



Mediation Effect of Assessment as Learning in Mobile-Based Module on Vocational Education Student's HOTS

Fitrah Asma Darmawan¹, Amat Jaedun²

¹Mechatronics Vocational Education, Universitas Negeri Makassar, Indonesia

Email: fitrahdarmawan@unm.ac.id

²Educational Research and Evaluation, Universitas Negeri Yogyakarta, Indonesia

Email: jaedun@uny.ac.id

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Abstract. *This study aims to find out the mediation effect of assessment as learning (AaS) model in a mobile-based module upon students' higher-order thinking. This study is a Research and Development (R & D) and Experimental research. R&D method consisted of: information gathering, product planning, product development, product validation, preliminary test, limited trial, revision, product implementation, and dissemination. The experimental method was one-group time-series design. Data is gathered by using the online assessment sheets. This study employed 40 students of vocational high school. The interpretation of higher-order thinking improvement is based on the criteria of value gain. In addition to calculating the gain score, this study uses a hypothesis. The hypothesis is tested by comparative two samples technique. The result shows that assessment as learning model in mobile-based module has improved student's higher order thinking skills. The teacher needs to consider the use of the assessment as learning model on the learning module.*

Keywords: *Mobile-Based Module, Assessment as Learning, Higher Order Thinking Skills*

INTRODUCTION

Higher Order Thinking Skills (HOTS) are often needed to learn a higher level courses. Teachers tried to develop various approach to implement Higher Order Thinking Skills (HOTS). It is important for teacher or school leader to be aware in terms of the importance for teaching higher-order thinking skills to prepare young men and women to live in the 21st Century (Collins, 2014). It is needed in a Context of the 21st century with labor market demands of knowledge and skills applicable base on the competency standardized, either locally, regionally, or globally. In addition, the dynamics and complexity of a job require a worker who can adapt upon the changes of the work environment, and rapid technological advances (Mane & Corbella, 2017). Thus, labor market needs and

skills matching have featured prominently on the policy agenda of many countries, driven by both rapid technological advances and global competition.

Mobile-Based Module is developed to increase learning process. Computer-assisted learning modules are prominent in many countries. IT offers a high flexibility and mobility learning for users. E-learning module improved students' knowledge and self-efficacy (Ikram, Essink-Bot, & Suurmond, 2015). Then the mobile-based module is highly facilitate for teachers' fieldwork, and students as well (Hsu, Chen, & Department of Geography, 2010). Yet, mobile module is mostly used as teacher-centered approach in evaluating process to assess the learner. Whereas, teacher-centered assessment not the only one method to measure learner

achievement but also can be collaborated with assessment as learning, also known as self-assessment, to develop self-instructional so the learners can independently monitoring the progress of their own learning. It aims to make learner more active in learning experience to catch up in term the content of job competence, because vocational education and training holds mastery learning paradigm.

The effect of Mobile-Based Module on HOTS are found vary. Mobile-based instructional media for teaching physics can enhance divergent thinking skills and higher order thinking skills of students (Mardiana, 2016). Mobile-based learning in vocational Education can offer some advantages: learning any time and any where, access to information rapidly and broadly so affect the student activity in learning, two-way interaction and collaboration among teacher and students, variation for learning let students to get knowledge appropriate the student ability, and give a fun learning for students during learning process (Joanne & Michael, 2013; Sarrah, Al-Shihi, & Hussain Rehman, 2013). It is suggested that Assessment As Learning is useful to increase the effect of Mobile-Based Module on HOTS.

One solution effort to face the dynamic and complex labor market is that vocational education and training institutions need to reset the curricula and instructional methods to improve competency and higher-order thinking skills for learner . Vocational education and training institutions are asked not only provide job competence for their students, but also equipping the higher-order thinking skills for their graduates. Center for the Advancement of Learning and Assessment (CALA) concluded that HOTS as logical, critical, creative, reflective, and metacognitive thinking. They will occur when individual encounter unfamiliar problems, questions, or choice. The Successful implementation of HOTS results good performances, explanations, decisions.

