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Research article

Minimum Competency Assessment Design to Improve Mathematical Literacy in Junior High Schools

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Abstract.

Mathematical literacy ability is important in the process of learning mathematics at schools. Efforts to improve mathematical literacy skills mostly involve providing materials and integrating learning with an ethnomathematical approach and higher-order thinking skills (HOTs) related to real life. The minimum competency assessment (AKM) is one of the ways to photograph students' numeracy skills so that students can face and understand the flow of information. This study aims to design AKM tools for junior high school students in the city of Semarang, with a focus on mathematics. The study included the administrators of the association of mathematics teachers and all junior high school mathematics teachers in the city of Semarang. A large-scale focus-group discussion was created. The results show that the AKM design has a positive influence on teachers. Since teachers receive contextual information more quickly, the form of AKM questions becomes up to date. Students, on the other hand, are happy as the questions are presented in the form of stories. Thus, students' mathematics learning ability increases, this is indicated by students being able to understand information from AKM questions.

Keywords: mathematical literacy, minimum competency assessment, HOTs

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1. Introduction

Assessment of learning outcomes is very important in Education. Assessment of mathematics learning is a systematic and planned process that aims to determine the extent to which the objectives of learning mathematics have been achieved [1]. Assessment of student learning outcomes provides information to teachers about the strengths and weaknesses of the learning process. These results also provide information about the level of learning that students need to achieve the targeted educational goals. Furthermore, the relationships identified between learning-related strengths and weaknesses provide information about students' achievement levels [2]. For assessments to be of high quality and relevant, and to inform real improvements to the overall education system and outcomes, assessments must be fully and functionally aligned

with the system's curriculum, teacher training and support, texts and materials [3]. While classroom teachers have widely used various forms of assessment to monitor their students' mathematics learning and inform future teaching, more and more external assessments are being used by policymakers around the world to measure a country's students' mathematical knowledge and sometimes to compare that knowledge. for the knowledge of students in other countries [4]. Awareness of the relationship between assessment, teaching, and learning affects the validity of assessment and calls for further development of assessment practice in mathematics education [5].

Effective learning planning, teaching and assessment will improve the quality of literacy and numeracy [6]. So that the quality of teaching and learning outcomes continue to be a reference in the development of educational infrastructure, one of which is how to assess. The development of assessment models has been carried out to investigate the quality according to usability, feasibility, appropriateness and accuracy by involving elements of students, teachers, and stakeholders [7]. The credibility of assessment instruments measuring the achievement of learning outcomes among individuals and institutions remains a major challenge, as does the question of how to strengthen confidence in learning outcomes [8]. One of them is the use of the LKS assessment instrument using the PISA basis to increase the level of achievement of students' mathematical communication skills with realistic learning [9].

The development of information technology can assist in improving learning outcomes and processes. The use of this technology will facilitate and assist the process of monitoring learning outcomes for the stakeholders involved [10,11] and provide a positive response, namely students are more interested in learning [12]. Active participation during the teaching and learning process, both inside and outside the school is formed when a mini project is given to students as well as providing opportunities to interact with other people in a real context while collecting information and giving presentations to the community [13]. The use of information technology has been widely studied to support the implementation of learning in the classroom [14-30]. Researchers have and continue to strive to create media that are used to improve learning outcomes, but they have not created learning media based on Android online media that can help improve reading literacy skills, information texts and mathematical literacy.

Based on the results of the assessment using the PISA test in the eyes of the international community and environment, Indonesia is considered to have not been successful in providing education with international standards [31]. The student location variable causes local variations in students' school grades as an index of learning achievement and becomes apparent when compared to national reference points, such

as their reading literacy performance [32]. Although PISA is not the only tool to monitor student learning outcomes, it is an important reference in developing student learning outcomes (NEPS and PISA show a high degree of overlap in terms of constructs [33]. Because PISA is not an assessment of students' knowledge and skills for life, but only 'knowledge and skills in assessment situations'. However, even this latter form of assessment is not completely reliable, due to problems at the concrete item level of relative and absolute evaluation [34].

The Minimum Completeness Assessment includes the reading and numeracy literacy assessment in the AKM which can be viewed from 3 components (aspects), namely: content, cognitive processes, and context. Table 1. describes the details of the components of the AKM literacy reading and numeracy [35].

Table 1: Scope of AKM Literacy.

