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# Analysis of Student Responses to STEM-Inquiry Learning Using Cloud Classroom (CCR) on Food Loss and Food Waste Topics

Ernita Vika Aulia[1*], Martini[1], Siti Nurul Hidayati[1], Beni Setiawan[1], Dyah Astriani[1]

[1] Department of Science Education, State University of Surabaya, Surabaya, Indonesia.

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Corresponding Author:
Ernita Vika Aulia
ernitaaulia@unesa.ac.id

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**Abstract:** The implementation of STEM-Inquiry learning puts forward the process of how students independently acquire knowledge through problem solving and have the ability to use that knowledge. STEM-Inquiry learning supported by the use of the CCR platform can support online learning activities, allow students to work in groups, and help students not only memorize concepts, but can understand and apply the acquired knowledge in everyday life. This study aims to determine student responses to the application of STEM-Inquiry learning on the topic of food loss and food waste. This research is a quantitative descriptive study using a survey method. The subjects of this study were students of Science Education Class of 2019 State University of Surabaya. The research instrument used was a questionnaire form. The questionnaire form provided consisted of 20 questions developed from 7 indicators, namely interest, novelty, convenience, clarity, interest, assessment, and response. The results showed that the average percentage of student questionnaire responses was 84.9% which was categorized as very positive, meaning that students had an interest and were interested in being involved in a meaningful learning experience. Based on this, it can be concluded that the application of STEM-Inquiry learning on the topic of food loss and food waste received a very positive response from students.

**Keywords:** Cloud Classroom (CCR); Food Loss and Food Waste; STEM-Inquiry Learning; Student Responses.

## Introduction

Learning in the current curriculum focuses on creating an interesting and fun learning process (Saifulloh & Darwis, 2020), learning that makes students interested in science and technology (Aulia et al., 2022), and learning that facilitates students gain knowledge and abilities that are useful for learning. everyday life. One of the efforts to make learning more interesting and easier to understand is by using a learning model that is given problems in everyday life by using the STEM (Science, Technology, Engineering, Mathematical) learning model (Wahono & Chang, 2019).

The STEM learning model requires students to be able to solve problems, make innovations, find/design new things, understand themselves, do logical thinking and master technology (Li et al., 2019). This education is focused on real world and authentic problems so that students learn to reflect on the problem solving process (Bicer et al., 2017; Radloff & Guzey, 2016). STEM learning makes students have deep insight, is dynamic and creative, so that they can create a superior generation (Swaid, 2015; Takeuchi et al., 2020). One of the topics that can be applied with the STEM learning model is food loss and food waste because they are related to problem solving activities in everyday life. According to a study by Bappenas, food waste wasted in

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Indonesia in 2000-2019 reached 23-48 million tons per year or the equivalent of 115-184 kilograms per capita annually (Bappenas, 2021). Then based on data from the Ministry of Environment and Forestry in 2021, among all types of waste disposed of, food waste is the composition of the most waste, amounting to 30.6 percent of the total waste (Kementerian Lingkungan Hidup dan Kehutanan, 2021). Based on these data, the topic of food loss and food waste was chosen as the material applied to STEM learning so that students can make the best use of food ingredients and minimize food waste. By being given problems in everyday life on the topic of food loss and food waste, students can analyze, design, and design the process of solving each problem they face.

STEM learning can be combined with inquiry learning in order to increase student activity, interest and understanding in learning (Sabirova et al., 2020). This is because in inquiry learning there is still the role of the teacher in providing guidance to students during the discussion process, so that the direction of student learning remains in accordance with the context being studied and the goals are in accordance with what the teacher expects. The advantage of inquiry learning is that learning emphasizes the development of cognitive, affective, and psychomotor aspects in a balanced way, so that this learning strategy is considered more meaningful, provides space for students to learn according to their learning styles, is considered in accordance with the development of modern learning psychology which considers learning to be a the process of changing behavior due to experience and learning that can serve the needs of students who have above average abilities (Kuhlthau, 2015). This means that students who have good learning abilities will not be hampered by students who are weak in learning (Nunaki et al., 2019; Servitri & Trisnawaty, 2018). In identifying various food loss and food waste events, of course, students must go through the stages of scientific investigation to obtain facts that support their answers. In an effort to obtain these facts, a learning media can be used, which can help students develop skills such as observation skills, communicating, making predictions and concluding data (Liu et al., 2020; Tsakeni, 2021).

Learning media is a tool to convey or communicate learning materials in the teaching and learning process, in choosing learning media must be considered, because the right selection will affect the learning process in students (Amin, 2019). The topic of food loss and food waste in general requires the existence of a learning media, because learning without using learning media will be difficult. In addition, students need teaching materials or media that are innovative, interesting, and easy to use in delivering learning materials as a form of visualization to provide and make it easier for students to understand the material (Aulia et al., 2018). Efforts in solving this problem, with the use of effective learning media (Bely et al., 2019). In the use of learning media, educators must be skilled so that the teaching and learning process is student-centered, while the teacher in learning acts as a facilitator (Čanigová, 2022).

