Mathematics Teaching Videos with the Context of Riau Culture to Enhance the Mathematical Problem Solving Ability of Class VIII Students on the Material of Polyhedron

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Abstract. This development research is based on low ability of students to solve mathematical problems (Mathematical Problem Solving Ability or MPSA) and the lack of learning devices which can be used as solution for these problems. This research was originally aimed at developing learning devices which is syllabus, lesson plans (LP), and student worksheet (SW). Due to the Covid-19 pandemic outbreak and online learning must be taken, the learning is supplemented with the preparation of learning videos. The development model used refers to the Borg & Gall model, but it has not gone through all phases. The phases that were completed: research and data collection; plan; development of initial product designs; first field trials; and product revisions. The following stages whose implementation requires formal classes cannot be performed. The resulting products are in the form of syllabus, lesson plans, student worksheet and math learning videos using the discovery learning model with Riau's cultural context on the Polyhedron material. Validity and practicability measurement was performed for syllabus, lesson plans, and student worksheets, while learning videos were used directly. The results showed that the learning devices were categorized as valid and very practical for improving MPSA.

1. Introduction
The study result of Program for International Student Assessment (PISA) stated that the Mathematical Problem Solving Ability (MPSA) of Indonesian students is still low [1]. In line, researchers observed the implementation of learning, interviewed teachers and students, and conducted MPSA tests to students in Kampar Regency. The MPSA test questions related to the polyhedron material of class VIII that was given to 28 students of SMP Negeri 1 Kampa are as follows.

From the results of the students' work, it can be said that the MPSA is still low. One of the results is shown in Figure 1, which shows that students have understood the problem well, but they did not create mathematical models, did not use the correct formula for problem solving, and did not draw any conclusions. The low level of MPSA is due to the mathematical concepts are given informatively and students are asked to work on many questions without deep understanding [2]. In addition, students are not used to solving non-routine questions that challenge students to think and practice math problem-solving skills [3].
Students' low MPSA is also due to the learning devices that the teacher has not been able to display to facilitate and improve their math problem solving skills. The learning devices consist of syllabus, Lesson Plan (LP), Student Worksheets (SW), teaching materials, media, and assessment designs. The learning devices prepared by the teacher are not complete and systematic, while the full and systematic preparation will deliver effective learning and train the MPSA of students. The competence performance indicators and learning objectives in the lesson plans drawn up by the teacher has not contained the intended basic competence achievements. In the learning activity component of the lesson plan contains an introduction, core, and cover. However, it was not seen the learning model phase used in the core activity. In addition, it was not accompanied by a scientific approach. The teacher has not made SW independently and only relies on Student Activity Sheets (SAS) from the publisher. Publisher's SAS contains a collection of formulas and questions on each learning topic. By giving the formula directly without any problem solving process, the MPSA of students has not been tightened up properly. The set of questions on the SAS contains only routine questions, so students are not trained to work on non-routine questions.

Several studies have shown that learning devices in other region are still not in line with process standards, including research [4] and [5]. In Yogyakarta’s junior high school, it appears that most of teachers only download lesson plans from the internet and use the previous lesson plans without any change in their learning activities [4]. Meanwhile, [5] stated that the lesson plans designed by the junior high school math teacher in Sawahlunto had not yet instructed students to be actively involved in the learning process, while SW contained only a collection of materials in the form of formulas and questions who only trained math skills without any problem solving process.

The reality described that it requires a solution to improve learning planning. Learning devices that can guide students actively in discovering a concept and training of MPSA should be developed. The development of learning devices certainly requires the application of a learning model that supports students as a learning center. One of the suitable learning models to use is discovery learning models. Discovery learning model has stages that help students develop MPSA. MPSA of students who receive discovery learning as a whole fall into the good category and student responses tend to agree with the learning [6]. The results of the study [7] indicated that the MPSA of junior high school students had increased after receiving the application treatment for the discovery learning model.