	Reading Literacy	Numerical Literacy
Content	Information Text	Algebra, Numbers, Geometry, Data Measurement and Probabilistic
Cognitive Process	Finding Interpretation and Integration, Evaluation and Reflection of Information	Understanding, application and reasoning
Context	Social and Scientific	Social and Scientific

Based on the background of the discussion above, it is necessary to develop research to develop learning assessment tools. The instrument developed is the Minimum Competency Assessment (AKM) for mathematics lessons at the junior high school level in the city of Semarang. Furthermore, it was developed into an online media-based AKM. This research is very important to do because it will be able to measure students' competence fundamentally and thoroughly from various types of literacy (reading, mathematical, and data). Thus students can connect one subject with other subjects. With online media-based AKM students will be facilitated in learning and practising solving mathematical problems related to daily and contextual activities.

2. Method

This research was development research. This research development theory refers to ADDIE (Analyze, Design, Development, Implementation, and Evaluation). This article discusses the development of the AKM instrument to the Development stage. Partners in this study are mathematics teachers in the city of Semarang. They are part of the Mathematics Teacher's Meeting (MGMP) in Semarang. The analysis and design process

involves partners. The form of this activity is to discuss mathematics learning and the assessment instruments used. The results of the analysis of the assessment of mathematics learning are used to design an offline Android-based AKM. This design includes covering mathematics material as assessment material, assessment stages and assessment schemes. The results of the design are then developed into a display in Android as AKM media. All of the above activities involved mathematics teachers in the city of Semarang.

3. Result and Discussion

Based on the scope of the mathematics AKM (Table 1), the design of this study ensures that it measures the competence of reading literacy and mathematical literacy. The AKM questions in this study measure content, context at several levels of cognitive processes and the use of information technology [35]. Content in Reading Literacy shows the type of text used, in this case, it is divided into two groups, namely informational text and fictional text. Meanwhile, content numeration is divided into four groups, namely Numbers, Geometry, Data Measurement and Uncertainty, and Algebra.

The cognitive level shows the thinking processes that are required or needed to be able to solve problems or questions. Cognitive processes in reading and numeracy literacy are divided into three levels. In Reading Literacy, the levels are finding information, interpretation and integration as well as evaluation and reflection. In Numeration, the three levels are understanding, application, and reasoning. The context indicates the aspect of life or situation for the content used. The context in AKM is divided into three, namely personal, socio-cultural, and scientific. Online Media (Android)-based assessment with interesting features and a variety of questions according to the competencies measured.

The design of this study uses several tourism destinations in the city of Semarang. Mathematics questions use a contextual approach so that students who work on the questions can understand the cultural indicators of the city of Semarang. The city points used are the “Tugu Muda” monument, the “Masjid Agung” mosque, the “Simpang Lima” city centre, and the “Pasar Johar” market (Figure 1).

In the design of the AKM in this study, students worked on Numbers, Measurement and Geometry, Data and Uncertainty, and Algebra questions. The four contents are directed into the form of contextual questions. Numbers are directed to market “Pasar Johar”. Geometry is directed to the mosque ”Masjid Agung”. Measurement of data and

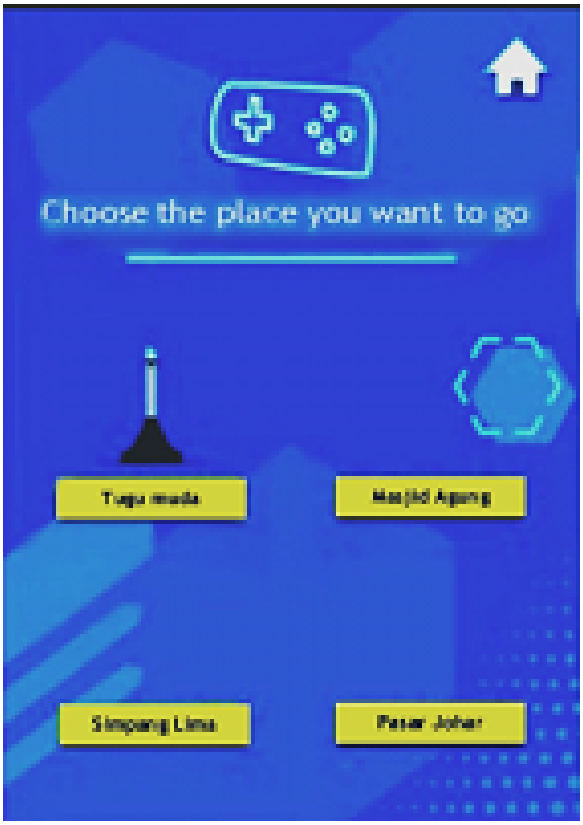

Figure 1: Student AKM Choices.

uncertainty is directed to the monument ”Tugu Muda”. And finally, Algebra is directed to the city centre ”Simpang Lima”.

