I do because I choose it. I pass my test." .....that's what they said.

When the written test, they were able to answer higher order thinking skills problems. One of the example the teacher gave the study case problem, how should you move 100 kg of table from your living room to your bedroom. There is only you and your sister at home? They got the main idea, they need simple machine to do this work. They tried to describe and wrote their discerning to analyze the problems, then process the data, explain the possible alternative to solve the problems. They tried to find tools or something around their house to help them move the table. They also comparing and contrasting their alternative to choose which solution is the most right decision to solve the problem. They generated some problem solving. Finally they integrated the whole information to explain the most possible, effective and efficient machine then they wrote one certain machine to solve their problem. Scoring range 0 - 100. 80% of the students gets mark above 80. 20% gets mark 75-79.

### *Reflection*

The important part in this method is how the teacher must have the good leadership. One most important part is the role of the people especially the teachers who relate well to their students. The new culture in education which combined the technology in traditional instruction needs strong leadership. The teachers must have various skills responsible in caring, willingly to serve, having ability to create, inspire the students and the colleagues [3]. It's responsive teaching so the teacher will be able to meet the students' needs [10].

Their idea to response the duration were amazing. They gave solution, we should limit the time duration only when rotate at ICT station. They changed the ICT station as a station to consul and discuss with the teacher too. Teacher station changed to art and craft station. They also asked me to add one more stations, library corner. The students access the library corner without limit but they will give the rule of thumb in borrowing the book. Since we need book as the source, one group only two books will stay in their place.

The whole process, they learned to criticize, discerning, and considering their ideas before to decide. According to Anderson and Krathwohl, a revision of Bloom's taxonomy, high order thinking skills on the level ability to analyze, evaluate, and create [7]. They created and developed their ideas to produce the product as a representative of their understanding. They also prepared and performed creative performance to present their product. Each group brought their ideas in different way. They used roleplaying to present and their project/product. One group prepared more than two products to show simple machines then display them all in their exhibition corner. They created and build interactive activities to challenge another group to be creative to present their product. They have a full confidence to invite students from different grade and also the teachers to come and join to their exhibition. They learned to prepare everything. They shared their thought, they learned to listen and accept the differences ideas from their peers then discuss it together. They dare to explain. This is promote their higher order thinking skills. The teacher also grows together with the students. I have a lot of chance to know my student more, to recognize them closely, to identify their difficulties even their unspeakable problems.

## CONCLUSION

Two cycles class action research about the application of station rotation to promote higher order thinking skills proves that station rotation teaching and learning method is a good method to promote the students high order thinking skills. Tomlinson revealed that to achieve learning objective, learning should respond to the needs and to the differences of students [9]. Station rotation provides differentiated activities that meet students' needs. The method with differentiated approach in instruction aims the higher order thinking skills among the students [12]. Station rotation provide choices. This is an open door to the students to nurture their ability to compare, to contrast, to differentiate, to analyze, to consider, to discern, to reason, then to decide. It will not stop here. It drives the students' idea to innovate and to create something new. Station rotation makes the students not only downloading the knowledge but grows the wisdom and their problem solving skills. They experience their enjoyable and meaningful learning. This is a good climate for their learning process.

## REFERENCES

- (1) Truitt, A.A. (2016). *A Case Study of Station Rotation Blended Learning Model in a Third Grade Classroom*. Dissertation student research university of Colorado Scholarship & Creative Works @ Digital UNC, 2016.
- (2) Mackay, K. (2015). *Proof Points: Blended Learning Success in School Districts: Case study* by Evergreen Education Group and Clayton Christensen Institute. <https://www.christenseninstitute.org/publications/proof-points/> (accessed June 3, 2019)
- (3) Haas, J.S. (2016). *Change Leadership Practices For Effective Implementation Of Alternative Breakthrough Models In Blended And Online Learning At Select K-12 Schools: A Phenomenological Study*, Liberty University, Lynchburg, VA. Dissertation Prospectus-Core <https://core.ac.uk/download/pdf/75898006.pdf> (accessed June 3, 2019)
- (4) Johnson, D.W and Johnson, R.T. (1996). *Learning together and Alone; Cooperative, Competitive, and individualistic Learning*. Massachusetss : Allyn and Bacon a Paramount Communications Company, 1996.
- (5) Christensen, C. M., Horn, M. B., & Staker, H. (2013). Is K-12 Blended Learning Disruptive? An introduction of the theory of hybrids. [www.christenseninstitute.org](http://www.christenseninstitute.org). [Online] February 21, 2019. <http://www.christenseninstitute.org/wpcontent/uploads/2013/05/Is-K-12-Blended-LearningDisruptive.pdf>.
- (6) Bookhart, S.M. (2010). *How to Assess Higher Order Thinking Skills in Your Classroom*. U.S.A : Association for Supervision & Curriculum Development (ASCD), 2010.
- (7) Anderson, L.W and Krathwohl, D.R. (2001). *A Taxonomy for Learning, Teaching, and Assessing; A Revision of Bloom's Taxonomy of Educational Objectives*. New York, U.S.A : Addison Wesley Longman, Inc.
- (8) Saifer, S. (2018). *Hot Skills Developing Higher-Order Thinking in Young Learners*. St.Paul, MN : Redleaf Press, 2018.
- (9) Tomlinson, C.A. (2014). *The Differentiated Classroom: Responding to the Needs of All learners. 2nd Edition*. Alexandria, VA, U.S.A : ASCD Publication,
- (10) Aubusson, H. and Ritchie. *Metaphor and Analogy in Science Education, Science and Technology Education Library Volume 30*. Dordrecht, The Netherlands : Springer, 2006.
- (11) Kemmis, S and and McTaggart, R. (1992). *The Action Research Planner (3rd ed.)*. s.l. : Geelong: Deakin University Press., 1992.
- (12) Tomlinson, C.A.(2001). *How to Differentiated Instruction in Mixed Ability Classroom*. Alexandria, VA, U.S.A : ASCD Publication, 2001.

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