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# The Effectiveness of Using Blended Learning in Mathematics Teaching on Algebra

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Abstract

Currently the use of blended learning activities is many used. Even now in high school blended learning has been applied to several subjects. One of the subjects that utilizes blended learning is mathematics. One of mathematics materials in high school is algebra that can utilize blended learning in the delivery of its material. Algebra is one material where most students get low grades. In this paper we will discuss the effectiveness of using blended learning in algebra material high school. The present study is designed to answer the question. We can find the effectiveness of using blended learning. The research field (statistical population) included all available digital and written sources related to the blended learning. The research sample was a purposeful homogeneous sample. It is used to describe the sample that includes information based on the qualitative and the quantitative research goals. This study reviews the literature and provides a scientific background by reviewing some of the contributions made by various researchers and institutions to the concept of blended learning. The results showed that students who used blended learning in algebra learning got better results compared to students who used traditional learning methods.

Key word:

Blended learning, algebra, effectiveness.



## 1. Introduction

Nowadays, distance learning is very common. By using smartphones and internet services that are now more easily accessible, online learning can be accomplished. Another factor that supports the implementation of distance learning is the presence of applications and the web such as Google Classroom, Edmodo, Elena, and others that further facilitate the smooth learning process with this distance method.

A system designed to utilize information technology in teaching and learning activities is blended learning. This system combines traditional learning systems (face to face) with electronic learning (e-learning). This makes it easy for students to repeat lessons outside of school hours. The subject matter can be accessed flexibly, anytime and anywhere. The forms of material offered by this blended learning method are also diverse ranging from videos, images, e-books, simulations in the form of animation, etc. which all require technology and are packaged in a more interesting form so students are more interested in learning the material is compared with only conventional learning in ordinary classrooms.

A number of investigators have assembled a comprehensive agenda of transformative and innovative research issues for blended learning that have the potential to enhance effectiveness (Garrison and Kanuka 2004; Picciano 2009 in Dziuban *et al*, 2018). Generally, research has found that blended learning results in improvement in student success and satisfaction (Dziuban and Moskal 2011; Dziuban *et al*, 2011; Means *et al*, 2013 in Dziuban *et al*, 2018). Therefore, blended learning can be applied to mathematics leaning, especially in algebraic material that many students state it is difficult to understand.

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This is because almost all of the material is abstract mathematics, including algebra itself. Thus as a teacher, she/he must provide an interesting thing for students so that they have an interest in algebra material. With the students' interest in algebra, it is hoped that students can easily absorb the material they receive and implement it in exam questions and in daily life.

### *1.1. Problem Formulation*

Based on this background, the problem can be formulated whether the use of blended learning is effective in algebra learning for high schools, especially for senior high schools.

### *1.2. Goals and Advantages*

Furthermore, the purpose of this study is to determine whether the use of blended learning effectively in learning algebra senior high school. In addition, through this research is expected that the obstacles faced by students can be known when implementing learning using blended learning. The existence of this research is also expected to increase the reader's knowledge about blended learning and can find out the benefits of its use as an algebra learning method in high school.

### *1.3. Literature Reviews*

According to Cobcroft *et al* (in Jeffrey *et al*, 2014) blended learning is a learning strategy that very important for higher education institutions because it integrates physical and virtual components. In traditional learning, sometimes teachers cannot deliver material with manual explanation only, but teachers need physical simulations with the help of technology in the form of virtual outputs which hopefully can help students to understand the material that being studied. Thus, the existence of abstract algebra material in mathematics is expected to be easier for students to understand the material with the help of this blended learning method.

Brooks Kanuka & Saranchuck (in Jeffrey *et al*, 2014) defines bended learning as learning that eliminates time and place but allows for higher quality interactions between teachers and students. This learning model using blended learning is believed to be able to offer students greater affordability compared to online only or face-to-face methods (Jeffrey *et al*, 2014). Blended learning integrates traditional teaching (face-to-face) and online learning has the advantages of each method so that by combining both methods and packaged in a blended learning is able to provide more benefits to the students.

