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Developing Realistics Mathematics Education (Rme) Based Mathematics Teaching Video To Advance Higher Order Thinking Skills (Hots) In Cognitive Level Of Vocational School Students

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Abstract. The research method for this study is design method with developing approach. This developing research aims at obtaining the learning video of Mathematics that oriented on RME with valid quality, pragmatics and effective to increase the skill of higher level thinking of Vocational School students. It consists of three stages, i.e. Preliminary research, prototyping and assesment. This is applied in all vocational schools in Badung regency. The result of this research is learning video of valid equation linear, practice and effectives and video which able to advance the Higher Order Thinking Skills (HOTS) in cognitive level of Vocational School students.

Keywords : Higher Order Thinking Skills, Cognitive Level, Vocational

1. Introduction

Mathematics is a universal science that is useful for daily life and becoming the basic of modern technology development, and it has important role in various disciplines and developing mind set of human. It trains the skill of logical thinking, analytics, systematic, critical, innovative and creative, and also the skill of teamwork. Learning mathematics in Revolution Industry 4.0 is directed to develop the competence of 21st century, i.e.: (1) Critical thinking purposes at student can solve various contextual problems by using critical and rational logics; (2) Creativity motivates students to be creative in finding various solutions, designing new strategy or find unusual ways as in advance; (3) collaboration facilitates students to have teamwork or work in group skill, tolerant, comprehend the diversity, able to communicate broadly, get the idea/information, able to interpret an information and skill of giving argument in broad mean [1] [15] [16] [17]. In level of elementary and middle school can be developed through learning activity and assessment at school. In education field, it needs media that can motivates students to advance their HOTS skill [7] [12] [13] [14].

Meanwhile, the fact, it is yet discovered mathematics learning media that can motivates students to developing their HOTS skill [4] [12] [20]. The mathematics subject that has been taught at school until now, generally it starts from definition or understanding from an intuitive object, then it operates toward that object, it will be ended by giving example then the homework or assignment as their practice. There are some of students assume that Mathematics subject is quit difficult, it is full of



formula and numeric. Some of students are giving up before the class is begin and think that they are not able to understand even after explained by the teacher. It causes students not actively participate in mathematics class.

The result of international study, *Program for International Student Assessment (PISA)* showed the achievement of reading literacy, mathematics literacy and scientific literacy achieved by the student is very low. Generally, the student ability of Indonesia was low on; (1) Integrating information, (2) generalize cases to be a general solution; (3) formulating the real problem into subject's concept; and (4) doing investigation [2]. RME is an approach that formulating real world problem as starting point of learning. It was firstly introduced by Freudenthal in Netherland in 1970 [3] .

This reseach aimed at developing mathematic learning video oriented on RME with valid quality, practice and effective. The result obtained that this video can be used by mathematics teacher of vocational school as assisting tool in teaching mathematics to advance the skill of HOTS in cognitive level.

2. Method

Research method that was used is designing research with developing research type. It aimed at giving result of mathematics learning video that oriented on RME with valid quality, practice and effective in advancing the skill of HOTS of vocational school students. This developing research consisted of three stages, i.e. Preliminary research, prototyping and assessment [5]. Preliminary research stage was the first stage, the researcher analyzes the students, the curriculum or learning media, analyze the theory (Learning video, RME and HOTS). Then, Prototyping, the researcher designed and developed the learning video, it was called as draft 1. Assessment stage, this stage was begun with validating by the experts, the obtained result of this validation is called draft 2. Moreover, it gave trial to draft 2 on limited sample to see the practicality, the revision result of this stage was called draft 3. The next step was field trial by using draft 3, where in this stage, the researcher saw the practical and effectivity in using this video to advance the HOTS skill of vocational school students in cognitive level.

The used of technique of collecting data was validating guidance to get the expert's validation. Observation, interview and questionnaire to get the practicality value. Test was used to get the HOTS skill in cognitive level [6].

3. Result and Description

In preliminary research stage, it begun in relation of students situation, curriculum and supporting theory (Learning video, RME and HOTS). In stage of analyzing students was found that; (1) almost all of Vocational school students have smartphone; (2) students could use smartphone; (3) students were yet using smartphone in maximum as supporting tool of studying.

The analysis of curriculum was found are; (1) basic competence of mathematics subject in Vocational School is overmuch; (2) the material in textbook which was prepared by the government is irrelevant with the student's situation; (3) the unavailable learning media that can support students to develop HOTS skill.

Furthermore, theory of analysis: (1) criteria considered by teacher in choosing media is the accuracy of media with teaching purpose, supporting content of learning material, the practical in obtaining the media, teacher's ability in using it, the time allotment, regarding level of students thinking; (2) RME characteristic was the used of context, model, utilization of result and students construction, interactivity based learning process, related to various knowledge [3] ; (3) HOTS skill is six levels of thinking ability, it started by the lowest, such as remembering, understanding, applying, analyzing,

evaluating and creating [8]. In prototyping stage is designed and obtained a product such as draft of learning video regarding the situation where students come from, curriculum and supporting theory.

