The effectiveness of google classroom as a tool to support online science learning: a literature review

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Abstract. The purpose of this article was to investigate the effectiveness of Google Classroom as a tool for support online science learning during pandemic COVID-19 in Indonesia. One of the impacts caused by COVID-19 in the education field is the implementation of online learning in all subjects, including science learning. This condition causes many teachers to use tools for online learning. Google Classroom is one of several tools to support online learning. Based on the literature review, this tool can manage class schedules, provide online and offline communication, share files, create and organize assignments, and provide feedback efficiently. This article also outlines the advantages and disadvantages when organizing online learning using Google Classroom, particularly in science learning.

1. Introduction

The Covid-19 pandemic has hit all countries in the world, including Indonesia. One way to break the chain of spreading Covid-19 is by carrying out restrictions on community interaction that are applied in physical distancing. However, the physical distancing policy can inhibit the rate growth in various fields, i.e., in economic, social, and education. In the education field, the government's policy is moving the teaching and learning process from schools to be at home by applying study from home. Thus, the teachers must try to conduct online learning. Online learning has made transformations in collaborative learning, adaptive learning, and the way in which a teacher function [1]. Thus, the achievement of the online learning process depends on the effectiveness of the interaction and communication that happens during the lesson [2].

There are several platforms to conduct online learning, such as Moodle, Edmodo, Blackboard, SEVIMA EdLink, Schoology, and Google Classroom. From those platforms, one way to conduct online learning in science subjects is using Google Classroom. Google Classroom platform has been accepted by the academic community to improve the quality of online learning. It was launched in 2014 by Google [3]. Google Classroom is designed to make things easy the interactions of teacher-students in online learning. The innovation in this platform delivers opportunities for teachers to explore scientific ideas to students.

Innovations provided by Google For Education aims to help create active learning, effective, efficient, and fun. Google For Education is the most interesting innovation from Google because it is a product created to assist teachers and students in carrying out online learning activities. One of the main functions of the learning process in the new normal era is to make the students actively engage in the

learning process. This process of engagement makes the learning process to be in student-centered, guides them to work together, builds critical and creative thinking, and makes them learn independently.

The purpose of discussing the Google Classroom literature review was to investigate the different ways this platform has been incorporated into online science learning. The following question guide this study is why Google Classroom is an effective tool to support online science learning?

2. Method

This paper is a review of the literature. This review includes published research addressing the effectiveness of Google Classroom as a tool to support online science learning. To investigate this review, we carried out a database search articles (ERIC, Scopus, ISI Web of Science, Springer, and google scholar) related to the effectiveness of Google Classroom in online learning. The flowchart of the method in this review paper showed in Figure 1.

Figure 1. Flowchart of the method

The steps taken to investigate the effectiveness of Google Classroom in online science learning are:

(1) Identified the primary research outcome for each article and arranged the papers accordingly,
(2) Analyzed the features of Google Classroom to support online science learning,
(3) Categorized the studies by looking at the advantages and disadvantages of Google Classroom in each article,
(4) Analyzed the communication interaction among teachers and students in Google Classroom,
(5) Analyzed the reasons why Google Classroom is an effective tool to support online science learning,
(6) Finally, the conclusion is presented in this review paper.

3. Results and Discussion

3.1 Google Classroom Features

Google Classroom is a free online learning platform with various unique functions to facilitate the teaching and learning process. Google Apps for Education (GAFE) launched Google Classroom in 2014 [4]. GAFE is a free suite of hosted communication and collaboration application provided by Google for educational institutions. It features several Web applications with parallel functionality to traditional office suites, including Google Mail, Google Docs, Google Meet, Google Form, Google Drives, and Google Calendar for communication and collaborative study anytime and anywhere [5]. For students

who are blind, they can use the screen reader feature. There are many accessibility features built into the G Suite for Education tools that all work with Google Classroom. Google Classroom features that are integrated with GAFE can be seen in Figure 2.