According to Lewis & Parsad (in Dziuban *et al*, 2018) blended learning is a combination of online learning and traditional learning that reducing sitting time students in the classroom. It should be underlined that reducing the sitting time does not mean that it actually makes students understanding of a material decrease even with the presence of blended learning can provide a different flow of thinking that makes it easy for students to understand the material being discussed. Reducing this sitting time also provides a solution for students because of their tired during class which is considered monotonous and boring. Although blended learning is a pioneer of modern instructional technology, its existence will always be tied to contemporary communication technology that is close to the human thought process (Dziuban *et al*, 2018). The point is blended learning will always in line with the times and at the same time be linear with the human thought process. Blended learning describes a process or practice of using hybrid pedagogy to help determine a set of processes and practices that vary in which blended learning pedagogy here as a tactic whereas hybrid strategy (Pandit, 2015).

Blended learning has many advantages, including this method which is very effective to use today where technological advances have been increasingly rapid. Effective means the most appropriate and best to be applied or used. In this case our focus on effectiveness is towards learning mathematics, especially in algebra material in senior high school using blended learning. In an example condition, suppose we have 2 different classes where one class uses the blended learning method while the other class does not use the blended learning method (or traditional method). When the final results of student assessment in a class that uses the blended learning method are higher than other classes, it can be said that this blended learning method is effectively used in algebra learning.

Based on some research above the researcher here will be discussed how the effectiveness of using blended learning is in the learning activity on algebra material in senior high school. Is this effective or not the teacher applied the blended learning in the learning activities also will be discussed in this article.

Many research said that there is an effectiveness of blended learning in learning activity. This article will be conclude in general to the reader.

Ferryansyah *et al* (2018) find some difficulties that experienced by students in learning algebra including that students cannot denote the mathematical symbols (especially in the matter of algebra), students cannot understand the symbol or notation that using logical reasoning, and the difficulty of checking whether notations / symbols that used is correct or not by using the excuse that logical. With this blended learning method, it is expected that these difficulties can be minimized or even eliminated completely. The teacher's ability to provide material packaged in blended learning is also a success factor of the use of blended learning itself.

## 2. Discussion

In research conducted by Gleason (2016), through blended learning students can learn independently by utilizing technology while the teacher remains the main actor in learning. The data collected during this study show no statistical difference between the two learning methods on either immediate or long-term retention of learning.

The implementation of blended learning requires a lot of time in preparation. Whether it's preparing teachers to improve their ability to use online learning tools and in terms of students in adjusting to online learning in blended learning (Gleason, 2016). In this study, the teachers that participate not only teach algebra, which was the concern in research, but also teach two other lessons. This causes significant demand for teachers in preparing themselves to teach with blended learning method.

Although this study found no statistically significant difference in blended learning and traditional methods, this study found the benefits of blended learning. One of the example is blended learning will prepare students for college life. At the university itself, online learning will be used more often. Therefore, with blended learning students will be better prepared and accustomed to online teaching and learning activities. Blended learning also provides a more flexible environment for learning that can be adapted to meet students' needs in content and time.

Another benefit of blended learning is that it is flexible in terms of time and place. The online videos provided can be watched by students according to their time and place. They can also watch and pause the video if they do not understand the material provided in the video.

Whereas in Jeffrey *et al* (2014) discusses blended learning from the teacher's perspective. The journal concludes that teachers oppose the existence of technology in education, but inevitably blended learning develops so quickly that it requires teachers to follow the development of the learning system. Actually this blended learning method offers better results for the education system if it is accompanied by the teacher's ability to prepare teaching instruments in the classroom. But in the end the teacher feels burdened with this method because it requires more time especially to prepare the online learning component in the package of blended learning itself. In other words blended learning provides a double task for teachers because blended learning itself integrates face to face learning and online learning as well. The teacher believes that in teaching and learning activities, between teacher and student, the teacher remains the main actor in the learning process while technology is only a small support.

