




Development of a Quizizz-Based Mathematics Learning Assessment Tools to Improve Students' Concepts Understanding

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| Article Info | Abstract |
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| Article History Received: 18-01-23 Revised: 02-02-23 Accepted: 14-02-23 | <p>This study aims to develop a Quizizz-based assessment tool and test its effectiveness on students' conceptual understanding abilities. This research began with preliminary studies, preparation of Quizizz-based Assessment Tools, validation of Quizizz-based Assessment Tools, limited field trials, and field trials. The subjects of this study were class VIII students of SMPN 6 Kota Metro in the 2022/2023 academic year. Research data was obtained through tests of critical thinking skills. The preliminary study results show the need to develop a Quizizz-based Assessment Tool. The Quizizz-based Assessment Toolkit is prepared by compiling a draft of the Quizizz-based Assessment Toolkit and its components. The results of the validation show that the Quizizz-based Assessment Tool meets the eligibility standards for content, media, and language in the proper category. The results of the field tests showed that there were differences in the conceptual understanding abilities of students in the experimental class and the control class. The conceptual understanding abilities of students who used Quizizz-based Assessment Tools were higher than the students' conceptual understanding abilities who did not use Quizizz-based Assessment Tools. Based on the field test results, it can be concluded that the Quizizz-based Assessment Tool effectively increases students' conceptual understanding skills.</p> |
| Keywords: Mathematics Learning Assessment; Students' Concepts Understanding; Quizizz | |

INTRODUCTION

Learning devices are things that the teacher must prepare before carrying out learning. In KBBI [1], devices are tools or equipment, while learning is a process or way of making people learn. According to Zuhdan, learning devices are tools or equipment to carry out processes that enable educators and students to carry out learning activities [2]. Learning tools guide teachers in learning in the classroom, laboratory, and outside the classroom. Permendikbud No. 65 of 2013 concerning Process Standards for Elementary and Secondary Education states that the preparation of learning tools is part of the lesson plan [3]–[5]. Learning plans are designed as syllabi and lesson plans that refer to content standards. The lesson plan also prepares media and learning resources, assessment tools, and learning scenarios. Furthermore, Rusman explained that learning tools must be monitored so that the implementation of learning is more directed to achieve the expected competencies [6]. This means that components are needed and must be prepared to manage and implement learning activities to achieve learning objectives.

Assessment is essential in learning to improve the quality of education [7]. Assessment because it becomes essential because it aims to determine the achievement of a lesson. Assessing students' competence requires collecting information to help determine the extent to which

students have achieved learning targets [8]–[10]. Various techniques can be used in the process of gathering information. This includes observing the formation and information from students; thus, the ability to decide which technique is best for the learning situation is needed.

Based on the purpose of the assessment, according to Daryanto and Dwicahyono, the functions of the assessment are described, including [11]: 1) Describe the extent to which students have mastered a competency, 2) Evaluate student learning outcomes in order to help understand themselves, make decisions about the next step, both for planning learning programs, personality development, as well as for majors (as guidance), 3) Finding learning difficulties, possible achievements developed by students, and as a diagnostic tool that helps educators/teachers determine whether someone needs to take remedial or enrichment, 4) Finding weaknesses and the lack of an ongoing learning process to improve the following learning process, 5) Controllers for educators/teachers and schools regarding the progress of student development.

National Education in Uno [12] states in detail the functions of the assessment, including (1) learning objectives are the attainment of competency standards and essential competencies; (2) class-based assessment can also function as a basis for evaluating student learning outcomes in order to help students understand themselves and make decisions about the next step; (3) finding learning difficulties and possible achievements that students can develop and as a diagnostic tool that helps students determine whether a student needs to take part in remedial or needs an enrichment program; (4) assessment also functions as an effort by educators to be able to find weaknesses and deficiencies in the learning process that has been carried out or is ongoing; (5) assessment can be used as a control for educators and all stakeholders in the school environment regarding the progress of the development process and student learning outcomes.