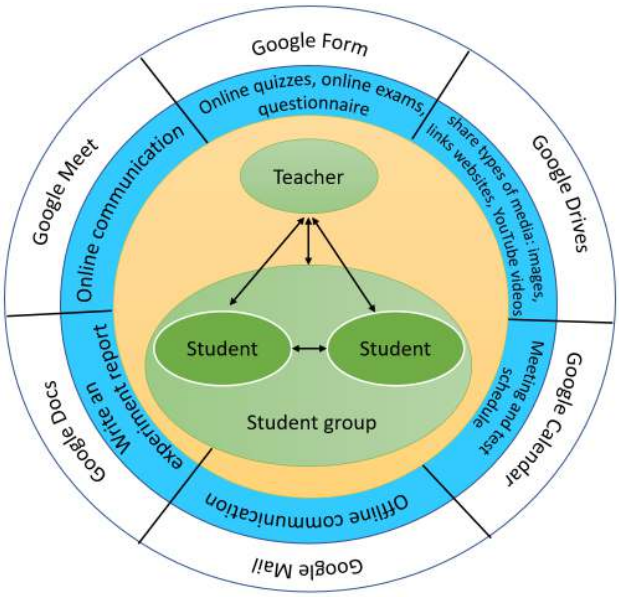

Figure 2. Google Classroom Features

The teacher can use Google Calendar to remind students about meeting and test schedules for science subjects. Google Drive for sharing resources such as images, videos, PowerPoint files, modules, students' worksheets, and students' discussion sheets. This tool also helps science teachers to distribute assignments, collect assignments, and discuss lessons anywhere without boundaries time by using Google Docs and Google Mail. Thus, the students become more independent in understanding science material or assignments given by teachers.

For online communication, the teacher can use Google Meet for discussion about the difficult and complex science concept. Furthermore, the teacher can share files with the students, such as PowerPoint presentations or science learning videos. A spreadsheet tool in Google Classroom can be used to collect student opinions on a students' discussion sheet. Google Classroom can help the discussion activity easier for teachers and students. It makes up for the science online learning process more attractive, more fun, and more efficient in terms of time management.

The characteristic of science learning used practical or laboratory activity. The teacher can not only add guidance to the tasks of laboratory activity in Google Classroom but also attach any necessary file, i.e., video, virtual laboratory software, animation program, visualization program, and simulation program. Furthermore, the teacher can perform online science experiments by using PhET interactive simulation [6], the virtual laboratory programmed Labster [7-8].

Google Classroom could be a tool that encourages collaboration among teachers and students; moreover, the teacher can create and disseminate assignments for students in an online classroom for free. The teacher can use Google Classroom to improve their teaching productivity and meaningful learning by efficiently managing assignments, increasing collaboration, and improving communication. To have class at Google Classroom, teachers should create an account on the website https://classroom.google.com/ and sign up as a teacher.

3.2 The Interaction of Online Science Learning

ICT has been rapidly changing and advancing how educators instruct within the classroom [9]. Furthermore, in this era, students are known as digital natives that seem to absorb the technology innovation in every aspect of their lives. Thus, the students can adapt very quickly when they are introduced to new technology—for instance, using Google Classroom for online science learning to make effective interaction and communication among teacher and students.

One of the most important advantages of using Google Classroom is effective and efficient online communication. Communication is the method of transmitting information from one to another for a specific reason [10]. The communication of science learning process is said to be effective if two-way information flow occurs during the communication interaction, that is, with the emergence of feedback from the recipient of the information. Within the Google Classroom, the interaction of all learning subjects ("student-student", "student-student group", "teacher-student", "teacher-student group"). Figure 3 showed the communication interaction in Google Classroom.

