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## Implementation of Authentic Assessment on Mathematics Teaching: Study on Junior High School Teachers

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**Abstract:** This study aimed at analyzing the implementation of authentic assessments and constraints faced by junior high schools' teachers in mathematics teaching. A qualitative approach was applied in the study. The data on the implementation of authentic assessments and constraints were obtained from 50 mathematics teachers in several public junior high schools in Malang City, East Java Province-Indonesia, trained by the 2013 curriculum. Documentation, questionnaires, observations, and interviews were used to collect the data. The study results showed that most teachers implemented authentic assessments in mathematics teaching as designed in the learning plan. The obstacles faced by the teachers in the implementation of the authentic assessment included the time limit and accuracy. The efforts made by the teachers varied, but the teachers tried to administer the authentic assessment properly following the demands of the curriculum.

**Keywords:** *Authentic assessment, junior high school, mathematics teaching, mathematics teachers.*

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### Introduction

Education contains three critical aspects. First, the curriculum as the elaboration of educational goals forms the teaching and learning program's basis. Second, teachers conduct the teaching and learning process to achieve the objectives formulated in the curriculum and assessment. Third, assessing the curriculum level's achievement and the success or failure of the teaching and learning process (Merta et al., 2015). Learning in schools requires an assessment to determine the curriculum implementation (Ferita & Retnawati, 2016; Ried, 2011).

Assessment plays a vital role in education because it is used to identify what teachers must do to improve and develop students' abilities (Darling-Hammond et al., 2020; Puspitasari, 2016). Also, assessment is one of the five important classroom learning components (Mundia, 2020). Teachers and their activities are the most crucial variables in the learning scheme (Ahmad, 2020). One such activity is conducting authentic assessments. The assessment is performed during the learning process to help students learn (Barrio et al., 2015) and allow teachers to review the teaching and learning process (Azim & Khan, 2012; Kulasegaram & Rangachari, 2018).

Assessment of the learning outcomes serves to monitor learning progress and learning outcomes, as well as detect the need for continuous improvement in student learning outcomes (Kemdikbud, 2014). In general, the assessment of the learning outcomes aims to determine the level of competency mastery, establish the improvement programs based on the level of the competency mastery, and improve the learning process (Hakim, 2015; Safitri et al., 2019; Scheopner Torres et al., 2018). Assessment is an integral part of learning (Edwards, 2013; Kesianye, 2015). Teachers make judgments about the level of students' skills or knowledge, measure the improvement over time, evaluate students' strengths and weaknesses, determine their ranks for selection or exclusion, or motivate them. Furthermore, assessment can help teachers get useful feedback on what, how much, and how well their students learn (Buyukkarci, 2014). The assessment quality is a critical component in learning as it facilitates the students' understanding of learning (Edwards, 2013; Prozesky, 2000).

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The assessment has two main priorities. First, as the primary purpose of education, namely learning how to learn from experience so that the next learning plan becomes meaningful; second, it accommodates students' diversity, especially in terms of learning style to help teachers in planning the improvement of the learning process (Okoye, 2014). According to Bloom, learning outcomes consist of three domains, namely cognitive, affective, and psychomotor (Gulikers, 2004; Irvine, 2017; Kasilingam et al., 2014; Retno et al., 2019; Jacoba van der Wal & van der Wal, 2003; Zulfadli, 2017). In the learning practice, most teachers do not carry out a comprehensive evaluation. The teachers emphasize the assessment of knowledge and skills rather than attitudes. Besides, the learning process assessment is provided with less attention compared with the two other assessment components. Therefore, it is necessary to choose the right assessment techniques from various assessment techniques (Sukanti, 2010; Yerrabati, 2017). Authenticity is an essential element of new modes of assessment.

The new approach of evaluation is authentic assessment (Hodgman, 2014). An authentic assessment includes various techniques such as written products, portfolios, checklists, observations, and projects (Amsami et al., 2015; Natalia et al., 2018; Sasmaz-Oren & Ormanci, 2011). The authentic assessment takes place in the context of authentic activities with complex challenges, and is centered on active learners who produce products, and is linked to several learning indicators. It includes developing tests and projects (Martin et al., 2016; Olfos & Zulantay, 2007). A similar idea was expressed by Gulikers et al. (2004) that authentic assessment requires students to use the same competence, or combinations of knowledge, skills, and attitudes, that they need to apply in any situation in their professional life.