Assessment of learning outcomes is closely related to the objectives to be achieved in the learning process. Benjamin Bloom [13] classifies human abilities into two main domains: cognitive and non-cognitive. The non-cognitive domain is divided into two groups: the affective domain and the skill domain. The assessment that will be developed in this research is the cognitive domain.

In study units, knowledge is the principal place in elementary, junior high and high school teaching. Anderson and Krathwohl [6] made revisions in 2001 to Blomm's taxonomy, including (a) Remembering, namely being able to remember materials that have just been studied; (b) Understanding, namely understanding the meaning, translation, interpolation, and interpretation of assessment tools and problems; (c) Applying, namely being able to apply ideas, procedures, methods, formulas, theories, etc., in learning conditions. (d) Students can analyze incoming information and divide or structure information into smaller parts to recognize patterns or relationships, (e) Assess (Evaluate). Namely, students can provide an assessment of solutions, ideas, methodologies, work procedures, and others, (f) Creating, that is, students put elements together to form a coherent and functioning whole, reorganize the elements into a new pattern or new structure through arouse, plan, or produce something.

The Quizizz application is an online learning that contains quizzes and games. Quizizz is an application that can be used to create interactive quizzes and accessed via devices such as computers, smartphones, or tablets to complete these quizzes. Quizizz is an educational game-based application that brings multiplayer activities to the classroom and makes classroom practice interactive and fun [14].

According to official Gawaiweb (2020), the procedure for creating a Quizizz account is (1) Go to the web, type Quizizz, (2) If you do not have an account yet, click sign up, (3) Fill in all accounts registration conditions, (4) Click log in to the application Quizizz, (5) Type in the email address and password used when registering an account, (6) Determine the quiz model, you can make your own by clicking crate my quiz. Meanwhile, Agustina (2019) how to operate Quizizz in the attachment. An example of an image for using Quiziz is as follows:



Figure 1. Display of the Quizizz Homepage



Figure 2. Initial display of selecting a Question



Figure 3. Display of Questions on Quizizz

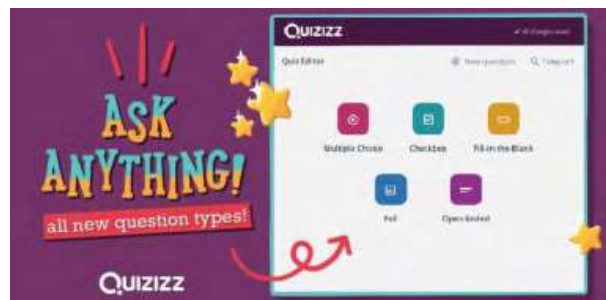


Figure 4. Quiz Categories on Quizizz

Currently, on Quizizz, there are five quiz categories, namely multiple choice, checkbox, fill in the blank, poll, and open-ended.

According to Purba, Quizizz can also be interpreted as an interactive learning media because Quizizz can be used in teaching and learning activities such as holding pre-tests, post-tests, practice questions, material reinforcement, remedial, enrichment, and others. One of the requirements for creating Quizizz is having a Gmail account or another account. Quizizz can be used easily by teachers in the learning process as a medium for daily tests, Midterm Exams, Final Semester Exams, giving homework assignments, or providing entertainment to students in the learning process. With this educational game-based application, teachers can use it as a tool to carry out daily evaluations of students.

Assessment of learning outcomes is closely related to the objectives to be achieved in the learning process. Benjamin Bloom [13] classifies human abilities into two main domains: cognitive and non-cognitive. The non-cognitive domain is divided into two groups: the affective domain and the skill domain. The assessment developed in this study includes the cognitive and skill domains.

Information obtained based on observations at SMPN 6 Kota Metro related to learning assessment documents shows that (1) the tests made by the teacher as an assessment of mathematics learning were taken from textbooks which were only adapted to the needs of the teacher as assignments without any qualitative analysis of the instrument grid which are made; (2) the test results given by the teacher are still in the form of learning assessments in written form; (3) the results of the evaluation of the assessment given still do not get optimal results where students are still passive in participating in the learning process, (4) the difficulty for teachers to carry out assessments during the Covid-19 pandemic which is generally done online, (5) the assessment is only done as a form of evaluation given to self-evaluate without any reward activities carried out so that they are more challenged by competition in general assessments, (6) students still commit

fraud, namely cheating with their friends in assessments so that measuring students' abilities is still challenging to do, and (6) there has never been an assessment of mathematics learning by utilizing technology to increase the active role of students in conducting learning assessments.