The stages of students working on the questions are made in three stages. The types of questions given are multiple-choice questions, complex multiple-choice questions, matching questions, true-false questions, and short description questions. While the categories of questions given are easy 8^{th}-grade math questions, difficult 8th-grade math questions, difficult 7^{th}-grade math questions, and easy 7^{th}-grade math questions. In the first stage, students work on 8^{th}-grade questions, the easy category.

Student achievements at the end of the third stage are categorized into four categories, namely expert, competence, basic, and need special intervention. If students can work on this problem, then students enter the second stage. In this second stage, students work on 8^{th}-grade math problems, in the difficult category. Furthermore, if the student succeeds in answering the question correctly at this stage, then the student enters the third stage, namely the question of matchmaking for 8^{th} grade, the difficult category. When students can correctly answer the questions of this third stage, then students are considered an expert. Alternative student results for each stage up to the third stage are presented in Figure 2.

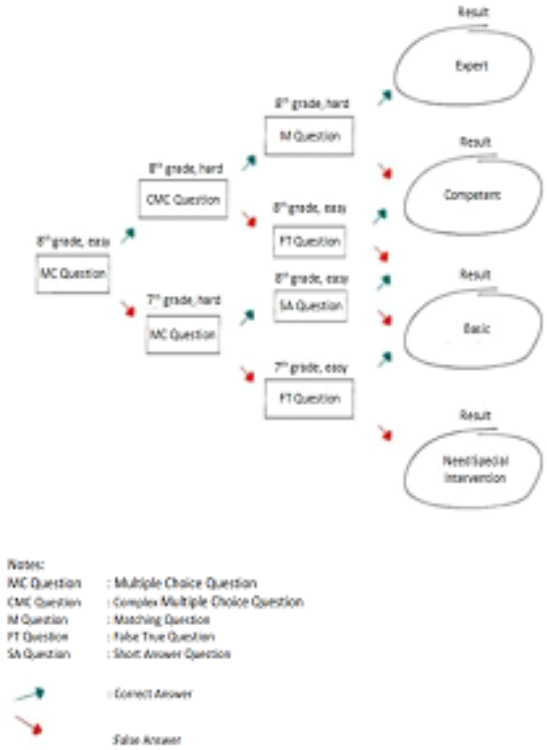

Figure 2: Content Scheme of AKM Literacy Mathematics.

Based on Figure 1, if students choose ”Simpang Lima” then students will get Algebra questions in the AKM. The route to be taken and the questions encountered by the students are presented in Figure 3 and Figure 4. Figure 3 shows the route for students to depart from the city centre “Simpang Lima”. Next, students stop at the radio station ”RRI” and work on the available questions, and so on until students complete the third stage.

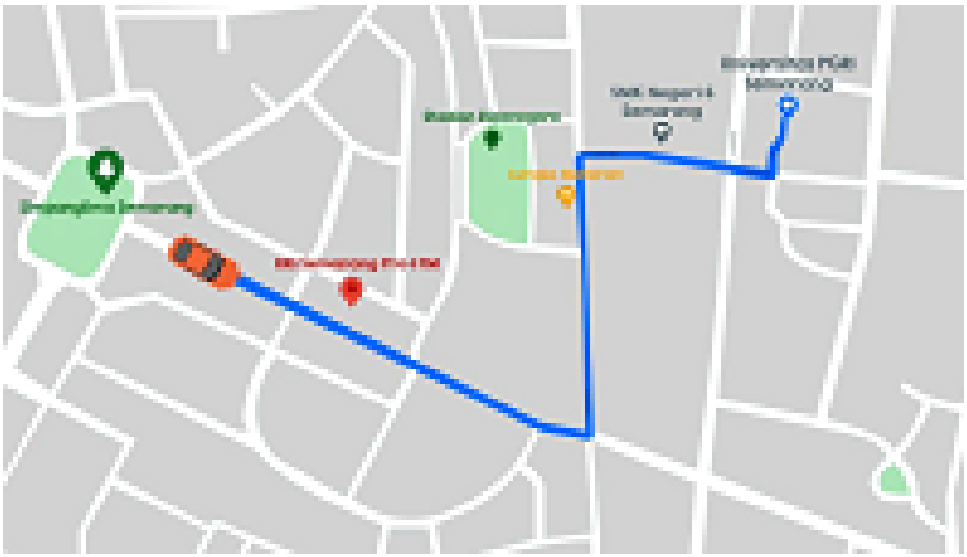

Figure 3: Student Path “Simpang Lima”.