It should be understood that the learning approach used in vocational education and training different from the learning approach used in the other form of education. Learning approaches In vocational education use contextual learning based on "hands-on" a particular job competence. Training module or training job sheet is used as guidance for learning experience and be one of the teaching assistant having characteristics for learning in vocational education. Module as a guidance for trainers and

trainees in the teaching and learning experience has the characteristics of self-learning aspect for students (self-instructional) and self-assessment for students or learners. Hence, this study aims to develop a mobile-based module using the assessment as learning approach or self-assessment collaborated with assessment of learning from teacher/ trainer to improve higher-order thinking skills of students in vocational education and training.

Various definitions of Higher-order Thinking Skills (HOTS) presented by some experts. According to Bloom theory, the cognitive domain is divided into Lower-Order Thinking (LOT) and Higher-Order Thinking (HOT). LOT included remember, understand, and apply, whereas HOT included analyze, evaluate, and create (Anderson, Krathwohl, & Bloom, 2001). Then, HOTS consists of logical, critical, creative, reflective, and metacognitive thinking. They will occur when individual encounter unfamiliar problems, questions, or choice. The successful implementation of HOTS results good performances, explanations, decisions. (King, Goodson, & Rohani, 1998).

In line with the definition above, Dewey's theory argues that thinking does not active spontaneously but must be activated by the problems, questions, choice, dilemma or doubt, consequences of a confusion,. Observations or data they have can not provide the solution. Further, it demands a solution that fosters and guides the whole process of reflective thinking. The nature or characteristics of the problem will govern the end of a thought, and ultimately control the thought process. Dewey's concept is relevant to current discussions and research on problem-solving and metacognitive strategies and the importance of teaching students to think through their own thought processes (Kauchak & Eggen, 1969). Those definition can be interpreted that higher-order thinking skills include critical thinking, logical thinking, reflective, metacognitive, and creative thinking. This thinking ability arises as a result of unusual problems, uncertainties, questions, or dilemmas. The results of this skill is a valid explanation, decision, performance, and product in the context of specific scholarship and experience. It can encourage further growth in other thinking skills.

In addition, there are three main concepts that are closely related to HOTS processes and are based on assumptions about learning and thinking (King et al., 1998). First, the level of thinking cannot be separated from the level of

learning; both involve dependencies, many components and levels. Second, in real life, students will learn a lot from experience in the school and the surrounding environment, regardless of what concepts and vocabularies they learned in the previous year. This will help students learn about HOTS and new content in the coming year. Third, in the complex situation faced by students, HOTS will involve a variety of thought processes and have many variables. These variables are procedural knowledge, metacognitive thinking, creativity, insight, critical thinking, and problem solving abilities.

When teachers teach and assess high-order thinking on a regular basis, teachers will know the benefits of the method for students. Understanding how students think and process what they learn should be improved as teachers use assessments designed specifically to demonstrate students' thinking skills. In the end, their thinking skills must increase, and their overall performance should also increase. Students learn by building meaning, incorporating new content into their existing mental representations (Brookhart, 2007).

Based on some of the expert's explanation above, it can be concluded that higher-order thinking skills is a high-level thinking skill which included the ability to analyze, ability to evaluate, ability to solve the problems, creative thinking, and logical thinking. Those thinking skills arise from a variety of conditions such a problem, dilemma, confusion, and an unusual question. The higher-order thinking ability can be enhanced through periodic or regular assessment. Furthermore, when teachers teach and conduct tests to assess higher-order thinking regularly, then within the time, the benefits for students would be appeared. In the end, students' higher order thinking skills may be improved. Psychologically, students will learn to build the meaning of self-evaluation and incorporate new knowledge into existing mental representations.

Generally, mobile-based learning is interpreted as a combination of the use of mobile devices in learning and electronic-based learning (e-learning) (Shepherd, 2011). Then, mobile-based learning is a teaching and learning tool using smartphone, handhelds, or mobile phones, or the other gadget (Traxler, 2009). Traxler said that some of the advantages of mobile-based learning are: technology-based learning, portable, informal, classrooms that are connected virtually, informally, and personalized.