METHOD

This type of research is research and development or Research and Development (R&D). According to Gall, Gall, and Borg in the book *Educational Research An Introduction* [15], the educational development model is based on industry which uses research findings in designing new products and procedures, which are then tested systematically in the field, evaluated, improved to obtain criteria specifically about effectiveness, quality, or similar standards. The product produced in this study is a Quizizz-based mathematics learning assessment tool to increase students' competitive motivation and conceptual understanding in junior high schools.

The research procedure carried out by researchers in this development was adapted from the development steps developed by Borg and Gall with some limitations. Therefore, the implementation of the steps in this development is adjusted to the needs of researchers. The procedure for developing this research was adapted to the steps of the Borg and Gall development model, which include: (1) research and information collecting; (2) planning (planning); (3) development of the initial form of the product (Develop a preliminary form of product); (4) preliminary field testing; (5) revise the trial results (primary product revision); (6) field trials (Main field tests); (7) product improvement from field test results (Operational product version); (8) field implementation test (Operational field testing); (9) final product improvement (Operational field testing); (10) dissemination and implementation (Dissemination and implementation) [16].

This research is simplified into nine development steps based on these ten steps. These steps are (1) research and information gathering, (2) planning, (3) initial product development, (4) initial product validation, (5) initial product revision, (6) limited trial, (7) revision limited trial product, (8) field trial, and (9) final product revision.

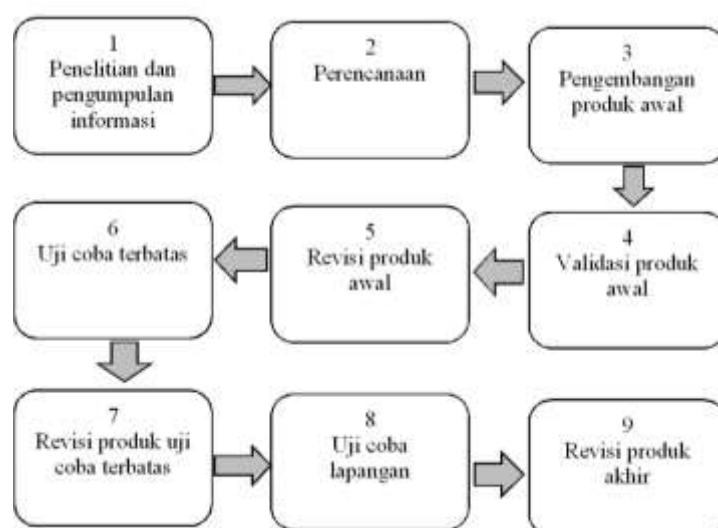


Figure 5. Modified Development Procedure Chart of the Development Model According to Borg & Gall [16]

RESULT AND DISCUSSION

This type of research is research and development or Research and Development (R&D). According to Gall, Gall, and Borg in the book *Educational Research An Introduction* [15], the educational development model is based on industry which uses research findings in designing new products and procedures, which are then tested systematically in the field, evaluated, improved to obtain criteria specifically about effectiveness, quality, or similar standards. The product produced in this study is a Quizziz-based mathematics learning assessment tool to improve understanding of the concept of the Cartesian Coordinate System in junior high schools.

This research was conducted at SMP Negeri 6 Metro, located on Jl. Patimura 29 Banjarsari, North Metro District, Metro city of Lampung. This research was conducted at the beginning of the odd semester of the 2022/2023 academic year. SMP Negeri 6 Metro was chosen as the research location because the product results were a contribution of thought as an alternative assessment to achieve a competency standard of assessment and the quality of school education by the applied curriculum.