Some studies show that teachers often see the process of teaching, learning, and assessment as separate tasks (Azim & Khan, 2012). It is further explained that they recognize the curriculum being taught, studied, and then assessed. However, authentic judgments consider teaching, learning, and assessment as ongoing, intertwined, and simultaneous. Also, they strongly influence each other. Therefore, to improve student achievement, it is necessary to develop a classroom assessment that provides high-quality information about student learning. Therefore, we need to consider the assessment process as an integral part of learning.

The important things to consider in designing an assessment include how the assessment is directed to measure competency achievement using reference criteria (Merta et al., 2015). These criteria indicate what students can do after participating in the learning process and do not determine a person's position so that the assessment system is conducted continuously. In the 2013 curriculum, assessment standards use authentic assessments, where the assessment system must be adjusted to students' learning experiences (Kemdikbud, 2014).

Efforts have been made to provide teachers with the 2013 curriculum in Indonesia (Hermayawati, 2020; Toto, 2019). Likewise, the application of authentic assessment in learning has been trained (Candra et al., 2019; Rukmini & Saputri, 2017). In this connection, the 2013 Curriculum requires the application of authentic assessment in learning to achieve the objectives of learning mathematics. However, in practice, the implementation of the authentic assessment by teachers in schools is still diverse. Some work well; some others have problems. Several studies on the authentic assessment have been carried out. For example, in Gao and Grisham-Brown (2011), teacher perceptions suggest advantages and disadvantages in using the authentic assessment such as the Assessment, Evaluation, and Programming System (AEPS) model; besides, practical problems in the authentic assessment can be overcome by providing training to teachers. The study of Sabri et al. (2019) shows several teachers' constraints to apply the authentic assessment in mathematics learning. The constraints include the lack of learning books following authentic assessment, the complicated stages of the authentic assessment, the longer time needed to conduct the authentic assessment as many aspects must be assessed, and the lack of teachers' knowledge on the authentic assessment.

Several studies on applying authentic assessments related to students' mathematical competencies have also been carried out (Reyes-Cedeno et al., 2019; Suciati et al., 2018). A study by Fauziah et al. (2018) shows that the application of authentic assessment can improve students' mathematics learning outcomes. Likewise, Mirian and Zulnaidi (2020) state that mathematics teachers' conceptions of assessment are moderate. The higher the teacher's qualifications, the better the application of assessment in learning. According to Winarso (2018), there is a positive influence on the application of the authentic assessment to students' mathematical competencies in terms of attitudes, knowledge, and skills. In addition, Sambeka et al. (2017) reveal that the implementation of the authentic assessment in problem-solving learning can improve students' concept mastery, although the scores obtained are still of sufficient category.

Studies on the application of authentic problem-solving have also been carried out. Fitriani (2017) shows that the teachers have obstacles in applying the authentic assessment due to the burden of excessive assessment, managing valid assessments, monitoring academic dishonesty, and maintaining the assessment's quality and consistency. In contrast, Rizavega (2018) reveals that two English teachers are quite capable of planning, designing, and implementing the authentic assessment. The constraints they face cover the time management in applying the authentic assessment.

According to the studies mentioned earlier, the evaluation of authentic assessment application is important, especially in learning mathematics in junior high school. Additionally, the study on evaluating the application of the authentic assessments in mathematics learning is relatively lacking, especially in planning, experience, and implementation. This study emphasizes the analysis of the implementation of the authentic assessment in learning mathematics in planning,

teacher's experience and implementation, the obstacles teachers face in implementing them, and the efforts made to overcome these obstacles.

## Methodology

### *Research Goal*

This research aimed to analyze the implementation of teachers' authentic assessments and constraints in mathematics learning at junior high schools. This study's results have implications and contributions for developing teacher competencies in applying the authentic assessments, especially in aspects that are considered less mastered by teachers.

### *Type of Research*

This research was a qualitative study with descriptive data from the results of documents, questionnaires, observations, and interviews.

### *Sample and Data Collection*

The subjects were fifty public junior high school mathematics teachers in Malang City, East Java Province-Indonesia in 2018 who were chosen randomly. The teachers from public schools have been trained and implemented the 2013 curriculum (it was why the study was conducted in public schools). According to preliminary observations conducted by the Education Office of Malang City, teachers in public schools have attended the 2013 curriculum training, including the authentic assessment. Meanwhile, some teachers of private schools who have not participated in the 2013 curriculum training.

