Blended Learning as a Learning Strategy in the Disruptive Era

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Abstract. In this disruptive era, the need of independence and innovation in learning strategy are required. Blended learning strategy offers face-to-face learning and self-study that combined both online and offline. In other words, it is a combination of traditional learning in a classroom and e-learning via disruptive technology device. There are several courses were encouraged to provide e-learning and face-to-face in delivering material in Mathematics Department of Universitas Negeri Surabaya such as Computer Application, Basic Mathematics, Contextual Mathematics, Visual Programming, and Discrete Mathematics. At the end of the semester, we gave the final exam followed by giving questionnaire about students' opinion regarding the blended learning strategy. Positive responses on the application of blended learning were showed by students. Furthermore, the learning result of each courses are above 75. By this condition, blended learning is considered as a way to support students’ learning in the disruptive era.

Keywords: blended learning, e-learning, mathematics, disruptive era

1. Introduction

National education, especially higher education must be in line with the rapid development of Science and Technology at present that called disruptive era. In order to adapt with the disruptive technological progress, the components of higher education such as curriculum, learning activities, facilities and infrastructure on the campus environment are being an effort to master science and technology. The students' mastery of science and technology will equip students with an ability to apply their knowledge in solving problems on various fields of life that are increasingly competitive and full of challenging.

The development of science and technology that is widely used in various aspects of life is Information and Communication Technology (ICT) with internet as its disruptive technology. Likewise in higher education, the need for information cannot be fulfilled without using the ICT. But the basic concept of education is not only teaching and learning but also requires face-to-face activities. In addition, unattended use of the internet can result in unwanted things. In order to overcome these problems there are efforts to combine the delivery strategy of learning using face-to-face activities, offline computer-based learning, and e-learning using internet that known as blended learning [1].

The blended learning strategy is expected to minimize the deficiencies in lectures on higher education that not only to mastery of the material but also how to deliver material using ICT that appropriate to the students conditions.

The Department of Mathematics in Universitas Negeri Surabaya holds some courses that provide e-learning and face-to-face in delivering mathematics material such as Computer Application (http://spada.ristekdikti.go.id/course/aplikasi-komputer-2), Basic Mathematics (https://vi-learn.unesa.ac.id/course/view.php?id=2605), Contextual Mathematics...
In the rest of this paper, we would describe the implementation of those courses using blended learning strategy and the learning outcomes obtained by students.

2. Blended Learning

Blended learning is an instructional methodology that using technology to provide a more personalized approach to learning and to give students control over the time, place, path and pace of their learning[2]. Blended learning is an innovative concept that embraces the advantage of both traditional teaching in the classroom and ICT supported learning including both offline and online learning [3].

2.1. History of Blended Learning

The term of "blended learning" was used first by Conney et. al in 2000 to combine elements of play and work in a prekindergarten [4]. A combination of asynchronous internet-based learning, synchronous learning in virtual tool and face-to-face learning was conducted in military course in 2002 by Bonk et.al. [5].

During 2003-2006 that called Definition period was fullfilled with 1200 articles on defining blended learning [5]. The next period (2007-2009) was observed more articles about blended learning that named as Popularity period [5].

In this decade or in the industrial technology 4.0 there are many articles and practices about blended learning. According to these facts, it can be said that blended learning become more and more learning concept that suitable with learning strategy.

2.2. Feature of Blended Learning

There are many features that can be blended in this concept that includes both traditional teaching and learning supported by ICT, such as [6]:

1. Face-to-face teaching, teachers and students both are able to do direct communication and get feedback immediately.
2. Student interaction with material, student could learn from not only teacher's words as in traditional method but also ICT media learning.
3. Group interaction, although student use e-learning individually, he could meet and discuss together with his classmate.
4. Accessing library, student can get access to digital library besides school library to get more books.
5. Online assessment and practical test, online assessment can make evaluation effective but some skills need to test practically.
6. Tutoring, because of student different needs, the teacher could give special tutoring for slow learner while the other could get it from internet (YouTube) or vice versa.
7. Virtual laboratory, practicing is the best teacher, but if it is very crucial or the school cannot establish, the virtual laboratory is a solution.

2.3. Characteristics of Blended Learning

In advance of apply blended learning, we should find out some characteristics of blended learning [7] such as:

1. Students can select of the two modes, although some teachers decide on the appropriate mode for the material being with. Students get face-to-face interaction as well as they interact in virtual environment. Students gain not only training in life skills but also experience in using technology.
2. Teachers are well provided in both traditional ways or via technology to deliver the material.
3. Physical and supporting equipment is possible with in school or owned by the students.
4. Blended learning has a human touch due to balanced interaction between students, teachers and technology.
3. Learning Strategy in the Disruptive Era

The objective of the Indonesia Higher Education is to enhance the relevancy, quantity and quality of qualified human resources with higher education backgrounds, as well as to empower science, technology and innovation, for improving the national competitiveness [8]. Disruption technology in the era of the 4th Industrial Revolution requires higher education to use competency-based education, the internet of things, virtual system, and artificial intelligence.

