Implementation of Quizizz Online Evaluation Tools With STEM Approach to Measure Analytical Skills of the Junior High School Students

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Abstract: The evaluation process at SMP Kesatrian 1 Semarang based on the results of observations cannot be used to measure analytical skills of the students. Based on observation, the average analytical ability of students still at low criteria. The purpose of this research is to measure analytical skills of the students using Quizizz application with STEM approach. This is a pre-experimental research with one shoot case study design. Population of this research is all students of grade 8 Kesatrian 1 Junior high school of Semarang Central Java in the 2019/2020 school year. The sampling technique was carried out by purposive sampling with a sample of 30 students. The instrument used in this research are analytical skills test of students using Quizizz application with STEM approach and questionnaire of students response about Quizizz as evaluation tool. Students are attending the lesson according to the lesson plan and are evaluated at the end of the lesson using the online Quizizz application as evaluation tool with a STEM approach. The result of test is quantitative data that analyzed descriptively. The results indicated the profile of analytical skills of the students are of 6.67% in the high criteria, 73.33% in moderate criteria and 20% in low criteria. It can be concluded that the average analytical skills of the students at Kesatrian 1 junior high school of Semarang is in moderate criteria. Finally, the research provides teacher recommendations to applying Quizizz application with STEM approach to measure analytical skills of the students in early learning environments.

Keywords: Evaluation tools, Quizizz, STEM, Analytical skills

Introduction

National education has a big purpose to develop potential of students to become human who believe and fear God Almighty, have noble character, healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens. One of the government efforts is 2013 curriculum which requires students to be more active in the learning process. Science learning is required to improve hard skills and soft skills the students. It can be doing by five activity (Observing, Asking, Trying, Reasoning, and Communicating).
Indonesia's PISA score of science in 2018 was in the low category, it is 396 (OECD, 2018). The low ability of science indirectly affects to analytical skills of the students. Analytical skills require reasoning in thinking because it is included in the fourth bloom taxonomic level C4 (Analyze). Based on observations, the student’s analytical skills at SMP Kesatrian 1 Semarang still low. It can be seen from the results of the tests, there are only 8 of the 28 students reached the Minimum Completion Criteria (MCC). Some of the questions used in tests are questions of the analytical skills which require students to analyze. In the questions of analytical skills, many students can’t answer correctly.

Based on the results of the observation, the analytical skills is low is because the students less understanding concepts of the material, especially the material of vibration waves and sound. This can be seen from the answers of students that only can answer on questions C1 (remembering), C2 (understanding), C3 (applying), and a small part of C4 (analyzing) questions. Anderson & Krathwohl (2010) explain about indicators analytical skills in detail as follows: a) Distinguishing indicators, differentiating indicators include distinguishing parts of the entire structure with their relationship or importance. Differentiation occurs when learners differentiate information that is relevant and irrelevant, or important and insignificant information. b) Indicator organizing, organizing involves identifying the elements of a communication or situation and recognizing how information fits into a coherent structure. Learners build systematic and coherent relationships between the pieces of information presented. c) Indicators attributing (concluding). Concluding occurs when learners are can ascertain points of view, bias, values, or the intention underlying the communication. Concluding involves a deconstruction process, in which students are can understand the author's intentions of the material/ information presented.

The role of the teacher is very important to train students think analyzing. One of them is the learning methods and learning evaluation tools used. Learning evaluation more important in the learning process. In China, exams still play an important role in assessing student academic performance (Lee 2013). Arikunto (2018) states that evaluation is an activity of collecting data to measure the learning objectives have been achieved. Evaluation tools that are often used today are still conventional by using paper. The weakness in this conventional evaluation is that students often lack time and tend to be less motivated to answer the question. The obstacle experienced by the teacher is the length of time for correction. One alternative that can solve this problem is using online evaluations with internet technology.