Data collection was carried out through documentation, questionnaire, observation, and interview. In the documentation and questionnaire methods, the data were collected from fifty teachers; meanwhile, the data was only taken randomly from twenty out of fifty teachers for the observation method. It was due to the assumption that twenty teachers represented fifty teachers. The rationale used was that only twenty teachers gave permission / agreed to be observed along with the considerations of time efficiency, funds, and human resources availability. The documentation method was used to collect documents of learning plans, planning authentic assessment models, and the steps for developing the authentic assessment prepared by fifty teachers. The questionnaire was used to collect data regarding the teachers' perception of implementing the authentic assessment based on mathematics teaching experience. The questionnaire consisted of four statements, namely (1) "Appropriate assessment is the assessment of processes and outcomes carried out simultaneously," (2) "I have applied attitude competency assessment in learning," (3) "I have used knowledge competency assessment in learning," and (4) "I have applied skill competency assessment in learning."

The questionnaire in this study fulfilled the validity and reliability aspects. The questionnaire was validated by experts, who were two mathematics education lecturers with more than 20 years of teaching experience. The data from the two experts were analyzed with SPSS version 17 for windows, where the results showed that the score averages were 3.75 with very good categorized. This result indicated that the questionnaire was declared valid and could be used without revision. Based on the Cronbach's Alpha value, the questionnaire's reliability score was 0.714. This score showed that the questionnaire was reliable, and it could be used in this study.

Moreover, the authentic assessment models and the steps to develop the assessment were also collected. The observation method was used to determine the application of the authentic assessment in the learning activities. Observations were conducted on twenty teachers, one meeting, with a duration of two to three hours (according to the teacher's learning schedule).

Interviews were conducted to collect the data on the authentic assessment models used, the obstacles in applying the authentic assessments, and their efforts to overcome them. In-depth interviews were conducted with each teacher employing recordings and notes (important points). The recordings' results were then transcribed for interpretation or analysis of the teacher's statement's content.

### *Analyzing of Data*

The content analysis method referring to Miles and Huberman (1994) was used for the data analysis. There are three activities carried out: data reduction, data presentation, and drawing conclusions and data verification. At the data reduction stage, a process of selecting appropriate data, simplifying data, abstracting, and transforming the raw data that emerge from records in the field was carried out. Data reduction took place continuously during the research activities. Data presentations were made to ensure that the data were valid and accurate, presented in the form of tables and interview excerpts containing essential information. Data presentations were made to combine information into an integrated and easily understandable manner. Meanwhile, concluding and data verification was carried out by reviewing the data analysis results, whether they were supported by valid evidence or not until the conclusions were drawn. In short, the meanings emerging from the data were tested for correctness, robustness, and suitability.

## Findings

The authentic assessment implementation analysis results on mathematics teaching in junior high schools were clustered into four groups, namely the results of the analysis of the document, questionnaire, observation, and interview data.

### Implementation of Authentic Assessment

The study results applying the teachers' authentic assessment based on the analysis of the learning plan document, questionnaire, and observation are presented in Table 1, Table 2, and Table 3.

Table 1. Analysis of the application of the authentic assessment based on the learning plan documents

Statement	Yes	%	No	%
The teacher plans the authentic assessment in mathematics learning	38	76	12	24

Based on Table 1, 76% of the teachers have prepared a lesson plan using authentic assessment. The results of the interviews with the teachers show that the authentic assessment in the learning plan is general, incomplete, and not accompanied by a complete assessment rubric. The general aspects are mainly in the attitude assessment, as the teacher's statement follows:

*"In developing the authentic assessment in learning plans, all components are included, but only general as a guide for teachers in implementing learning, especially in planning attitude assessments. Also, the assessment of knowledge and skills is only equipped with an answer key without any complete rubric".* (Respondent-1/11/2018).