In line with this definition, Rajappa &

Motiwala (2007) said that mobile learning allows the integration of individualized learning with learning anywhere and anytime. Mobile-based learning combines individual learning independently and learning any time. Specifically, the use of mobile devices refers to services and applications using mobile device in which individuals can use it during their activities (Sarraf et al., 2013). Sarraf said that the mobile device such as tablet, laptop, smartphones, pocket PCs, Personal Digital Assistants (PDA). Mobile devices in learning extend the function of e-learning to the utilization of mobile devices (m-learning) where the devices have a great ability to enhance learning activities. Educational administrators and teachers are provided with more flexible learning management and a teaching method.

Based on the exposure of some experts above, it can be concluded that mobile-based learning is a learning that utilizes mobile devices as electronic learning that aims to make the learning process more flexible and independent.

Various definitions of the module are presented by several experts, either by the name of the 'module' or by the name of the 'learning module'. Module is the learning materials that are made systematically based on the learning curriculum and are arranged in the form of the smallest learning unit that supports students learning independently anytime and anywhere. (Purwanto, Rahadi, & Lasmono, 2007). In line with this definition, the module is a planned type of learning activity, designed to help learners individually in achieving their learning objectives (Sudjana & Rivai, 2007). Sudjana said that the module can be viewed as a package of learning programs consist of learning content, learning resources and evaluation systems.

The module is the learning materials that helps the students to move into the "zone of proximal development" for new learning together with the teacher and peers in the group, forms the 'scaffolding', (Chew, Hamid, & Madar, 2017). The module should contain learning materials in activity units that are sufficiently complete so that it is easy for students to learn (self-study). This module must also be independent (stand-alone), independent of other media, flexible (adaptive) and user friendly, and help students to give feedback or to responds the module (Directorat of Vocational High School Development, 2008).

Based on some of the above definition it can be concluded that the module is a learning material that is planned and independent where it

has a goal to help students learn individually to achieve specific learning objectives. The learning module has its own characteristics that distinguish it from other teaching materials. The learning module can contain learning objectives, expected competencies, learning materials, and evaluation of learning.

Based on the definition of mobile learning and the definition of module above, it can be concluded that mobile-based module is an independent learning unit produced systematically that utilizes mobile devices (PDAs, Smartphones or mobile phones) as a media to deliver the learning content. Through this mobile devices, the administrative functions of learning become more orderly in an information system in which learning content can be integrated with the assessment system. The assessment system in the mobile-based module may be integrated with assessment as learning or also known as self-assessment to involve students actively in assessing themselves and see the progress of own learning, see which aspects are still lacking in mastering the thorough (mastery learning) content of practicum activities.

Three classroom assessment approaches: assessment of learning, assessment for learning, and assessment as learning (L Earl, 2003). Earl said that these three approaches have different meanings and applications. This expert defines Assessment as Learning with the assumption that students can be involved and expanded their role in formative assessment of students, that is not only as an object in the assessment process in learning, but also as a good assessor collaborator between them. Students as a link. Students, as active assessors, are critical, and have high involvement, can understand information, relate it to prior knowledge. Assessment as learning emphasizes on the assessment process involving students to assess themselves with mentoring their teachers. Students are active to see for themselves the extent to which their understanding of the material has been taught by the teacher.

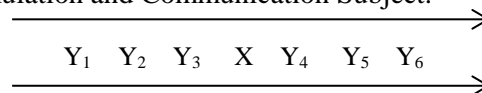
Furthermore, another definition suggests that assessment as learning is a student-focused assessment and emphasizes on assessment as a metacognition process (knowledge of a person's thought process) for students. Assessment as learning arises from an idea that learning is not just a matter of transferring knowledge from someone who has more knowledge, but is an active process of restructuring the cognitive that occurs when individuals interact with new

knowledge. Assessment as learning is based on research on how learning occurs, and is characterized by students who reflect on their own learning and make adjustments for themselves so that they can reach deeper understanding (Lorna Earl, Katz, & WNCP, 2006).