The research procedure carried out by researchers in this development was adapted from the development steps developed by Borg and Gall with some limitations. Therefore, the implementation of the steps in this development is adjusted to the needs of researchers. The procedure for developing this research was adapted to the steps of the Borg and Gall development model, which include: (1) research and information collecting; (2) planning (planning); (3) development of the initial form of the product (Develop a preliminary form of product); (4) preliminary field testing; (5) revise the trial results (primary product revision); (6) field trials (Main field tests); (7) product improvement from field test results (Operational product version); (8) field implementation test (Operational field testing); (9) final product improvement (Operational field testing); (10) dissemination and implementation (Dissemination and implementation).

This study's subjects were divided into product validation and product trial research subjects. The product validation research subjects comprised three materials, media, language experts, and class VIII students of SMPN 6 Kota Metro. The subjects of this study were FKIP UNILA lecturers, mathematics teachers, and students at SMPN 6 Kota Metro. Product development validation subjects are described in detail in Table 1.

Table 1. Product Development Validation Subjects

| Assessment Aspects | Validators' Name | Validation |
|--------------------------------------|--|--|
| Material, Media, and Language Expert | 1. Dr. Sugeng Sutiarto, M.Pd. 2. Dr. Nurhanurawati, M.Pd. | Quizziz Based Assessment Tool and test instruments |
| Teacher Response | Sri Wuriyani, S.Pd | Quizziz Based Assessment Tool and test instruments |
| Student Responses | Twelve Class VIII 5 Students | Quizziz Based Questions |

The tests in this study were the initial test (pre-test) and the final test (post-test) on class VIII SMP Cartesian coordinate material in the form of essays to obtain data on students' conceptual understanding abilities. The instrument for testing the concept understanding ability indicates the ability to understand the concept. Before being used in the preliminary field test, the test instrument

for conceptual comprehension ability must meet good test criteria, so this test instrument was first tested on other classes that have studied Cartesian coordinate material, namely class IX, to know validity, reliability, level of difficulty, and power. Different questions are as follows:

a. Validity

By using a significance level of 5% and $dk = n - 2$, the following validity criteria are obtained: (1) if $r\text{-count} > r\text{-table}$, then the item is valid, and (2) if $r\text{-count} < r\text{-table}$, then the item is invalid. The results of the analysis of the validity test of the concept understanding ability test are presented in Table 2.

Table 2. Results of Test Instrument Validity Test Analysis

| Number | r-count | r-table | Criteria |
|--------|---------|---------|----------|
| 1 | 0,775 | 0,576 | Valid |
| 2 | 0,760 | 0,576 | Valid |
| 3 | 0,967 | 0,576 | Valid |
| 4 | 0,754 | 0,576 | Valid |
| 5 | 0,886 | 0,576 | Valid |

Based on the calculations obtained from each item that $r_{\text{count}} \geq r_{\text{table}}$, it is concluded that the five items of essay questions made are declared valid.

b. Reliability

Adapun hasil uji reliabilitas tes untuk soal essai adalah $r_{11} = 0,875$. Berdasarkan taraf signifikansi 5% dan $dk = n - 1 = 12 - 1 = 11$ maka diperoleh $r_{\text{tabel}} = 0,602$ Karena nilai $r_{11} = 0,875$ lebih besar dari $r_{\text{tabel}} = 0,602$ maka dapat disimpulkan bahwa instrumen bersifat reliabel dengan tingkat reliabilitas sangat tinggi.

The reliability results to test for essay questions are $r_{11} = 0.875$. Based on a significance level of 5% and $df = n - 1 = 12 - 1 = 11$, $r\text{-table} = 0.602$ is obtained. Because the value of $r_{11} = 0.875$ is greater than $r_{\text{table}} = 0.602$, it can be concluded that the instrument is reliable with a very high level of reliability.