Table 2. Analysis of the application of the authentic assessment based on the questionnaire

Items of statement	Yes	%	No	%
Appropriate assessment is the assessment of processes and outcomes carried out simultaneously	46	92	4	8
I have applied attitude competency assessment in learning	39	78	11	22
I have used knowledge competency assessment in learning	50	100	0	0
I have applied skill competency assessment in learning	47	94	3	6

Table 2 shows that 92% of the teachers have assessed simultaneously covering process assessments and outcome assessments, 78% of the teachers have implemented the authentic assessment in attitude competencies, 100% of the teachers applied the authentic assessment in knowledge competencies and 94% of the teachers the applied authentic assessment in skill competencies. The 2013 curriculum amended in 2016 emphasized that changes in student attitudes depend on the impact of learning in the classroom. Therefore, students do not need to be assessed continuously, although the attitudes can be observed in accordance with the knowledge and skill competency measurement.

Table 3. Analysis of the implementation of the authentic assessment based on observation

Statement	Yes	%	No	%
The teacher applies authentic assessments throughout the learning process	13	65	7	35

Table 3 shows that there were thirty teachers (65%) applying the authentic assessment. Based on the results of the interviews with teachers who do not carry out the authentic assessment (35%), it is found that they do not assess students' attitudes as they place more emphasis on assessing knowledge and skills. Attitude assessment is only seen from the activeness of students. Assessment of knowledge and skills is carried out by referring to the predetermined learning indicators. However, teachers admit that they have not distinguished between implementing knowledge and skills assessments in their teaching practice.

As the teacher's statement follows:

*"The three aspects of the authentic assessment are carried out in learning, but primarily in the attitude assessment, it is not the focus, except students' active participation in learning, both positive and negative attitudes. Two other aspects are the knowledge and skills assessments, but we still cannot distinguish between the knowledge and skills assessments in the learning practices".* (Respondent 2/12/2018).

*The Authentic Assessment Model*

The following are the results of applying the authentic assessment model in mathematics learning in junior high schools. The research results on the authentic assessment model based on the learning plan documents' analysis are presented in Table 4.

*Table 4. The authentic assessment model used by the teachers based on the lesson plan documents*

<b>Type of assessment</b>	<b>Yes</b>	<b>%</b>	<b>No</b>	<b>%</b>
Self and peer assessment	39	78	11	22
Observation	43	86	7	14
Paper and pencil test	50	100	0	0
Performance assessment	42	84	8	16
Portfolio assessment	35	70	15	30
Project assessment	40	80	10	20
Combination Assessment	31	62	19	38

Based on Table 4, the teachers' authentic assessment models to assess attitude competencies, including self-assessment and peer assessment, are 78%, while the assessment through observation is 86%. In the knowledge competency assessment, the teachers use a written assessment (paper and pencil assessment) model. As for the competency skill assessment, teachers apply many models, comprising 84% of performance appraisal, 70% of portfolio appraisal, and 80% of project appraisal. 62% of the teachers use a combination of several models. From the learning plan document analysis, most teachers prepare various authentic assessment models in learning activities.

The interview results show that the choice of various assessment models in the learning plan is based on the 2013 curriculum demands to measure aspects of attitude, knowledge, and skills. However, the assessment often used in learning plans is paper and pencil tests to measure students' knowledge and skills competencies. Attitude assessment places more emphasis on observing student activity during the learning activities.

The results of the teachers' authentic assessment models based on the questionnaire results are presented in Table 5.

*Table 5. The authentic assessment model based on the questionnaire*

<b>Type of assessment</b>	<b>Yes</b>	<b>%</b>	<b>No</b>	<b>%</b>
Self and peer assessment	39	78	11	22
Observation	47	94	3	6
Paper and pencil test	50	100	0	0
Performance assessment	46	92	4	8
Portfolio assessment	41	82	9	18
Project assessment	47	94	3	6
Combination Assessment	40	80	10	20

Table 5 displays that 80% of the teachers apply the authentic assessment with a combination of assessment techniques. 78% of the teachers use self and peer assessment, where the teachers ask the students to assess their work and their peers' results. 94% of the teachers observe the student's activities in learning using observation sheets. All teachers utilize written assessments to determine the students' mastery of the subject matter. Furthermore, 92% of the teachers implement performance assessments. The teachers ask the students to do presentations after completing a specified task. 82% of the teachers applied portfolio assessment models in learning. 94% of the teachers use the project appraisal model learning.

Referring to the questionnaire analysis results, most teachers have used variations of authentic assessment models in mathematics learning. The results of applying the authentic assessment model from the observations on twenty teachers are presented in Table 6.