Assessment stage is product testing which is developed through validating, observation, questionnaire and test. Validating was done by two experts, i.e. theory expert and media expert. Data of validating result related to mathematics learning validating theory of vocational school.

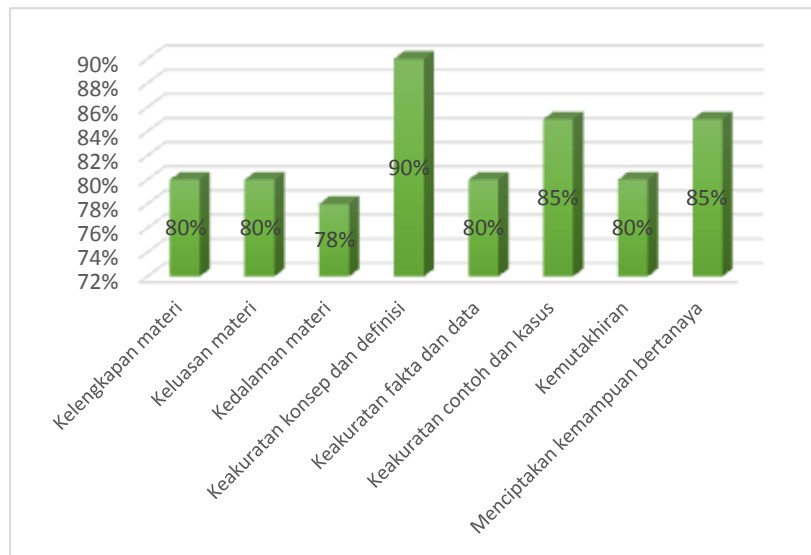


Figure 1. The Aspect of Validity Expert Theory

The percentage calculation of material expert was reviewed from relevance toward mathematics learning material with RME approach, it obtained the completeness of material 80%, Breadth of material 80%, Depth of material 78%, the accuracy of concept and definition 90%, accuracy of fact and data 80%, accuracy of example and case 85% modernism 80% and creating skill of asking 85%. The total average was 82%.

Data of expert validating result with learning video.

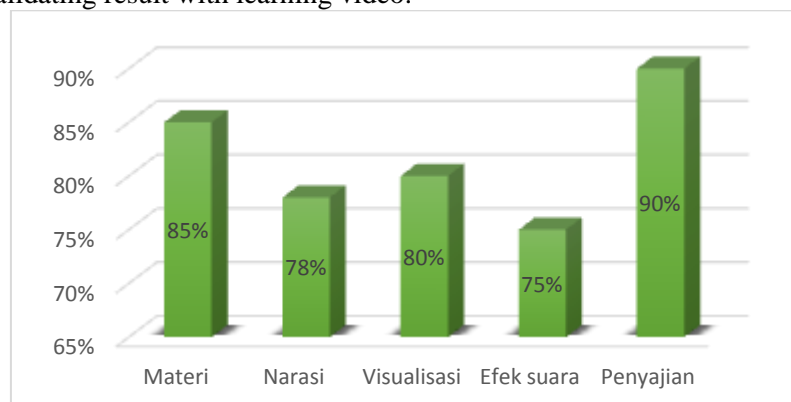


Figure 2. Video Validating Aspect

Material 85%, Narration 78%, Visualization 80%, Sound Effect 75% and Presentation 90%. The total average was 82%. Besides, validating data, the experts also give several advices to improving the video, such as:

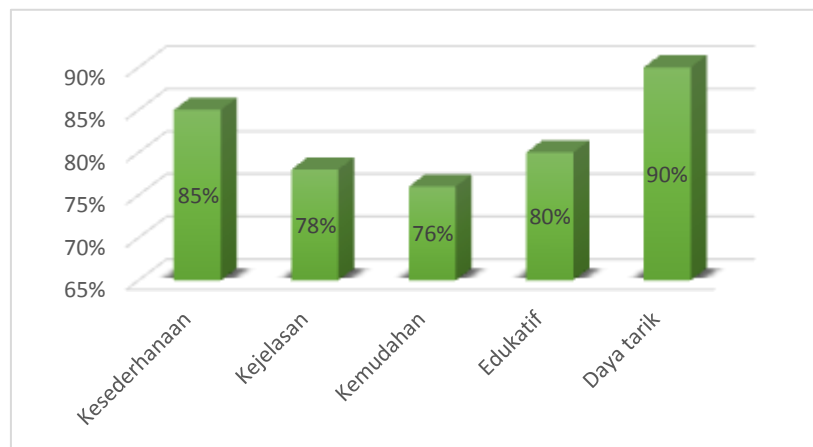
Table 1. Material Expert Advice

No	Advice of Material Expert
1.	The presented material is started from introducing the concept, definition, procedure, output display, example, case, practice until the interaction among the concepts for vocational school students
2.	Notation, symbol and icon are presented in right way according the prevalence.
3.	Giving more examples and cases which are presented regarding situation and condition occurred in daily life.