One of the suitable learning media used in STEM learning is the Cloud Class Room (CCR). CCR allows for the merging of traditional (face-to-face) and online classes. In addition, CCR is also a free online platform, easily accessible by teachers and students without the need for registration, and can find out student responses in real-time. The use of CCR media provides productive learning activities that support significant individual, group, emotional, and cognitive learning experiences, as well as support socio-scientific argumentation activities in the classroom (Chien, Y. T., & Chang, 2015). The CCR platform can also be used by teachers to form heterogeneous study groups or can also divide study groups according to the interests or views of many students. CCR can be used as a learning medium that supports the STEM approach. This has been proven by various previous studies which states that the STEM approach is a teaching and learning innovation to prepare students to hone higher-order thinking skills and attract students' interest to learn and adapt in a competitive era supported by the CCR platform (Wahono & Chang, 2019).

Based on the background of the problem above, the authors are interested in conducting a research entitled "Analysis of Student Responses to STEM-Inquiry Learning Using Cloud Classroom (CCR) on Food Loss and Food Waste Topics". The purpose of this study was to describe student responses to STEM-Inquiry learning on the topic of food loss and food waste using CCR.

## Method

This research is a quantitative research with a descriptive approach. The method used is a survey method that aims to determine student responses to STEM-Inquiry learning using CCR learning media. Descriptive research is research that is used to describe an event or phenomenon in the field. The research was conducted at the State University of Surabaya, the research subjects were 16 students of science education class 2019. Sampling was carried out using a purposive sampling technique. The purposive sampling technique is a sampling technique with certain considerations. In this study, sample selection was considered on the uniformity of test scores on the topic of food loss and food waste.

The instrument used in this study was a questionnaire form, which was used to determine

student responses to STEM-Inquiry learning using CCR. The main data of this study was obtained through a student response questionnaire, which consisted of 20 statements developed through 7 indicators, namely interest, novelty, ease, clarity, interest, assessment, and response. The questionnaire form uses a Likert scale (5 scale). Data from the results of the questionnaire obtained are then presented in the form of percentages and processed according to equation (1) formulated by Arikunto as follows:

$$P = \frac{Proportion\ of\ students\ who\ choose}{Number\ of\ students\ (respondents)} \times 100\% \quad (1)$$

Furthermore, the results of processing student response questionnaire data related to learning are interpreted based on Table 1 (Arikunto, 2010).

**Table 1.** Category Student Response

| Percentage (%) | Category |
|---|---|
| 80 < P ≤ 100 | Very positive |
| 60 < P ≤ 80 | Positive |
| 40 < P ≤ 60 | Enough positive |
| 20 < P ≤ 40 | Less positive |
| P ≤ 20 | Very less positive |

## Result and Discussion

This research was conducted for 3 meetings. The first meeting discussed the food loss sub-topic, the second meeting discussed the food waste sub-topic and the third meeting presented the results of student projects related to solutions to food loss and food waste problems that exist in everyday life. The research was conducted face-to-face and online, with the aim of optimizing student activities during the learning process. The applications used include CCR which is used during face-to-face meetings, the Google Meet application as an online classroom for online learning, and the Google Form which is integrated into CCR for student response questionnaires. This study was conducted to determine student responses to the application of STEM-Inquiry learning on the topic of food loss and food waste. Student responses to the application of STEM-Inquiry learning using CCR carried out by researchers were known from the answers to the response questionnaires filled out by Science Education students after three meetings. The recapitulation of the results of the student response questionnaires is presented in Table 2.

Based on the data in Table 2, it can be seen that STEM-Inquiry learning using CCR received good and very good (positive) responses from students because it reached a percentage of > 60% with positive and very positive categories. This is indicated by the percentage of students' positive responses to interest in learning that reaches the range of 80%-100% and the novelty of learning reaches the range of 80%-100%. This means that most students feel very interested and very new to learning activities. The percentage of students' positive responses to the ease of learning reaches the range of 60%-80%, meaning that most students easily understand learning activities.

**Table 2**. Student Response to Learning

| Indicator | Percentage (%) | Category |
|---|---|---|
| Interest | 90.7 | Very positive |
| Novelty | 92.0 | Very positive |
| Convenience | 77.5 | Positive |
| Clarity | 89.2 | Very positive |
| Interest | 83.8 | Very positive |
| Evaluation | 82.1 | Very positive |
| Response | 79.3 | Positive |
| Average | 84.9 | Very positive |

The percentage of students' positive responses to the clarity of the application of STEM-Inquiry learning reaches the range of 80% - 100%, meaning that most students feel very clear and are very happy to follow the learning process. The percentage of students' positive responses to the ease of answering test items reaches the range of 60% - 80%, meaning that most students find it easy to answer the items tested. The percentage of students' positive responses to interest in participating in STEM-Inquiry learning reaches the range of 80%-100%, meaning that all students have high enthusiasm in the learning process.