*Table 6. The number of teachers implementing the authentic assessment in learning based on the observation*

<b>Statement</b>	<b>Yes</b>	<b>%</b>	<b>No</b>	<b>%</b>
The teachers apply the authentic assessment model in the learning process	12	60	8	40

Table 6 presents that twelve teachers (60%) apply the authentic assessment in mathematics learning. It also means 40% of the teachers do not use the authentic assessment model. Table 7 is the observation result of the implementation suitability in the authentic assessment with the blueprint developed in the learning plans.

Table 7. The suitability of the authentic assessment implementation with the blueprint developed in the learning plans

Statement	Yes	%	No	%
The suitability of the authentic assessment implementation with the blueprint developed in the learning plans	10	83.3	2	16.7

As appeared in Table 6, Table 7 presents that in mathematics learning, from twelve teachers who have already implemented the authentic assessment, ten teachers (83.3%) have conducted the authentic assessment according to the blueprint in the learning plans. It shows that only very few authentic assessment implementations are not in accordance with the planned blueprint. Based on the interview results, the assessment and blueprint application mismatch is caused by the students' condition when learning in class.

Based on the interview results, teachers do not apply the assessment model in accordance with the learning plan that has been made due to the learning conditions in the classroom that are different from the plans developed previously—for example, planning to measure knowledge and skills with levels C3 and C4 from Anderson's taxonomy. In fact, students have difficulty understanding the materials, so the questions and assessments used are different.

#### Steps for Developing the Authentic Assessment

The data analysis results on the steps for developing the authentic assessments based on document analysis results are presented in Table 8. The data analysis is based on the blueprint analysis and the order in which the assessment is available in the learning plan.

Table 8. The steps for developing the authentic assessment based on the analysis of the learning plan documents

Steps for developing the authentic assessments	Yes	%	No	%
Determination of basic competencies taken from the curriculum	50	100	0	0
Preparation of learning indicators derived from basic competencies	50	100	0	0
Development of test indicators based on learning indicators	50	100	0	0
Selection of authentic assessment types (attitude, knowledge, and skill)	47	94	3	6
Developing assessment rubrics	46	92	4	8

Table 8 describes that all the teachers write basic competencies and compile learning indicators. Besides, the indicators of the test are in accordance with the competencies. 94% of the teachers choose authentic assessment models following the basic competencies and indicators. 92% of the teachers develop assessment rubrics as a reference in assessing student competency. The analysis results show that 6% of the teachers do not use authentic assessment in learning. They only use written tests to measure students' competencies. In addition, 8% of the teachers do not make any assessment rubric used as a guideline for assessing student competencies. In general, teachers have prepared a blueprint for carrying out the assessment.

The data analysis results on the steps for developing the authentic assessments based on the questionnaire analysis results are presented in Table 9.

Table 9. The steps for developing the authentic assessments based on the questionnaire analysis

The steps for developing the authentic assessments	Yes	%	No	%
Determination of basic competencies taken from the curriculum.	50	100	0	0
Preparation of learning indicators derived from basic competencies.	50	100	0	0
Development of test indicators based on learning indicators.	50	100	0	0
Selection of authentic assessment types (attitude, knowledge, and skill)	48	96	2	4
Developing assessment rubrics	46	92	4	8
Assignments or test items in learning according to real-world conditions	49	98	1	2

Similar to the document analysis results, Table 9 portrays that all teachers write basic competencies and compile learning indicators. Besides, the indicators of the tests are following the competencies. 96% of the teachers choose authentic assessment models that are following the basic competencies and indicators. 92% of the teachers develop assessment rubrics as a reference in assessing student competency. These results are relatively similar to those of the document analysis, revealing that most teachers have taken steps to develop appropriate authentic assessments. 98% of the teachers state that in the authentic assessment, assignments, or test items are developed according to the real-world conditions.

Based on the interview results, the authentic assessment development steps are understood and applied both in developing learning plans and practices. However, teachers still experience difficulties in making assessment rubrics, mainly in non-test assessments, such as performance assessments, products, projects, etc.

*Constraints and Efforts to Implement Authentic Assessment*

Based on Table 10 below, twenty-four teachers experience obstacles in applying authentic assessments. It means that twenty-four other teachers, or as many as 52% of the teachers, claim that they do not face any problem using the authentic assessment. All teachers who face the obstacle try to make an effort to overcome the difficulties. The main obstacles comprise how to assess learning activities and student attitude competencies simultaneously with a large number of students in a single class.