Table 2. Media Expert Advice

No	Advice of Media Expert
1.	Make the duration of video only 7-8 minute
2.	A video only sufficient to explain one indicator
3.	Adjust the background music volume with the local video
4.	Adjust the animation with the indicator

After the expert validity test, then another limited trial was done by involving 5 students of vocational school. This result presented in graphic as follow:

**Figure 3** Aspect of Students Assessment on Limited Trial

The indicators of limited trial were: simplicity, clarity, easiness, educative and attractiveness with 23 questions. The percentage of assessment result as follow: simplicity aspect is 85%, clarity 78%, easiness 76%, educative 80% and attractiveness 90%. The limited trial on RME oriented mathematics learning video was totally averaged 82%. After revision, then it was tested with 36 students. The obtained result is as follow:

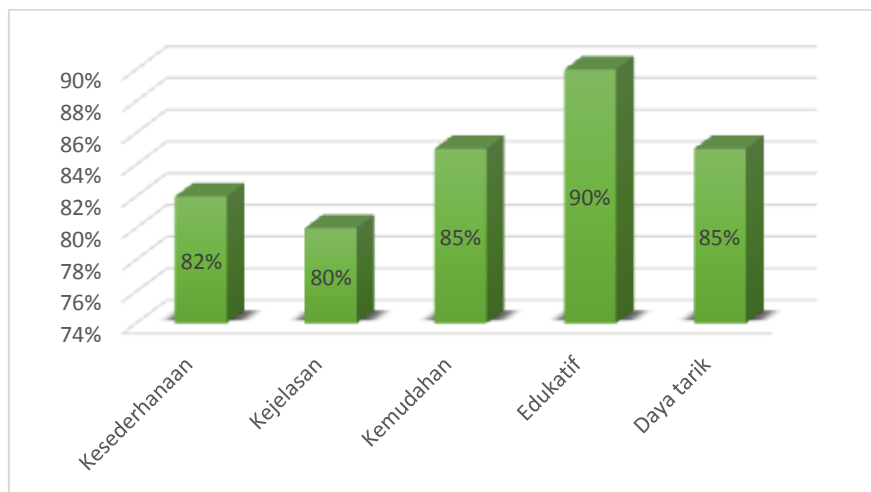


Figure 4 Aspect of Students Assessment on Field Trial

Percentage of field trials was as follow: aspect of simplicity 82%, clarity 80%, easiness 85%, aspect of educative 90% and attractiveness 85%. The result of field trial of RME oriented mathematics learning video in total average is 84%. The students' comment toward the learning video is presented in the table below:

Table 3. Students' comment toward learning video

 <p>Reva Yolanda26 2 bulan yang lalu</p> <p>Kalo aku singkatan.nya "semua SINDikat TANGannya COSong" Semua itu artinya sin,cos,tan positif</p> <p>👍 🗨️ BALAS</p>
 <p>connect_ 3 bulan yang lalu</p> <p>Kak coba bikin yang nilai sin, cos tan nya lain perkalian 5, contoh: 37° atau 52° gitu soalnya gimana kak?</p> <p>👍 1 🗨️ BALAS</p>
 <p>Yunika Nadhiya Anggraini 2 bulan yang lalu</p> <p>makasih ya</p> <p>👍 1 🗨️ 🍎 BALAS</p> <p>Lihat balasan ▾</p>

The score test of study result was used to measure the HOTS skill, it is presented in table below.

Table 4. Score of Study Result Test of HOTS Skill

No	Interval Class	Middle Grade	Frequency	Percentage
1	55 – 61	58	2	5,56%
2	62 – 68	65	3	8,33%
3	69 – 75	72	4	11,11%
4	76 – 82	79	12	33,33%

5	83 – 89	86	10	27,78%
6	90 – 96	93	5	13,89%
Total			36	100%

From table 4, it showed that 9 students get below average grade, 12 students get average grade and 15 students get above the average.

Developing RME oriented Mathematics Learning Video is bounded to the role of multimedia which produce an information such as image, sound and animation, so as the role of video is very helpful in distributing the information. This is supported by Sousa stated that learning video is the combination of text, image, graphic art, animation, sound and video [9] [18]. Various media is elaborated become one work unit which produce an information, not only can be seen as printed result, but it also can be listened, making simulation and animation can stimulate the demand and has high graphic art value in its presentation [10] [19].

Learning video is a media which is able to connect the teacher so that the learning process is not conventional. The attractiveness of developed media attracts the students, since there is music in video, sound and explanation illustration and also the image which is taken from the real life and designed in interesting way. It was according to the statement of Woolfolk who stated that learning process for adolescents in concrete operational stage can be done by using visual supporting tool and involving concrete things [11]. The developed learning video is able to show the real objects so it can be more interesting, since the problem is presented according to their chosen major.

4. Conclusion

According to the research, it can be concluded that: (1) RME oriented mathematics learning video is reasonably to be used in learning according to the material experts and video experts with a food mark; (2) RME oriented Mathematics Learning Video is able to motivate students to advance HOTS skill.

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