Based on some definitions, it can be concluded that Assessment as learning is an assessment method that focuses on self-assessment by students during the learning process takes place and involves students actively for the learning assessment process. It is expected that students can assess their own learning progress so can achieve a deeper understanding.

METHOD

This study was research and development (R and D) and experiment. The R and D adopted the development procedure proposed by Gall, Gall, & Borg (2003) consisting of 10 main stages: information gathering, product planning, product development, product validation, preliminary test, limited trial, revision, product implementation, and dissemination. The experiment method was one-group time-series design. This study employed 40 grade X students SMK Negeri 1 Soppeng who took Digital Simulation and Communication Subject.



Note:

$Y_1 - Y_6$: Tests periodically

X : Introduce the experimental treatment

The data were analyzed by determining the gain scores and hypothesis testing. The interpretation of higher-order thinking improvement is based on the criteria of value gain (Hake, 1998):

Table 1. The Criteria of Value Gain

No.	Gain Value	Criteria
1.	$g \geq 0,70$	High
2.	$0,30 \leq g < 0,70$	Medium
3.	$g < 0,30$	Low

In addition to calculating the gain score, this study uses a hypothesis. The hypothesis is tested by comparative two samples technique to see if there is an average difference between several tests performed periodically. The statistical hypothesis in this research is as follows:

$H_0 : \mu_1 = \mu_2 \rightarrow$ There is no significant difference in scores between the tests.

$H_a : \mu_1 \neq \mu_2 \rightarrow$ There is a significant difference

in scores between the tests.

RESULTS AND DISCUSSION

This study focused on the mediation effect of assessment as learning applied to mobile-based module to improve the HOTS. The HOTS consists of 3 aspects: critical thinking, creativity, and problem solving skills. The mobile-based module used in this study is complemented by evaluation sheets that will measure students' HOTS. Each module evaluation sheet is completed by students each week using a mobile device/ smartphone.

The following table is the data recapitulation of students' HOTS. The data is gathered from grade report on mobile-based module used in this study. The test is conducted four times periodically. The scale used to measure students' HOTS is a 1-4 scale.

Table 2 Scores Recapitulation of HOTS

	Test 1	Test 2	Test 3	Test 4
Critical Thinking	2.38	2.51	2.69	3.01
Problem Solving	1.78	1.84	2.57	3.08
Creativity	1.95	2.00	2.89	3.08
Maximum Score	4.0	4.0	4.0	4.0

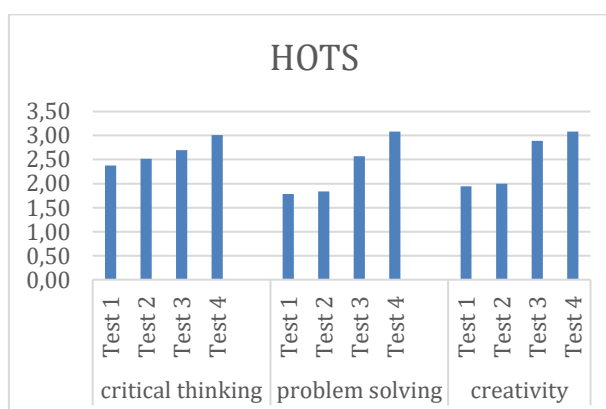


Figure 1. The Chart of HOTS.

The table and chart above are the result of recapitulation and analysis of students' HOTS. The visualization informs to us that the students' HOTS has increased from the tests conducted periodically using assessment as learning model applied to mobile-based module.