The interview results reveal that teachers have obstacles in managing the assessment. It is due to the fact there are a lot of students and limited time. Besides, some student competencies are still below the minimum standard. It is in line with the results of the questionnaire in Table 11.

The following interview excerpt:

*"We have difficulty in implementing the authentic assessment as well as accuracy in their implementation due to a large number of students in one class, the time constraints (teachers have to teach twenty-four hours per week). Also, some students are below the minimum standard, so they require more help than other students, let alone developing assessment rubrics with different student characters". (Respondent 3/13/2018).*

*Table 10. Constraints and Efforts to Implement Authentic Assessment*

<b>Constraints and Efforts</b>	<b>Yes</b>	<b>&amp;</b>	<b>No</b>	<b>%</b>
Teachers face obstacles in carrying out the authentic assessment when learning mathematics	24	48	26	52
Teacher tries or activity to overcome the barriers in applying the authentic assessment	24	100	0	0

The open questionnaire and interview analysis present the constraints of applying the authentic assessments experienced by twenty-four teachers, as shown in Table 11.

*Table 11. Types of constraints in carrying out the authentic assessments in learning mathematics*

<b>Type of constrain</b>	<b>f</b>	<b>%</b>
Limited time	20	83,33
A large number of students	15	62,50
Material learned by students is too hard	11	45,83
Student test scores are below the minimum standard.	9	37,50
Determining the assessment rubric	6	25,00
The abilities and characteristics of students differ	5	20,83

Table 11 implies that the teachers' biggest obstacle in the application of the authentic assessment is time constraints. Based on the interview results, 83.33% of the teachers admit that there is not enough time to assess all students with various assessment models. 62.5% of the teachers state that a large number of students make it difficult to assess students' overall performances. 45.83% of the teachers also reveal that the material is sometimes difficult for students as the material and sample questions presented in textbooks are difficult to understand. As many as 37.5% of the teachers confess that they have difficulty implementing the authentic assessment for the students who are below the minimum standard. As many as 25% of the teachers find it problematic in developing an assessment rubric because there are too many aspects to be assessed, especially on skills assessment rubric. In addition, 20.83% of the teachers state that students' different abilities and characteristics also make it challenging for them to assess students' overall performance.

Teachers' efforts in overcoming the constraints of applying the authentic assessment are diverse and adjusted to each teacher's conditions. The efforts made by the teachers to overcome the obstacles of applying the authentic assessment in mathematics learning are described as follows: 1) managing the time as well as possible, choosing easy materials for students, simplifying the authentic assessment tools in the classroom; 2) applying the self and peer-assessment models; 3) giving group assignments outside the classroom; 4) doing remedies and implementing peer learning so that competent students help students whose competencies are below the minimum standard; 5) joining training and discussion with other fellow teachers in developing the assessment rubrics, and 6) carrying out learning activities that emphasize individual student differences and administering the assessment according to students' abilities.

## **Discussion**

Based on the document analysis results, 76% of the teachers prepare learning activities with the authentic assessment. The questionnaire analysis results show that an average of 90.67% of the teachers apply the authentic assessment, while based on the observations, 65% of the teachers apply the authentic assessment during the learning activities. As

represented in the findings, Bentri et al. (2016) explain that most teachers use the authentic assessment in the implementation of the 2013 curriculum. It is also in line with Gulikers et al. (2004) and Wiethe-Korprich and Bley (2017). They argue that the authentic assessment's implementation covers three main domains, namely attitude competence, knowledge, and skill; therefore, in designing authentic assignments, the teachers should consider these aspects as the assessment parameters.

Authentic assessment is a form of assessment that asks students to show performance as done in the real world meaningfully; it is the application of students' knowledge and skills (Bentri et al., 2016; Rourke & Coleman, 2011). The authentic assessment, which tends to focus on complex and contextual tasks, has strong relevance to the scientific approach in learning according to the 2013 curriculum. In fact, the 2013 curriculum requires teachers to apply the authentic assessments (Bentri et al., 2016).

Many assessment models can be classified as authentic assessments as long as they are in accordance with the nature of the authentic evaluations (Arifin, 2018; Martin et al., 2016; Rukmini & Saputri, 2017). Authentic assessment models are applied by teachers to measure students' learning (Razmawaty & Othman, 2017). Based on the current study results, teachers' authentic assessment models in mathematics learning include performance evaluation, self and peer-assessment, observation, written assessment, portfolio assessment, project appraisal, and combination assessment.