Evaluation of online learning is still rarely done by most teachers. Even though there are so many online evaluation tools that can be used, it's just that requires adequate infrastructure. One evaluation tool that is easy to use is Quizizz application. Bury (2017) states that Quizizz is an online formative assessment tool that is easy use by students and free of charge, so it really helps teachers to assess students' knowledge. Quizizz is an online media of games interactive which helps students check their knowledge and progress in their learning. In the Quizizz application, the questions is randomized for each student. This can reduce cheating that can be done by students.

Interesting features in Quizizz can increase motivation of students to answer the questions. This application can be accessed for free from devices such as computers, smartphones, or tablets. (Amornchewin, 2018) states that online evaluation media Quizizz can minimize the weaknesses that occur when evaluations held conventionally to be more efficient. Students are controlling their speed in the game interactive Quizizz. Students get benefit because the speed appear on the screen of each student, so they can answer questions at their own pace and review their answers at the end. Teachers also get detailed grade-level and learner-level insights for each quiz and can download reports as Excel spreadsheets (Lestari, 2019).
This study uses Quizizz application to measure the student’s analytical skills by considering all the advantages of the Quizizz application. The advantages of Quizizz according to research by Yana et al. (2019) include (1) easy to use; (2) quizzes that have been created can be added directly to Quizizz; (3) can insert pictures or audio as questions; (4) quizzes can be distributed to students by giving codes; (5) the results of test can be downloaded directly in excel; (6) the time for each question can be adjusted as needed; (7) more practical to record answers automatically; (8) more efficient because paperless; (9) is not boring with colorful pictures and sounds. Pradilasari et al. (2019) stated that learning media using audio visual, internet, and certain applications can increase students learning outcomes and motivation.

Various facilities have been provided by the software development company to support learning activities in the classroom connected to the network the internet as a means of collaborators to unite face-to-face activities with internet network (digital literacy) in the world of education. This means that the world of education must provide educational facilities in accordance with technological developments (Raisa et al. 2017). Based on the results of observations during Field Experience Practices (FEP) at Kesatrian 1 Junior High School of Semarang, the evaluation process only used conventional method. Besides, the facilities and infrastructure of Kesatrian 1 Junior High School of Semarang are very adequate. The facilities in each classroom include a computer, LCD projector, speakers and a good internet connection are available. In addition, students also have sophisticated cellphones that can be used to access the internet properly. As it is known in this digital era, technology or internet-based learning innovation is very important because it is expected can increase the knowledge (digital literacy) of students in sophisticated digital era. Clark & Richard(2016) defines e-learning as instruction learning in a digital device (computer, laptop, tablet, or smartphone) that support learning. In addition, using digital devices is one of the reforms in education in line with the 21st century is STEM-based learning. So the teachers need to have adequate digital skills, especially abilities using digital technology in today’s digital era (Tursinawati & Widodo, 2019).

STEM is an acronym for science, technology, engineering, mathematics. STEM education is currently being popularized in various countries because it is considered to improve HR (Human Resources). The development of STEM education in Indonesia not too much so it is important to develop an innovative model of science learning with a STEM approach (Sudarmin et al., 2019). Reeve (2013) adopts the definition of STEM education as an interdisciplinary approach learning, that students use science, technology, engineering, and mathematics in a real context. STEM education connecting schools, the world of work, and the global world. Therefore developing STEM literacy can make students have skills to compete in a new knowledge-based economic era.

STEM knowledge in learning activities is indispensable for students. Cameron & Craig (2016) stated that STEM education does focus on direct activities prepared students for the development of a new competitive era. Learning activities using STEM approaches in the classroom are an effort to improve the quality of learning process. The main focus of STEM learning activities for students is soft skills such as problem solving, higher order thinking skills, and collaborative work (Li et al., 2016). Another important reason is that STEM education promises to be the right tool for students in facing global challenges and competition (Meyrick, 2011).

Several studies have proven the importance of STEM education in the era of global competition. One of them is the research of Estapa and Tank (2017) STEM is an effective way to facilitate and maintain the integration of science, technology, mathematics and engineering. STEM education in Asia leads to a higher effect on students ‘higher order thinking skills, student achievement, and finally students’ learning motivation. In addition, STEM education is the most promising teaching and learning innovation, especially to prepare students higher order thinking skills and to attract student in learning which very
important in competitive era. Yildirim (2016) states that STEM education is significantly effective in Southeast Asia, can be seen by learning outcomes the students higher than in other regions.