Gain score indicates how much improvement students' HOTS. Reinforcement value is obtained from the difference of the mean score gathered from the 1st test until the 4th test. The following table is a recapitulation values of the students' HOTS improvement:

Table 3. Gain Score of Students' HOTS

	1 st test	4 th test	Gain	Categori
critical thinking	2.38	3.01	0.34	medium
problem solving	1.78	3.08	0.57	medium
creativity	1.95	3.08	0.51	medium

The table above shows that all of students' HOTS gain values are categorized as medium. This values shows that the assessment as learning model on mobile-based module effectively improves student's HOTS.

Table 4. The Result of Statistical Test

	Test Statistics		
	Test 2 - Test 1	Test 3 - Test 2	Test 4 - Test 3
Z	-2.739	-1.078	-2.298
Asymp. Sig. (2-tailed)	.006	.281	.022

Test 2 – Test 1 : *sig* (0,006) < P-value (0,05), so that H0 rejected and Ha accepted. conclusion: there is a significant score difference between the first test average and the second test average.

Test 3 – Test 2 : *sig* (0,281) > P-value (0,05) so that H0 accepted and Ha rejected. conclusion: there is no significant score difference between the second test average and the third test average..

Test 4 – Test 3 : *sig* (0,022) < P-value (0,05) so that H0 rejected and Ha accepted. conclusion: there is a significant score difference between the third test average and the fourth test average.

Discussion

Based on the data analysis above, the assessment as learning model applied to the online module can improve students' HOTS (critical thinking, problem solving, and creativity). It is caused by the assessment as learning model gives students the opportunity to

assess their own answers in module and the peers answers. Students are involved in assessing and evaluating the answers based on the assessment rubric provided in the online module. It encourages students to be more proactive in evaluating their critical thinking, creativity, and problem-solving abilities. Thus, students are able to reflect their higher-order thinking skills used to evaluate the improvement of students' HOTS.

This is in line with research conducted by: (1) Telaumbanua, Sinaga, & Surya (2017) using formative and summative evaluation to measure students' mathematical problem solving ability; (2) Kusuma, Rosidin, Abdurrahman, & Suyatna (2017) using assessment for learning (formative assessment) is effective to train student's HOTS and effective measure student's thinking skills; (3) Mohamed & Lebar (2017) using authentic assessments to measure higher-order thinking skills among students. But, those 3 studies above using teacher-centered assessment to assess student's HOTS, even though it also requires assessment based on students (student-centered).

The learning-evaluation method of the teacher-centered certainly does not involves students in assessing and reflecting on their own learning. Their feedback from the evaluation system in the online module is only assessed by the teacher. Students only see the final score of each test so they can not see which aspect they lack. However, through the assessment as learning model, students are actively involved in assessing their HOTS, either critical thinking, problem solving, or creativity aspects.

In addition to assessment as learning model, HOTS-based tests giving to students are regularly stimulated to improve students' HOTS. It is based on the analysis results above showing that students' HOTS were increased through four tests given regularly. It is shows that there is gain values in each tests given periodically. The results of the first test will be used as a reflection and evaluation in the next test, either critical thinking, problem-solving, or student creativity. This is in line with what Brookhart (2010) explained that applying HOTS in teaching and assessing continuously and regularly, in a long period you will see the benefits and changes for students. The teacher must understand well how students learn and think reflectively if they want to use assessment methods to measure HOTS.. This is because students construct new meanings and understandings to be reflective in expressing their HOTS.

CONCLUSION AND SUGGESTION

The result of this study is that the mediation assessment as learning on mobile-based module effectively increases the students' HOTS in vocational high school. A teacher needs to consider the use of the assessment as learning model on the learning module. Assessment as learning enables students to self-assess their learning and enables students to assess their peers' learning. Based on the theories described above, students are good partners to conduct evaluation and assessment activities because they can reflect on their own learning well. It will stimulate an increase in their HOTS. In addition, regular tests or regular assessments will familiarize the students with higher-order thinking levels so can increase the student HOTS.

So, we suggest that the teacher needs to consider the use of the assessment as learning model on the learning module. The teacher assess student's HOTS during learning performance and use authentic assessment to see outcome learning based on the student's activities or the student's performance.

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