The stopping points for students in this game, such as radio stations RRI, Lumpia, SMK 6, and UPGRIS, are the centre of destinations (tourism, culinary, education) in the city of Semarang (Figure 4). At each stopping point, students work out questions related to that place.

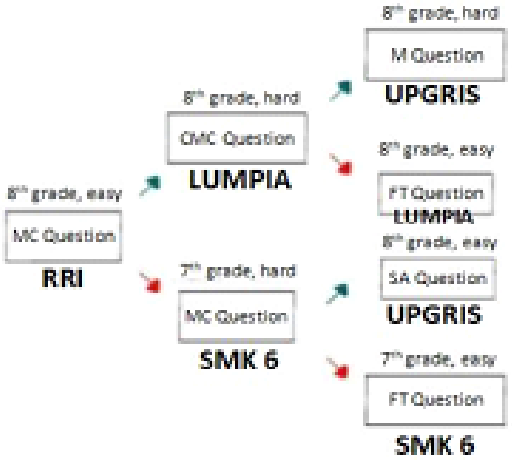

Figure 4: Content Schematic for the “Simpang Lima”.

The math problems in Figure 4 are presented in the form of word problems and contextual questions. When students follow the route as shown in Figure 3 and Figure 4, students will find a place such as in Figure 5. In Figure 5, students will get to know Semarang’s ”Lumpia” culinary (social) and mathematical ability questions. When students choose another game route, different stopping points are found. With the same type and level of difficulty of math problems (content and cognitive processes) for each stage, but the place for reading literacy is different (context).

Figure 5: Culinary Center “Lumpia Kampung Baris” Semarang (Source : https://foursquare.com/v/lumpia-mataram-kp-baris-501).

The form of AKM display when students answer matching questions (students choose the “Masjid Agung” mosque) is presented in Figure 6. In this case, students work on questions related to geometry material.

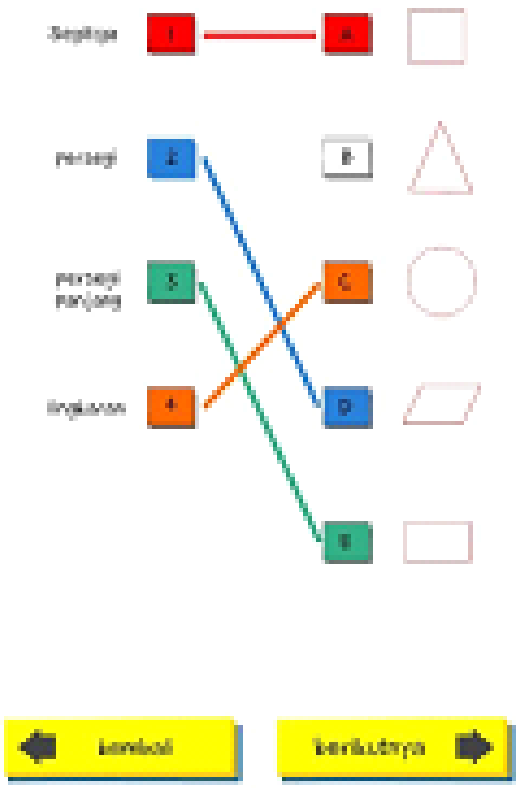

Figure 6: Matching question.

This AKM design gives students attractiveness in learning because, in addition to learning mathematics understanding, students are also introduced to indicators of tourist areas in the city of Semarang. So that social knowledge literacy is achieved in this study because the questions presented are tailored to the needs of each level of education. Students have a lot of information from the questions given, both general knowledge and specifically about mathematics. Information and questions are always new and updated every time, because of the development of a culture that is always evolving (tourist destinations, culinary centres, education). Thus, teachers can develop effectively and quality learning strategies [36]. However, because this AKM is a new thing, it must be socialized to students and teachers [37-38]. Through Android media both offline and online, learning can be done anywhere. While the teacher can see the results of students according to their final competence quickly.

4. Conclusion

The results showed that the AKM using offline and online Android media was very helpful for students and teachers. With tourist destination student games, students are challenged to be able to complete the game. Students should not be afraid of not being able to finish the game, because all games will come to the end of the game. The end of each game can be different for each student according to the results of answering AKM questions they encounter. The final result of the end of the game can only be known by the teacher and can be used as material for evaluation or discussion with students. The weakness of this research is that the questions have not reached the questions with long description answers. So it still needs to be developed for further research.

Authors' Contributions

All authors in this article were directly involved in research, data collection and writing activities.

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