Integrated STEM approach in science learning is not only a necessity but become a demand because of hard competition to preparing competitive graduates. Learning science in early age is recommended, students can create jobs that are suitable for their respective fields. STEM knowledge is an absolute prerequisite for creating future-oriented learning (Parmin et al., 2020). Therefore it is necessary to take a STEM approach in Indonesia’s classroom learning that can following the developments in the global era. Zamista (2018) added that STEM education is the most suitable education to prepare a generation who has literate towards STEM in order to answer the demands of the times and technological developments.

In this research, an online Quizizz application as evaluation tool with a STEM approach was used. The evaluation tool is multiple choice questions analysis (C4) on the material of wave and sound vibrations related to STEM aspects. The reasoned multiple choice test questions are presented in online form on the Quizizz application which purpose to determine the profile of students' digital literacy and analytical skills. This article is intended as a reference for online evaluation tools that are expected to be a solution from problem science subjects, especially in the material of wave and sound vibrations. In addition, students are also can maximize their smartphone or technology to prepare 21st century education.

**Methods**

This research is a pre-experimental design with a one shoot case study design. The research subjects were 30 students of class VIII Kesatrian 1 Junior High School of Semarang Central Java. The sample selection was done using purposive sampling technique with consideration from science teachers at Kesatrian 1 Junior High School of Semarang. The research procedure was carried out by giving treatment to students using the online Quizizz application as evaluation tool with a STEM approach. In this research, there is only a class as an experimental class and no control class. The test was administered once after learning the wave and sound vibration material. The instrument used was a test of analytical skills and a questionnaire for students' responses. Analytical skills test is multiple choice STEM approach online using Quizizz application. Student response questionnaires are taken using google form.

The data obtained were quantitative data from the multiple choice test results with reason and student response questionnaires. The data analysis technique used is quantitative data. The data was processed with Ms. Excel and then analyzed the students' analytical skills based on the test answers. The analytical skills students is grouped into several categories as in Table 1 below.

| Score          | Category |
|----------------|----------|
| x < 30.9       | Low      |
| 30.9 ≤ x < 70.3| Moderate |
| x ≥ 70.3       | High     |

The analytical skills indicator used consists three indicators which include (1) differentiating, (2) organizing, and (3) attributing (concluding). The instrument analytical skills test used has been tested on evaluation experts and media experts. Sukardi (2009) states that the first characteristic and has a very important role in the evaluation
instrument is the validity. The research instrument used has been tested for validity and reliability. Test the validity of the Quizizz online evaluation tool with STEM approach by experts using a validation sheet. The instrument is reliable if \( r_{11} \geq 0.7 \). The calculation result shows that the value of \( r_{11} \) is 0.75, so the instrument is reliable to use. The results validation of the evaluation experts were 79.1% and the media experts were 75% in the reasonable category so that the online Quizizz evaluation tool with a STEM approach was reliable and reasonable to use. Learning and data collection for this research was carried out online because the Covid-19 pandemic.

**Results and Discussion**

Learning and data collection in this research was carried out online because face-to-face learning was not possible in the pandemic era. Learning activity is carried out through the WhatsApp group, Quizizz application as an evaluation tool and other supporting learning media. Learning activities were carried out in four meetings before data collection was carried out. The material given is vibration waves and sound. Schedule of online science learning is once a week.

Students are using worksheets at each meeting and collected at a predetermined time. The worksheets used is problem-based with a stem approach that can improve students’ critical thinking (Nizarullah et al. 2017). According the research of Putri et al. (2020) learning use a STEM approach can be done online. Application of this approach increase the thinking ability of students up to 70%. The worksheets given by the teacher is a worksheet with a STEM approach that students can understand the concept of vibration, waves and sound based on STEM aspect.