In the application of discovery learning models, the first stage is to provide a stimulation by providing concrete examples of mathematical concepts related to everyday life. Things closely related to students' lives are the culture in their environment. Cultivating cultural values can be done when learning math in schools [8]. Mathematics learning should link math materials with culture so that students feel the cultural connection with the math materials they learn. So far, students are not used to being confronted with contextual mathematical situations about the existing culture in society [9]. The
culture that exists in the environment of students is the culture of Riau. The Riau culture in question can be in the form of historical buildings, typical foods, and so on. Furthermore, it is necessary to apply a model that can challenge students to discover concepts from contextual problems in learning which is the discovery learning model with the Riau cultural context comprising six stages.

The first phase, in the form of Riau’s cultural problems, which aims to awaken the desire of students to investigate the concepts to be studied themselves. For example, the material on the area of the cube is stimulated in the form of problems related to typical Riau food, which is wajik with cube-slice and put into a box. The second phase, problem statements (problem identification) based on things relevant to the concepts being studied, this will help students understand and model problems and formulate hypotheses. The third phase, data collection, addresses the problems students face so that students can make problem solving plans and see the relationship between concepts in findings. The fourth stage, data processing that has been collected so that students perform problem solving by applying the found formula. The fifth stage, verification (proof), verifies the truth of the hypothesis and relates to the results of data processing. The sixth phase, generalization (drawing conclusions / generalizing) which can be used as general principles and applies to all events.

One of the math teaching devices that should be mastered by junior high school students is the Polyhedron material [10]. The polyhedron material is the material that is not liked by students because it provides a high degree of difficulty. Furthermore, it is difficult for students to understand its elements and cannot solve problems with the material [11]. Students don't really understand the concept of polyhedron material as they just focus on the formula without knowing the process of its discovery.

Based on the explanation of the low MPSA, the learning process and the importance of learning devices, one of solutions is by developing learning devices. The learning devices developed in this study were in the form of syllabus, lesson plans, student worksheets, and learning videos on the polyhedron material. The development of this learning device uses a discovery learning model with the context of the Riau culture to enhance the MPSA of Class VIII SMP / MT students.

2. Methodology
The form of the research conducted is research and development with the Borg and Gall development model (in [12]) which has 10 phases: (1) research and data collection; (2) planning; (3) development of initial product designs; (4) first field trials; (5) product revision; (6) field testing of the main product; (7) operational product reviews; (8) field trials; (9) review of the final product; and (10) dissemination. In this study, the main field test phase of the product, the operational product revision, the field trial, and the final product revision were not performed. This is because all SMP / MTs in Kampar Regency were closed due to the Covid-19 pandemic which prevented investigators from conducting large-scale research.

The subjects in this study were 8 students of class VIII.3 SMP Negeri 1 Kampa with heterogeneous abilities, which is 2 high abilities, 4 moderate abilities, and 2 low abilities. The instrument used was the validity instrument in the form of a validation sheet for the syllabus, lesson plans, and student worksheet and practical instrument in the form of a student response questionnaire. Because learning must take place online, direct learning videos are used without being tested for validity and usability. Video users are students of class VIII.3 who have not been selected as subjects. This activity is designed to make students feel the teacher's presence while attending the lesson.

The data collection technique was performed by validating learning equipment and distributing answer questionnaires to students. The data analysis technique used is the analysis of the validity of the validation sheet to determine the validity of the learning devices. The analysis of the usability of the questionnaire for student responses to determine the usability of the learning devices. Learning devices are valid if the validation rate is higher than 70% and can be used if the readability rate is higher than 70% and the minimum level reached is practical [13].

3. Results and Discussion
The products resulting from this research are math teaching resources in the form of syllabus, lesson plans, student worksheet and learning videos. Learning devices developed using discovery learning
models with the context of Riau culture on the topic of Polyhedron. This research was conducted to see whether the learning devices developed meet valid and practical criteria to improve students' MPSA. The development model that used refers to the Borg and Gall model which includes: (1) research and data collection; (2) planning; (3) development of initial product designs; (4) first field trials; (5) review of trial results; and (6) dissemination.