The results are in line with previous studies. To assess attitude, knowledge, and skill, teachers use several authentic assessment models such as peer assessment for attitude competencies, written tests for knowledge competencies, and projects for assessment of skill competencies as excerpted in the 2013 curriculum (Bentri et al., 2016; Martin et al., 2016). Based on the results of the document analysis, an average of 80% teachers select the authentic assessment models. The authentic assessment model frequently used is the written test (all teachers use it)—meanwhile, 62% of the teachers apply the combination model, in which they combine several assessment models. Mathematics teachers not only apply one model when conducting an assessment but also complement one assessment model with another. According to Okoye (2014) and Rosli et al. (2013), it is used to obtain accurate and objective results.

Suurtamm's (2004) study on five secondary school mathematics teachers in Ontario Canada, shows that teachers choose to use authentic assessment techniques as they are innovative teachers. When they apply new learning strategies, the teachers admit that the use of paper-and-pencil tests is no longer comprehensive to measure students' activities and abilities. Therefore, they prefer to develop and implement other authentic assessment instruments, such as portfolios, performance assignments, journals, and group projects. In Malta, as reported by Buhagiar and Murphy (2008), the quality of learning carried out by teachers can be improved with classroom assessment strategies that are more effective in informing future teaching and learning activities.

Based on the results of the document, questionnaire, and observation analysis, the steps taken by the teachers in applying the authentic assessment at Junior High Schools in Malang City contain: (1) determining competency standards, (2) determining learning indicators, (3) determining test indicators, (4) ) determining the authentic assessment model, and (5) making the assessment rubrics. These results are in line with Bentri et al. (2016) and Susilo and Wardarita (2017), who posit that several steps that teachers need to pay attention to in applying the authentic assessment are determining competency standards, setting indicators, choosing task models, and making assessment rubrics. Ferita and Retnawati (2016) assert that the authentic assessment's implementation includes the stages of planning, implementation, and analysis.

With the application of the authentic assessment, teachers may face obstacles. Constraints in applying the authentic assessment will make the use of the authentic assessment less optimal (Bentri et al., 2016). The study results reveal that 48% of the teachers encounter obstacles in the application of the authentic assessment. The obstacles are time constraints, limited facilities and infrastructure, big class, challenging material, different student ability and characters, student ability that is under the minimum standards, and development of assessment rubrics. This study's results are in line with Rifka et al. (2017) who states that the inhibiting factors for the implementation of authentic assessment in chemistry are limited time and the large number of students that must be assessed individually. According to Sabri et al. (2019), the authentic assessment is quite complicated as there is still a lack of teacher's knowledge.

If no solution is given, this obstacle will cause the teacher to return to an inauthentic assessment pattern. For example, Dandis (2013) describes that teachers in Granada use written examinations to assess their students. The teachers explain that they use some alternative (authentic) assessments, but sporadically. Teachers show dissatisfaction with the methods they use, and they prefer to use direct observation to assess their students.

### Conclusion

Based on the findings and discussion above, this current research summarizes that most teachers implement the authentic assessment. The authentic assessment model that is often used is a combination of test and non-test evaluation. The teachers have developed the authentic assessment blueprint, with the steps for designing the authentic assessment at junior high school in Malang covering: (1) determining competency standards, (2) setting learning indicators and test indicators, (3) choosing authentic assessment models, (4) making assessment rubrics. The obstacles



faced by the teachers include limited time and accuracy in its implementation. The efforts made by the teachers vary, but the teachers try to administer the authentic assessment well and follow the demands of the curriculum.

### Suggestions

The implementation of the authentic assessment in learning mathematics in junior high school is significant. Specifically, in Indonesia, as it is in line with the demands of implementing the 2013 curriculum. Teachers must be able to apply authentic assessments in learning. In line with this study's findings, the government must conduct massive and scheduled training and involve many teachers through the education offices. Teacher competencies related to the authentic assessment must be improved continuously. Subsequent researchers must also review studies related to efforts to increase competence, appropriate models for implementing the authentic assessment, and its implementation at different grade levels and materials.

### Limitations

Only twenty teachers were observed in this study (out of fifty existing teachers). The rationale used was that only twenty teachers gave permission/agreed to be observed. Other considerations are the issue of time efficiency, funding, and observers' availability.

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