Student responses to the learning tools developed were assessed based on: (1) interest, (2) novelty of learning and the learning process, (3) ease of understanding learning resources, (4) clarity when participating in learning activities, (5) interest in participating in learning, (6) assessment of learning activities, and (7) responses to learning activities. Student response data was obtained through a questionnaire filled out by students at the end of the third meeting. Students fill out the questionnaire individually without any influence from other parties. If students respond positively to the learning that has been done, then this shows that learning is interesting for students and makes it easier for them to understand the material being studied (Aulia et al., 2018; Ural, 2016; Yerizon et al., 2018).

Based on the results of the questionnaire response analysis, students are interested in learning activities and learning tools used with scores in very good criteria. All students stated that they were very interested in the teaching materials and the learning atmosphere in the classroom (Shahali et al., 2017; Struyf et al., 2019). Students are also very interested in the teacher's way of

teaching. This is because the teacher uses the STEM-Inquiry learning model. STEM-Inquiry learning encourages students to seek and use various sources of information and ideas to improve their understanding of problems, topics and issues, so that students do not just answer questions (Kuhlthau, 2015). Students also feel new to the learning process and learning tools used by obtaining scores in very good criteria. The highest score was obtained on the indicators of novelty, namely aspects of the learning atmosphere and the way teachers teach because this is the first time students have received learning accompanied by practical activities so that students are directly involved in the problem solving process. This result is supported by a very good student response to the implementation of STEM-Inquiry learning given by the teacher with a score in very good criteria. In addition, all students feel new to the CCR used because it contains features that were not found on the online platform they used before, including being able to combine traditional classes (face to face) and online classes, free of charge, easily accessible by teachers and participants. Students without the need for registration first, can find out student responses in real-time, and can be used by teachers to form heterogeneous study groups or can also divide study groups according to the interests or views of many students (Means et al., 2016; Roberts et al., 2018).

The ease of students in learning to get a score with a positive category. This is because the instructions for carrying out assignments and instructions for conducting practicals in the CCR are clearly stated. 77.5% of students find it easy to understand the subject matter, this is proven by the test results which show that all students achieve scores in the good to very good category after learning. In general, students can participate in learning activities very well. STEM-Inquiry learning can be said to be successful because the percentage of positive student responses on each indicator reaches a value above 80%. All students stated that the explanation and the way the teacher applied STEM-Inquiry learning was very good. This is supported by data on the implementation of learning in the lesson plans by the teacher who received a good to very good rating. Most of the students (83.8%) stated that they were very interested in participating in STEM-Inquiry learning again at the next meeting. This is because learning is carried out by actively involving students such as in experimental activities and investigating phenomena related to students' daily lives. Students' interest in participating in STEM-Inquiry learning using CCR can increase their motivation to learn, so it is hoped that students' scientific literacy skills will also increase.

The lowest percentage of positive student responses is the ease of answering test items, each of which reaches a percentage of 60% - 80% with good criteria. Students suggested that the teacher give more practice questions before giving the test. The results of the student responses are supported by the percentage of the newness of the test items which reaches 80% - 100%, this means that the students have never worked on the test questions as in the previous meeting. The criteria for preparing test questions refer to higher-order thinking skills, which include questions at the level of understanding (C2) - evaluating (C5) according to Bloom's Taxonomy after revision (Anderson et al., 2001), so students are required to have a high understanding. In addition, test questions are also oriented to contextual problems that exist in everyday life, where students must be able to relate the concepts they have with the problems/phenomena given in the questions (OECD, 2016).

Overall, the STEM-Inquiry learning tools developed were considered practical because they received positive responses from students in the positive to very positive categories. The results obtained are in line with the research of Ural (2016) which shows that there is a positive response from students that effectively improves academic achievement and all aspects of student attitudes.

## Conclusion

Based on the analysis of the research results and the discussion that has been described, it can be concluded that student responses during STEM-inquiry learning activities using CCR on the topic of food loss and food waste are very positive and well received by students. This is evidenced by the average percentage of student response questionnaires on 7 indicators, namely interest, novelty, convenience, clarity, interest, assessment, and responses reaching 80.8% which are categorized as very positive. This means that students have an interest and are interested in engaging in meaningful learning experiences.

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**Author Contributions**

Conceptualization, Ernita Vika Aulia; methodology, Ernita Vika Aulia and Martini; software, Ernita Vika Aulia; validation, Siti Nurul Hidayati and Dyah Astriani; formal analysis, Beni Setiawan; investigation, Ernita Vika Aulia and Martini; resources, Beni Setiawan; data curation, Dyah Astriani.; writing—original draft preparation, Ernita Vika Aulia; writing—review and editing, Martini, Beni Setiawan,

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**Conflicts of Interest**
The authors declare no conflict of interest.

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