At a further meeting, teacher discusses the previous assignment and gives a new assignment. Students should ask directly to the teacher related to the concept of vibration, waves and sound subject from books and the internet to obtain more knowledge and information.

The evaluation tool used in this research is the online Quizizz application as evaluation tool with a STEM approach. The STEM approach online evaluation tool consists of 10 reasoned multiple choice questions covering STEM aspects and indicators of analyzing ability as in Table 2.

**Table 2. Questions of Analytical Skills test and Indicators**

| No. | Question | Indicator |
|-----|----------|-----------|
| 1.  | Rahmat and his friend was playing pendulum. He doing an experiment and the results of his observations are written in the following table: | Conclude |
|     | No. | Number of vibrations (n) | Frequency (Hz) |
| 1   | 5   | 10               |
| 2   | 10  | 20               |
| 3   | 15  | 30               |
| 4   | 20  | 40               |

Based on the data in the table above, the graph that can made by Rahmat about the relationship between number of vibrations (n) and the frequency (f) in a graph is ...
2. Consider the following table of experimental results have done by Ella.

| No. | Amplitude (cm) | Vibration Time (s) |
|-----|----------------|--------------------|
| 1   | 5              | 20                 |
| 2   | 10             | 30                 |
| 3   | 15             | 40                 |
| 4   | 20             | 60                 |
| 5   | 25             | 80                 |

From the table of experimental results by Ella it can be concluded that ...

a. the greater the amplitude, the greater the period
b. the greater the amplitude, the greater the frequency
c. period independent of frequency
d. period independent of amplitude

3. Look at the following picture

Tiara has conductive hearing loss. Where hearing becomes reduced because waves sound unable to enter the ear. Doctors diagnosed disorders of the eustachian tube and ear drum designated by the number ...

a. 1 and 3
b. 1 and 6
c. 3 and 6
d. 5 and 6

4. In a steel, metal and aluminum factory, aircraft production and other industries require inspection of products before distribution. Testing uses reflected ultrasonic waves to detecting damage or thickness on objects. The tools used are ...

a.  

b.  

Conclude

Technology
5. Look at the following picture!
Based on the picture beside the right pair to describe it is ...

| No. | Name     | Function          | Characteristics                          |
|-----|----------|-------------------|------------------------------------------|
| A   | Ultrasound | Seeing the baby   | The wave frequency used is 1-8MHz        |
|     |          | in the womb       |                                          |
| B   | Ultrasound | Treat muscle      | The wave frequency used is 1-8MHz        |
|     |          | fatigue            |                                          |
| C   | Sonification | Seeing the baby  | The wave frequency used is 800-2000 KHz  |
|     |          | in the womb       |                                          |
| D   | Ultrasound | Seeing the baby   | The wave frequency used is 800-2000 KHz  |
|     |          | in the womb       |                                          |

6. Look at the following picture!
A pendulum covers ABCBA for 4 seconds. If Andre does ABC experiments for 40 times. AB length is 20cm. The amplitude, period and frequency of the pendulum vibrations are ...

- a. A = 10cm, T = 0.2s and f = 5 Hz
- b. A = 10cm, T = 0.1s and f = 10 Hz
- c. A = 20cm, T = 5 s and f = 0.2Hz
- d. A = 5cm, T = 0.2s and f = 5 Hz

7. Andre plays a block of cork that is placed floating on a ripple tank. The cork moves up and down as well, while the waves travel through the water. The length of the path is 1.5 m by forming 5 waves in 10 seconds. How fast do water waves propagate through the tank?

- a. 5 cm / s
- b. 15 cm / s
- c. 1.5 cm / s
d. 2.5 cm / s

8. Look at the following picture!

Ocean depth is measured using a sonar system by utilizing infrasonic waves. If the reflected sound is detected 0.8 seconds after the wave is emitted, the ocean depth is 560m. Is the statement above true?

- a. Right, reason right, ocean depth right
- b. Wrong, right reason, wrong ocean depth
- c. Right, wrong reason, right ocean depth
- d. Wrong, wrong reasons, wrong ocean depth

Look at the following picture!