Education and work fields should be adjusted into the development of science and technology, but still attention should be given to humanism aspects. In other words, students' old literacy (reading, writing and math) should be strengthened by new literacy (data, technology, and human). The strategy is how to convince students that the new literacy could bring them to a competitive person? [9].

Blended learning strategy could be one of solution in higher education due to numbers of students are increased while lecturers are limited. One lecturer (accompanied by tutor or assistant) could teach a big class or some universities.

The Ministry of Research Technology and Higher Education (Kemenristekdikti) facilitates SPADA (Sistem Pembelajaran Daring), an online learning system in Indonesia [8]. The implementation of SPADA in Indonesia until 2017 can be described in Figure 1.

![Figure 1. The Implementation of SPADA](image)

4. The Implementation in Mathematics Department of Unesa

Universitas Negeri Surabaya (Unesa) has provided an online learning facility funded by an Islamic Development Bank grant with the address vi-learn.unesa.ac.id. Unesa lecturers are encouraged to create e-learning courses and provide opportunities to use online learning for a maximum of 4 times in one semester. In addition, some lecturers use other Learning Management System (LMS) to be used as online lectures, especially as a means to collect assignments.

Some courses that hold blended learning strategy in the Mathematics Department are described below.

4.1. Computer Application ([http://spada.ristekdikti.go.id/course/aplikasi-komputer-2](http://spada.ristekdikti.go.id/course/aplikasi-komputer-2))

This course has been selected as an open subject on SPADA. Although this course is designed for e-learning, however in its implementation at the Mathematics Department of Unesa is still need face-to-face in some certain weeks. The homepage of Computer Application is shown in Figure 2.
The course consist of 15 weeks that given in face-to-face, individually learning in offline and online system. There are some assignments, quizzes, midterm, and final exam as usual. The average scores of them are 78.12, 80.49, 79.2, and 81.37 respectively. The students' responses is more than 80% about: feel actively involved in the teaching and learning process; could integrate new ideas into previously knowledge; cooperatively in share ideas, suggestions, and experiences; enthusiastic to achieve the objectives; feel directed to meaningful learning processes; and get the benefits of the learning delivered.

4.2. Basic Mathematics ([https://vi-learn.unesa.ac.id/course/view.php?id=2605](https://vi-learn.unesa.ac.id/course/view.php?id=2605))
The aim of this course is to analyze the characteristics of mathematics, systems and deductive-axiomatic structures, logic operations, offices, conclusions, sets, relationships and functions. The material is delivered via offline then the discussion is held during face-to-face lecturing and the assignment is given online. The result of this course is carried out by test method and questionnaires. There are more than 90% of 31 students get B, B+, A- or A and the percentage of positive students' responses is more than 80%. Thus, it can be conclude that Basic Mathematics using blended learning has been successful.

4.3. Contextual Mathematics ([https://vi-learn.unesa.ac.id/course/view.php?id=2744](https://vi-learn.unesa.ac.id/course/view.php?id=2744))
This course is developed using ADDIE model. In Analysis phase, it get 40 participants who were computer literate participants so that they could use online learning. Lesson Plan with blended learning system is produced in Design phase. Then in Development phase, the material course is prepared and built an online learning system. The main phase is the Implementation phase that 8 weeks face-to-face meeting while the rest are online learning where students work in group and outside campus. At the end of the course, it held Evaluation phase with the results that all plan are realized. All students are pass this course with average score 81.75 and the students response is very positive.

4.4. Visual Programming ([https://classroom.google.com/c/NDcvNjU3NzU5OFpg](https://classroom.google.com/c/NDcvNjU3NzU5OFpg))
The course was held by Google Classroom, an LMS of Google that could integrated with any features from Google. Actually there is always face-to-face lecturing every week, while the LMS is use for put material that most of them are file code programming and for upload the assignments. The average score of assignments is 78 and all of the students are pass this course. The final task of this course is to make mathematical games which shown some in Figure 3.
4.5. Discrete Mathematics ([https://new.edmodo.com/groups/matematika-diskrit-2017e-26425712](https://new.edmodo.com/groups/matematika-diskrit-2017e-26425712))

This course is one of the hard subjects for mathematics students. It is become one reason to hold Discrete Mathematics in blended learning system using Edmodo that look alike Facebook. Student can interact with other student to solve the given problem or ask to the lecturer about something that they don't understand. Sometimes they just say hello or make a little joke, but it made them comfortable with the learning method. The result of Discrete Mathematics is not good enough but it is better than the previous lectures.

5. Conclusions

The need of information and technology is a must for higher education. The disruptive technology will help students, lecturers, also tutors to select the appropriate learning strategy which fit to them. One solution of these phenomena is blended learning which combine face-to-face lecturing and individually learning both offline and online.

Indonesian higher education could use SPADA or other LMS to hold courses with blended learning strategy. The implementation requires enthusiasm and cooperation between lecturers, students, and assistants also campus managers who provide the facilities and infrastructure.

According to the implementation of some blended learning courses in Mathematics Department of Unesa, it is belief that blended learning strategy could answer the challenges of higher education in the era of disruption.

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