Table 3. Results of the Test Instrument Difficulty Level Analysis

| Number | Values | Criteria |
|--------|--------|----------|
| 1 | 0,54 | Moderate |
| 2 | 0,52 | Moderate |
| 3 | 0,33 | Moderate |
| 4 | 0,42 | Moderate |
| 5 | 0,51 | Moderate |

Table 4. The Analysis of Differentiating Power Results

| Number | Differentiating Power | Criteria |
|--------|-----------------------|----------|
| 1 | 0,23 | Moderate |
| 2 | 0,25 | Moderate |
| 3 | 0,26 | Moderate |
| 4 | 0,46 | Good |
| 5 | 0,44 | Moderate |

The research results obtained in the study were used to analyze 1) the process and product development of the Quizziz-based mathematics learning Assessment toolkit, which is valid, reliable, and interesting, 2) the product effectiveness of the results of the development of the Quizziz-based mathematics learning Assessment toolkit to improve understanding of the concept of the Cartesian Coordinate System.

Table 5. Material Expert Validation Results

| Aspect | Validator Value | | |
|--------------------------------|--------------------------------|--------|--------|
| | 1 | 2 | 3 |
| First Validation Test | | | |
| Total | 45 | 45 | 45 |
| Percentage | 82.05% | 82.05% | 82.05% |
| First Validation Test Average | 82.05% | | |
| Criteria | Layak (sebelum revisi) | | |
| Second Validation Test | | | |
| Total | 45 | 46 | 45 |
| Percentage | 82.05% | 84.61% | 82.05% |
| Second Validation Test Average | 82.90% | | |
| Criteria | Very Eligible (after revision) | | |

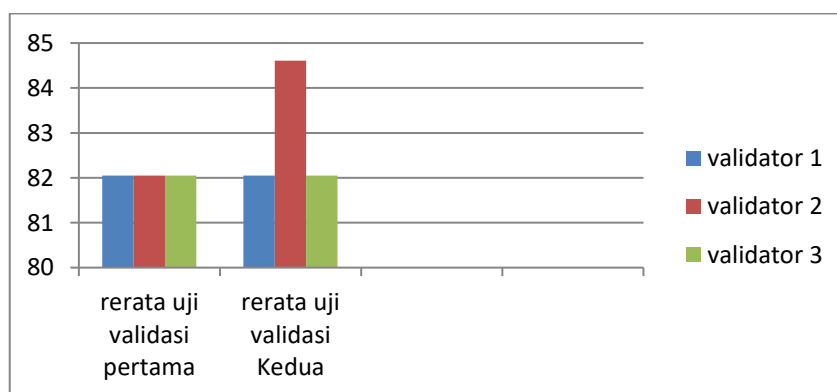


Figure 6. Bar chart of Material Expert Validation Test

Table 6. Media Expert Validation Results

| Aspect | Validator Value | | |
|--------------------------------|---------------------------------|--------|--------|
| | 1 | 2 | 3 |
| First Validation Test | | | |
| Total | 45 | 46 | 45 |
| Percentage | 82.05% | 84.61% | 82.05% |
| First Validation Test Average | 84.72% | | |
| Criteria | Very Eligible (before revision) | | |
| Second Validation Test | | | |
| Total | 55 | 60 | 55 |
| Percentage | 81,25% | 91,67% | 87,50% |
| Second Validation Test Average | 86.80% | | |
| Criteria | Very Eligible (after revision) | | |