In the research and data collection phase, the activities performed were interviews with teachers and students, observational and documentation study, materials analysis, literature review and MPSA test. In the planning phase, the researcher created a syllabus, a lesson plan and the design of a student worksheet. Furthermore, the learning devices are ranked based on designs created and validated by experts.

The results of the validation of the syllabus, LP and WS by three validators are presented in the form of diagrams in Figure 2, Figure 3 and Figure 4 below, respectively.

![Figure 2. Results of syllabus validation](image)

The results of the validation of the syllabus in Figure 2 show that the syllabus has very valid criteria with an average of 3.7. Improvements have been made to the use of Operational Verbs (OV) when formulating Competence Performance Indicators (GPA) that are not in line with basic competences (BC).

![Figure 3. Results of lesson plan validation](image)

The results of the LP validation in Figure 3 show that the total lesson plan is declared very valid with an average of 3.54. Based on the validator's suggestion, improvements were made to the GPA with OV that did not match BC, eliminating the formulation of learning goals that did not match BC,
adding facts to the description of learning materials, adding images to learning activities.

Figure 4. Result of student worksheet validation

The results of the SW validation in Figure 4 show that the overall SW is declared very valid with an average of 3.51. Based on the validator's suggestion, improvements were made to the discovery learning phase that cannot be repeated in one meeting, clarity of instructions in the data collection phase, and problem-solving columns created in the data processing phase.

Based on the results of the validation, the learning devices used the discovery learning model with Riau's cultural context to improve the MPSA of Class VIII SMP / MT students who met the valid criteria. If the learning device meets the valid criteria, the learning device can be used in the learning process [14].

The valid criteria of learning devices were tested on 8 students of class VIII.3 SMP Negeri 1 Kampa who were divided into two groups with heterogeneous capacities. The use of discovery learning models with Riau's cultural context in SW makes students interested in following the learning process. After seeing the pictures of typical Riau food presented with each SW, the students began to discuss with their group of friends the form of food and whether they had ever eaten the food.

In SW-1 about the area of cube and cuboid, stimulation related to the Riau culture is presented, namely pieces of wajik-shaped cube and cuboid inserted into the box shape cube and cuboid with the dimensions shown in Figure 5. The students discuss the shape of wajik pieces, there are students who encountered a cut out shape similar to the picture shown and there are also students who encountered different cut out shapes. This makes students curious about the relationship between these wajik pieces with cube and cuboid material. Students stated that the shape of the pieces in the form of cube and cuboid would make it easier to arrange wajik if they were put in boxes that were also cube and cuboid.

Figure 5. Wajik pieces and box shape cube and cuboid
On SW-2 on the volume of cube and cuboid, stimulation was presented about the typical Riau food, namely batang buruk cake where the dough is placed into container with cube and cuboid as shown in Figure 6. The students discuss with their group about batang buruk cake which they often eat when Eid day. There were some students who made the cake with their families and some did not. One of the students asked the researcher about the cookie dough tray if it should be cube and cuboid because he used a round bowl at home. The researcher explains the containers currently used in relation to the volume of cube and cuboid, while other containers can also be used for home use.

![Figure 6. Batang buruk cake and dough container in cube and cuboid](image)

On SW-3 about the prism area, stimulation was given about Riau's typical food, namely rasidah cake and bolu kemojo cake that are placed in a prism-shaped box, as shown in Figure 7. All students have eaten bolu kemojo cake, but students have never eaten or looked rasidah cake. This is the material for the discussion, they asked the researcher if this rasidah cake is the same as pizza because the pieces are almost the same. The researcher explains that rasidah cake is one of Riau's typical food and not pizza. Next, students discuss the unique shape of the box to wrap the cake. The shape is almost like a slice of cake that they think will make it easier to arrange the cake in the box.

![Figure 7. Bolu kemojo cake, rasidah cake and cake box prism-shaped](image)

On SW-4 about the volume of prisms, stimulation of Riau's typical food is presented, namely rasidah cake whose dough is put in a unique container in hexagon prism-shape, as shown in Figure 8. The unique shape of the container is a discussion material for students. Students said that the shape of the container is related to the subject matter, the same as the previous meeting.