In the journal Ya-Wen Lin *et al* (2017) application of the method of blended learning in mathematics lesson demonstrate a significant effect on academic achievement, and between male students with female students there is no significant difference in that field. The way students respond to mathematics is also increased because blended learning is considered interesting by students. With the use of blended learning, many students have stated that their interest in mathematics has increased. Thus, blended learning pedagogy shows a significant positive effect on mathematics learning. The reason maybe that in face-to-face learning, students cannot progress at their own pace, so students are required to keep up with the pace of learning of other peers. When each student has a computer and internet access to an e-learning website, they can control their own learning progress without being interrupted by other students. Students can browse as much learning material themselves as possible and repeat the exercises to deepen the material. Work on the online practice will immediately give a score of student work, so students immediately know which parts of the material they have not been understand.

Based on the results of the study of John F. Pane (2014), blended learning with a cognitive tutor system for algebra material is only significant for high school, while for junior high school it did not have

a significant impact. The impact given by the CTA1 (Cognitive Teaching Algebra 1) method is also only felt in the second year in the experiment using the method, whereas in the first year it has not had any effect on students. The impact given is also felt to be able to improve the average performance of students by around 8%.

Blended learning gives impact that is more conservative for student' group step by step (Crawford & Jenkins, 2017). Both the face-to-face and online components need to be complementary and interdependent to be successful (Montgomery *et al*, 2015). In such a context technology should be seamlessly integrated into the instructional design and teaching process. Thoughtful pedagogical planning by a discipline expert is required in order to ensure learning activities are relevant and meaningful. A layer of complexity is added when collaborating in a team teaching capacity as flexibility is required to accommodate different opinions and negotiation of curriculum content, engagement and delivery. While it is recognized that blended learning is a preferred flexible learning option for many students and to an extent thought to relieve budgetary pressure, there is increased time and work load to the academics on the teaching team.

The development and implementation of blended learning and team teaching strategies had positive outcomes on both the learning and teaching in this pre-service methods unit. Students were also able to draw links between the pedagogical approaches taken in the unit to their own developing teacher practice. Students indicated that they were more confident in utilizing team teaching strategies, rather than blended learning in the classroom, there is a clear indication of the valued potential and the willingness to develop these innovative skills and approaches. Two primary roles for the principal emerged: Principal as Technology Leader and Principal as Manager. The primary behaviors were creating and communicating a strong vision as well as creating a plan to sustain the vision. Lastly, the major goals of the principals were to improve student achievement and to provide differentiation for struggling students (Murphy, Corey J., 2017). A significant difference between students' view in relation with blended learning environment as well as online and face to face learning environments. In their answers, students have expressed that they learn more effectively in a blended learning environment (Eryilmaz, 2015)

**Tabel 1.** Some summary of the advantages of blended learning.

| Experts | Statement |
|---|---|
| Jesse Gleason | Students can learn independently by utilizing technology. Blended learning is that it is flexible in terms of time and place. |
| Ya-Wen Lin, *et al*. | Blended learning makes the students interested to learn in mathematics. |
| John F. Pane | Blended learning improve the average performance of students. |
| Eryilmaz | Students have expressed that they learn more effectively in a blended learning. |

## 3. Conclusion

From the literatures mentioned in the discussion points above, it can be concluded that the blended learning method that integrates online learning and face to face is effectively used in algebra learning in high school. This method has its own advantages because of its combination from two methods, online and face-to-face learning. Both of these methods with their respective strengths can overcome the obstacles faced by students when learning algebra. Blended learning can increase students' interest in learning algebra because learning with these methods can be said to be new to them. Blended learning is very flexible, especially in terms of time and place of implementation. Therefore, learning with blended learning is very effective for students to learn algebra.

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