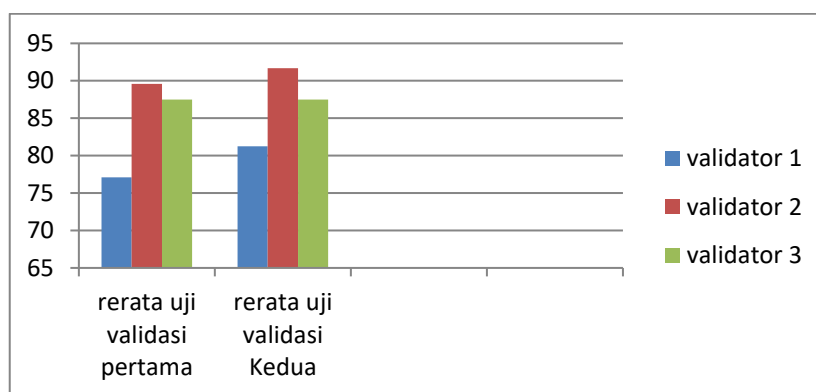


Figure 7. Bar chart of Media Expert Validation Test

Table 7. Linguistic Expert Validation Results

| Aspect | Validator Value | | |
|--------------------------------|---------------------------------|--------|--------|
| | 1 | 2 | 3 |
| First Validation Test | | | |
| Total | 33 | 31 | 29 |
| Percentage | 81.48% | 74.07% | 88.89% |
| First Validation Test Average | 81.84% | | |
| Criteria | Very Eligible (before revision) | | |
| Second Validation Test | | | |
| Total | 33 | 33 | 33 |
| Percentage | 88.89% | 88.89% | 88.89% |
| Second Validation Test Average | 88.89% | | |
| Criteria | Very Eligible (after revision) | | |

Hasil validasi ahli bahasa dari kedua uji validasi disajikan dengan diagram batang Gambar 8

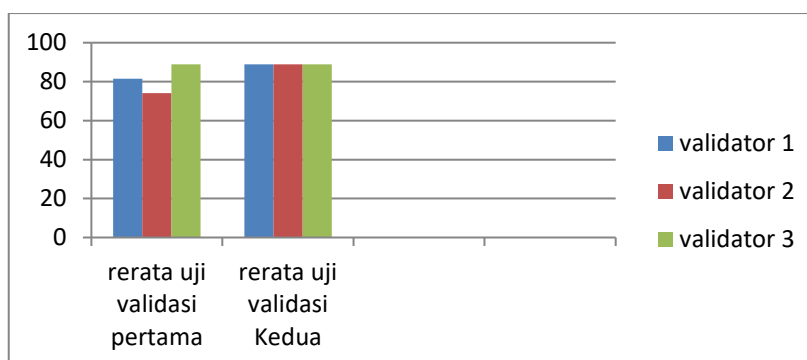


Figure 8. Bar Chart of Linguist Validation Test

The effectiveness of using the Quizziz-based Assessment Tool to increase the ability to understand the concept of the Cartesian Coordinate System is obtained based on the results of product trials. Trials are essential to development research carried out after design revisions are complete. The effectiveness of the use of products developed in the mathematics subject Cartesian Coordinate material includes testing student learning outcomes that are applied to product development results, namely the Quizziz-based Assessment Tool to increase the ability to understand the concept of the Cartesian Coordinate System by reviewing data on test results for understanding the concept of the Cartesian Coordinate System for class VIII 5 and VIII 6 conducted by researchers. The research was conducted in five meetings where the first meeting provided a design of the learning process to be carried out as well as a pre-test, and the second to fourth meetings provided learning according to the design in the RPP, which was adjusted to the Quizziz-based Assessment Tool developed, the fifth meeting provided a post-test.

The analysis was carried out to review the effectiveness of learning by using the Quizziz-based Assessment Tool to improve the ability to understand the concept of the Cartesian Coordinate System, namely by reviewing the pre-test and post-test results of students' conceptual understanding abilities. The results of the pre-test and post-test recaps are presented in Table 8.

Table 8. Pre-test and Posttest Recap Results

| Class | Information | Maximum Values | Minimum Values | Average |
|------------|-------------|----------------|----------------|---------|
| Experiment | Pre-test | 58.33 | 27.08 | 40.23 |
| | Post-test | 97.92 | 39.58 | 73.92 |
| Control | Pre-test | 70.83 | 29.17 | 48,96 |
| | Post-test | 81.25 | 35.42 | 61.32 |

The test results were carried out twice: limited trials conducted in class VIII, field trials conducted in class VIII 5 as the experimental class, and VIII 6 as the control class. The results of a limited trial conducted in class VIII to obtain product attractiveness data, the results of the analysis obtained an average of 81.74 with desirable criteria. Meanwhile, field trials were conducted to obtain data on improving students' conceptual understanding abilities. The analysis using the

increase (gain index) showed that the average percentage of the experimental class was 57.14% in the moderately effective category, and the percentage for the control class was 23.35% in the less effective category. In the following analysis, the researcher made the percentage of learning completeness both individually and classically for individual mastery by reviewing the post-test scores obtained, while classically by reviewing the percentage of the number of individual completeness where the percentage obtained for the completeness of the ability to understand the concept of the Cartesian Coordinate System class VIII 5 (experimental class) 57.14% or 17 students complete. In comparison, the completeness of understanding the concept of the Cartesian Coordinate System class VIII 6 (control class) is 23.35% or six students complete.