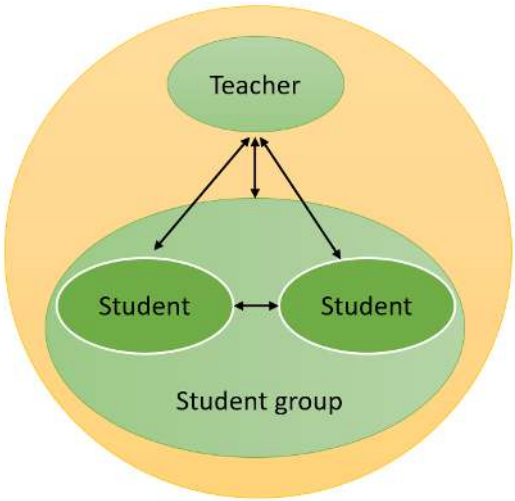

Figure 3. Communication interaction in Google Classroom

Communication between the students could happen in the discussion process. Conditions that can support student's involvement in online learning classrooms are the questions of the discussion, teacher facilitation, and student characteristics [11]. Meanwhile, communication between student and student group occurred when student group presents the experiment activity results. When the teacher gives feedback and responses to a student group who are presenting, there is a process of communication between the teacher and the student group. The teacher distributed documents through Google Classroom. All students can work together on Docs at one time. Then, the teacher used Google Meet to facilitate a short discussion. It can make sure everyone is heard, and it amplifies students' voices. Thus, Google Classroom can make the communication process in online learning similar to the communication process in the classroom.

3.3 Advantages and Disadvantages of Google Classroom in Online Science Learning

Learning Management System (LMS) utilizes various educational technology innovations while offering an infrastructure to empower management of learning contents, collaboration, communication, and assessment [12]. Several LMS has been developed for online learning purposes, but the cost of

server and maintenance is another problem. Thus, Google introduces a tool that helps educators to become more effective in the online learning activity. The use of Google Classroom has many advantages to support online science learning because of the LMS [13]. Before starting the lesson, the teacher and students learn how to use an LMS in the Google Classroom, such as starting activities, accessing online science learning, sending assignments, accessing discussion forums, making evaluation forms, and filling out questionnaires and surveys. The Summary of studies of the advantages and disadvantages of Google Classroom can be seen in Table 1.

Table 1. Summary of studies the advantages and disadvantages of Google Classroom

No	Google Classroom in Online Learning	Studies
	Advantages	
1	Easy to use the platform (share notes, assignments, and announcements)	[1] [14] [15]
2	Google Classroom helps teachers save time	[14] [16] [17]
3	Google Classroom can improve the communication interaction among teachers and students	[18] [19]
4	Google Classroom effectively manage classes with a high number of students	[20]
5	Google Classroom is free and can be used by anyone to open a class as long as they have a Google Mail account	[9]
6	The teacher can upload test and knowing the students' score immediately	[14]
7	Google Classroom can stimulate innovation and creativity in the online learning activity.	[19]
	Disadvantages	
1	The utilize of Google Classroom in the learning process must be supported by computer and the internet	[14]
2	The management system in Google Classroom does not provide automated quizzes and tests for the students.	[16]

Based on Table 1, there are advantages and disadvantages of using Google Classroom for the science online learning process. Using Google Classroom is useful for teachers, students, and parents. Using Google Classroom, a science teacher can create a simple science classroom by sharing the unique class code for students to join the science classroom. The students can learn independently by guidance from the teacher. Students can study new science concepts by active engagement through Google Classroom. Furthermore, students can do the science tasks online everywhere and every time while parents can control the student's activities.

The advantages of using Google Classroom are very beneficial for the learning process, especially science subjects. For instance, Google Classroom can help science teachers manage classes, conducting laboratory activities, and making online tests. Science teachers also can use Google Classroom that combines with Google Drive for assignment distribution, video, and PowerPoint file-sharing, Google Mail for collecting the assignment and science experiments report, and Google Calendar for scheduling the science meeting schedule. For online science learning, Google Classroom is an excellent learning

tool in supporting interactive, fun, meaningful learning with more flexible, conducive, and holistic classroom management, particularly in the laboratory activity. However, Google Classroom will be difficult to be accessed when teachers and students have limited internet signals.

4. Conclusion

The literature review suggests that Google Classroom plays an important role in the online science classroom and science instruction during the pandemic Covid-19 situation. The success of the online learning system is very dependent on several components, including students, teachers, learning resources, internet networks, and information, communication, and technology. Google Classroom can help science teachers manage classes, conducting laboratory activities, and making online tests. Findings from this article showed that Google Classroom is an effective learning tool to support online science learning.

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