9. Indonesia is developing the above tool by utilizing ocean waves to be used as a wave power generator.

The working principle accordingly is ...

- a. Ocean waves (have kinetic energy) - enter the wave conversion machine and flow to the turbine - rotating rotors - produce mechanical energy - are channeled through a generator - are converted into electricity
- b. Ocean waves (have kinetic energy) - rotating rotors - produce mechanical energy - are channeled through a generator - enter the wave conversion engine and flow to a turbine - converted into electricity
- c. Ocean waves (have kinetic energy) - produce mechanical energy - enter the wave conversion machine and flow to the turbine - are channeled through a generator - rotating rotors - are converted into electricity
- d. Ocean waves (have kinetic energy) - transmitted through a generator - enter the wave conversion machine and flow to the turbine - rotating rotors - produce mechanical energy - are converted into electricity

10. The application of vibration has many benefits for everyday life. Apart from having benefits, excessive vibration in some industrial machines can also be destructive. Efforts that need to be done are ...

- a. Perform periodic checks
- b. Added vibration dampening device
- c. Calibrate the machine before operation
- d. All answers are correct

The time for processing the questions is 30 minutes. Each question is adjusted to an indicator of the analytical skills. Students answer the questions online by choices and
provide reasons for each question they answer. The reasons for the answers written by students were analyzed to measure their analytical skills.

The profile of analytical skills students measured in this study is seen from three sides, based on indicators of analytical skills, STEM aspects and classically. Students answer the questions by choosing options a, b, c, or d then include the reasons for the answer in the next number. Multiple choice answers and answer reasons were analyzed to obtain students’ scores. The scores obtained are categorized into analytical skill category in Table 1.

The profile of the analytical skills classically from 30 students who became research sample is presented in Figure 1.

![Figure 1. Classical profile of analytical skills of the students](image)

The score of students answered of the questions correctly and completely was 5, for incomplete answers the score was 1-4. The score is multiplied by 2 to obtain the value and categorize analytical skills each student based on Table 1. The results of the 30 students who took the test were 6 in the high criteria, 22 in the medium criteria and 2 in the low criteria as shown in the diagram Figure 1. The average of student’s analytical skill classically is in the medium criteria. Students are still not accustomed to answer the question with the type of analysis that requires higher order thinking skills. It can be seen from the answers of students who mostly quote directly from the science textbook and not changed with their own language. Students should can express their opinions based on the theory that has been taught to answer the questions given. However, based on the data obtained, only 6.67% of students were able to use their own words to answer questions, so that they were included in the high analytical skills category.

The tendency of students prefer to answer questions by quoting from books or other sources. Nur et al. (2017) which states that the learning process in the classroom is more directed at the ability of students to remember and understand information without being required to analyze and relate it with everyday life. In this research the analytical skills of students were in the medium category and had not developed optimally.

The students profile of the analytical skills is seen based on the indicator of analytical skills were presented in Figure 2.
The percentage is obtained by sum up the student’s score on each indicator, divided by the maximum score, multiplying number of students then multiplying by 100%. The differentiating indicator gets the lowest percentage, while the highest is the organizing indicator. Based on the recapitulation of students' answers, they often make wrong distinguish. For example in numbers 7 and 8 the total score obtained from 30 students is small. Students are feel difficult to identify information from the pictures to get important information that will be used to calculate. Begin from that the calculations they do are wrong. It is like in question number 5, most of students difficult to distinguish the characteristics of sound and wave vibration tools because some tools have similar shapes and characteristics. However, if seen as a whole, each indicator of students' analytical skills is in the good category. Nur et al. (2017) also revealed that in the initial test of analytical skills at differentiating indicators obtained a low percentage, but after the final test the students’ analytical skills increased.

Organizing indicators are reflected in question number 3, namely regarding the systematics of hearing in humans. Students are required to analyze the part of the ear that has problems with known characteristics in the questions. Fifteen students answered correctly with a complete analysis, 7 answered imperfectly and the rest answer wrong. On this indicator, students get the highest percentage 56.66%.