Learning objectives or instructional objectives are the behaviour of learning outcomes expected to occur, be owned, or be controlled by students after participating in specific learning activities. Learning objectives are the direction to be addressed from a series of activities in the learning process [2]. The role of teaching materials in individual learning is the primary material and is very decisive in the learning process. In addition, teaching materials can also be used as a tool that can be used to compile and monitor the process of students obtaining information.

Assessment is essential in learning to improve the quality of education [10], [17]–[20]. Assessment because it becomes essential because it aims to determine the achievement of a lesson. Assessing students' competence requires a means to collect information to help determine the extent to which students have achieved learning targets. Various techniques can be used in the process of gathering information. This includes observing the formation and information from students. Thus the ability to decide the best technique for the learning situation is needed.

The assessment that occurred in the research location showed that (1) the tests made by the teacher as an assessment of learning mathematics were taken from textbooks which were only adapted to the needs of the teacher as a task without any qualitative analysis of the instrument grids made; (2) the test results given by the teacher are still in the form of learning assessments in written form; (3) the results of the evaluation of the assessment given still do not get optimal results where students are still passive in participating in the learning process, (4) the difficulty for teachers to carry out assessments during the Covid-19 pandemic which is generally carried out online, (5) the assessment is carried out only as a form of evaluation given to self-evaluate without any reward activities carried out so that they are more challenged by competition in general assessments, (6) students still commit fraud, namely cheating with their friends in assessments so that measuring students' abilities is still challenging to do, and (6) there has never been an assessment of mathematics learning by utilizing technology to increase the active role of students in conducting learning assessments.

Reviewing the problems in implementing assessments can provide opportunities for students to increase competitiveness and game-based while maintaining the concept of learning activities, especially mathematics, which is considered a difficult and frightening subject. The selection of assessment designs by utilizing technology as learning support needs to be done to increase teacher competence. One of the applications developed for assessment is Quizizz. Quizizz is a game-based educational app that brings multiplayer activities to the classroom, making classroom practice fun and interactive [21]–[23]. By using Quizizz, students can do in-class exercises on their electronic devices. Quizizz invites students to compete with each other and motivates students to learn so that their learning results increase. The development of assessment in electronic form using Quizizz

in the assessment of mathematics learning. It can increase students' understanding of concepts [23]–[25].

In addition, one way for students to easily understand mathematical concepts is by involving students actively in learning. A learner is said to have a good understanding of concepts if he can re-explain the concepts he has learned, provide different examples from the examples the teacher gave, and use concepts in problem-solving. Students can train their understanding of mathematical concepts to solve their problems. The more often students use the concepts they already have, the more their understanding of them will increase. Of course, what must be known in advance or analyzed is how students' conceptual understanding abilities are where the problems students face to understand a concept, which of course, the concept understanding abilities of each learner are different, so indicators of understanding concepts that are suitable for them can be selected are. Find out how students' understanding of concept abilities.

CONCLUSION

Based on the data analysis and discussion results, the following conclusions can be drawn: The development of a Quizziz-based learning Assessment Tool to increase the ability to understand the concept of the Cartesian Coordinate System begins with pre-research, which shows the need to develop a Quizziz-based learning Assessment tool. The results of expert validation, teacher responses, and students showed that the Quizziz-based learning assessment tool on Cartesian coordinate material was valid, reliable, and interesting, so it was feasible to use in the learning process. The Quizziz-based learning assessment tool effectively increases the ability to understand the concept of the Cartesian Coordinate System. This can be seen from the criteria for the average increase (gain index) in the ability to understand the concept of the Cartesian Coordinate System classically, with the criteria being quite adequate for the experimental class and not practical for the control class. There are differences in the ability to understand the concept of the Cartesian Coordinate System in the experimental and control classes and the mastery of student learning outcomes.

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