![Figure 8. Rasidah cake, rasidah cake dough, and hexagon pyramid-shape container](image)
On SW-5, about the area of pyramid, stimulation of Riau's typical food is presented, namely *lepat bugi* wrapped in banana leaves, as shown in Figure 9. Students were very interested in *lepat bugi* because they often see it every day. *Lepat bugi* in the shape of a pyramid amazes students because they only realized it at this meeting, while previously they often ate lepat bugi.

![Figure 9. Cuick (lepat bugi) pyramid-shape](image)

On SW-6 about the volume of pyramids, stimulation of Riau's typical food was presented, namely the production of *lepat bugi* where the dough would be put into the provided banana leaves, as shown in Figure 10. Students discuss with their group how to get *lepat bugi* after they put it in banana leaves, the bugi are quickly steamed. As with the previous meeting, students were interested in the cultural issues raised in Riau.

![Figure 10. The dough of quick (lepat bugi) and quick (lepat bugi)](image)

The students’ interest in the Riau culture presented in the stimulation phase ensured that students understood the problem well and were able to make careful resolution plans in the problem definition phase. This is in line with the results of research [15], namely, when students are faced with contextual problems that exist in their environment, students will more easily understand and organize their knowledge based on their personal experiences. Thus, giving problems related to Riau culture can develop MPSA students. In addition, [16] stated in his research that incorporating culture into the learning process fosters awareness and motivates students to recognize the surrounding culture related to mathematics.

In the verification phase, students checked the answers they obtained using a formula with an estimated answer in the problem statement. Through verification, it can develop students’ MPSA on indicator of recheck. In the generalization phase, students have drawn conclusions in their own language about the area and volume of polyhedron.

During the trial process, there are several things that confuse students. Among them are the location of the area of the cardboard in the stimulation in SW-1 that is not appropriate, as well as the shape of abstract images that students do not understand in the SW-2 questions. This is used as a material for revision to improve SW.
In addition, students are given an answer questionnaire to see the usefulness of using SW. The results of the analysis of the student response questionnaire averaged 88.57. Based on these results, it can be concluded that the learning devices developed have a very practical practical level. If the learning device meets the minimum practical criteria, the learning device can be used in learning [17].

Based on the interviews after the trial, students indicated that the learning steps in the SW helped them find concepts. Concepts and principles usually given immediately without the discovery process make it easy for students to forget and not be able to do the exercises if the problem is slightly different from the sample problem. After getting used to the process of discovery and getting a problem about the area of an incomplete shape, students can solve it because they already understand the concept. The learning devices used can thus improve students' MPSA. This is in line with the results of research [18], namely the collaboration of teachers, students and appropriate learning discovery models can create conducive learning and improve students' MPSA.

The next development stages that researchers were unable to do due to the Covid-19 pandemic were field testing of the lead product, product revisions, field trials, and final product revisions. All schools in Kampar Regency were closed until the end of the even semester 2019/2020, which meant that researchers were unable to conduct large-scale trials. Students learn online. In addition, a learning video has been designed that aims to make students feel the teacher's presence in the learning they are participating in online. The videos taken for the six meetings are as follows.
The next phase, namely field testing of the lead product, product revision, field testing and final product revision, could not be carried out by researchers due to the Covid-19 pandemic. All schools in Kampar Regency were closed until the end of the even semester 2019/2020, which meant that researchers were unable to conduct large-scale trials.

For the dissemination and implementation phases, the learning devices developed will be on a limited scale seminars during a research seminar in the Master of Mathematics Education program attended by supervisors, respondent teachers and seminar participants.1

4. Conclusion
The development research conducted has yielded products in the form of learning devices (syllabus, lesson plans, and SW) utilizing the discovery learning model with Riau's cultural context to enhance the MPSA of Class VIII SMP/MTs students. Learning devices are validated through the validation process and are declared very practical through limited trial tests. Learning videos are tools to accompany SW that are much needed in online learning. Unfortunately for this study validation and trial test could not have been done yet.

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