The profile of the analytical skills every aspect of STEM is seen based on the question that students worked on in each aspect. The profile of the analytical skills based on the STEM aspect can be seen in Figure 3.

The analytical skills of the students also can be seen based on the STEM aspect. Technology aspect obtained the highest percentage compared to other aspects. Total score obtained on this question is very high. In question number 4 only 2 students answered incorrectly and get score 0. Question number 5 all students answered so one got score 0 and it is same in number 6. This is because students are familiar with the application of wave and sound vibrations in everyday life such as ultrasound, sonar systems, the advantages and disadvantages of applying these vibrations and waves.

Mathematical aspects get the lowest percentage 36%. Based on the answers from students on questions number 7 and 8, most of them still have difficulty identifying what is known in the questions. Students still cannot count what is being asked. Therefore, it is necessary to improve the understanding of the material and the students’ analytical skills on the aspects of mathematics by practicing many questions.
Measuring analytical skills using Quizizz's online evaluation tool with STEM approach has weaknesses and strengths. The weaknesses that are felt are: 1) the implementation of full online learning, so miscommunication often occurs in conveying information to students. 2) sometimes students' internet connection is not good, so it affects the time for solving the questions 3) The concentration of students is divided because learning is carried out online, supervision from the teacher cannot be carried out optimally. 4) description questions is difficult to correct automatically by the system, this is because the key answers entered by the teacher must be the same as the students' answers in order to be detected correctly.

The advantages of online evaluation Quizizz with STEM approach are: 1) faster correction for multiple choice questions. 2) online learning and evaluation processes make students more familiar with technology. 3) cost-effective and paperless because the results are recorded directly on the system. 4) makes it easier for teachers to report evaluation results to parents of students because it can be sent via email directly. 5) Quizizz's online evaluation tool with a STEM approach is more interactive because the teacher can insert sound and moving images into the questions. 6) train students to think broadly covering aspects of STEM in accordance with the demands of the 21st century. 7) The question models that can be made with the Quizizz application are more varied so can interesting the students to doing evaluation. 8) equipped with a back sound make students are more relaxed and motivated to work on evaluation. The perceived advantages are in accordance with the research of Yana et al. (2019) who used the Quizizz application to measure the students’ analytical skills by considering all the advantages of the Quizizz application.

Perceived strengths and weaknesses are supported by research Zhao (2019), which compares two classes with different frequency of use of Quizizz application. Students who use Quizizz more often state that Quizizz is easy to use, it stimulates their interest, helps them concentrate in class, and reduces distraction caused by electronic devices. Learners who use Quizizz also get higher evaluation scores more often. On the other hand, the class using Quizizz with less frequency stated the opposite.

**Figure 3.** Profile of Analytical Skills for Each Aspect of STEM

![Figure 3](image_url)
Based on the advantages and disadvantages that have been described, the evaluation process using the online evaluation tool Quizizz application with STEM approach is quite effective to use by considering the advantages that are more and more representative with increasingly sophisticated developments. This was supported by the responses of students who stated that using the Quizizz online evaluation tool with a STEM approach was more fun and interesting. Students also feel compelled to work on questions with the backdrop and attractive appearance. Quizizz's online evaluation tool also includes appropriate components such as font size, language and clear instructions.

**Conclusion**

The conclusion of this research is the application of Quizizz application as online evaluation tool with STEM approach can be used to measure the profile of students' ability to analyze because it meets the validity and reliability requirements. The ability to analyze students is seen based on three things, that is classical, STEM aspects and based on indicators. Based on these three aspects, the ability to analyze students in the medium criteria. Classically the percentage is 73.33%, based on the STEM aspect the average percentage is 47.35% and based on the indicators analyzed the average percentage is 51.85%. Therefore, the students' ability to analyze at Kesatrian 1 Junior High School of Semarang is already good after using the online Quizizz application as evaluation tool with STEM approach.

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