Development Content and Online Discussion Strategy in Blended Learning to Improve Student Mathematical Learning Outcomes

L D P Patni¹, I G P Sudiarta², and I N Suparta³

¹,²,³ Departemen of Mathematics Education, Faculty of Mathematics and Science
Universitas Pendidikan Ganesha, Bali-Indonesia

Email : diahpraba22@gmail.com

Abstract. Content and strategies online discussion have an important role in blended learning, but the content and strategies currently implemented have not been able to contribute optimally. This study aims to identify the characteristics of content and the application of online discussion strategy and describe their quality in terms of validity, practicality, and effectiveness as means to improve students' mathematics learning outcomes. This research is a developmental research with Design Based Research approach. The subject of this research were students of VIII SMP Negeri 1 Mengwi in academic year 2018/2019. Learning outcomes data collected in the form of data understanding students' mathematical concepts and student attitudes in learning mathematics. The data were analyzed descriptively. This research produce blended learning content that meets valid, practical and effective criteria. The content has the following characteristics : 1) Text, containing a summary of the material and focuses on the ability of students to construct their own knowledge. 2) Interactive media, being able to actively involve students in learning abstract concepts with the help of illustrations and visualization. 3) Video links, helping students improve their mathematical skills such as the ability to decrease formulas. 4) Exercises, containing variations in the types of questions and giving students instant feedback. This research also resulted in effective online discussion strategy with the following steps : setting goals for online discussion, preparing role for online discussion, preparing content that facilitates students to learn independently, motivating students to have the confidence to hold discussions, involving teachers to moderate discussions, implementing reward and punishment by giving points and additional tasks respectively to increase positive competitiveness, evaluating by giving online quizzes. Learning outcomes obtained by students have increased, 79.70 in first try out and 82.76 in second try out. Thus, it can be concluded that the quality of content and online discussion strategy have an important role in improving student mathematics learning outcomes.

1. Introduction

Learning innovation by utilizing technology in education one of which is changing conventional learning systems into modern learning systems. Blended Learning model is one of the learning innovations that utilizes the technology. [1] [2] Blended Learning is a combination of online learning and face-to-face learning in an integrated learning activity. The current learning paradigm is student-centered learning. If the delivery of learning only focuses on face-to-face, students will feel bored in learning and lack the time to deliver additional material. Whereas if learning involves information and communication technology students will be motivated to be actively involved in learning. [3] [4]
Blended Learning was developed to integrate the best features of learning in face-to-face class and online class to enhance active independent learning by students. The combination of learning in Blended Learning is believed to have advantages that are more efficient, students become more active, students can review the material at any time anywhere, and are flexible.

However, studies conducted by several researchers involving Blended Learning with different "fusion" have varied impacts and research recommendations. [5] obtain the results of the analysis, a significant difference between students' views in relation to conventional learning environments and mixed learning environments. [6] stated that Blended Learning was not significant to improve student learning achievement. [7] Blended Learning with edmodo applications based on PDEODE learning strategy can improve student achievement. [8] obtained results showing that student performance on traditional learning and blended learning was comparable, but students also reported a high level of interaction with their teacher. From the several studies it can be seen there are differences in the results when implementing Blended Learning, so it is necessary to do a more in-depth study related to problems in the application of Blended Learning.

[9] testing the experience of teachers related to the use of online discussion in Blended Learning, the results they provide advice to improve the effectiveness of online discussion in Blended Learning. [10] in the development of blended e-learning approaches in terms of content design models and pedagogical approach for the teaching and learning of mathematics need to be considered. [11] also conducted research on facilities for successful online discussions, stating that student responses in online discussions were a major challenge. Online learning will continue to grow so practitioners need to pay attention to strategies to facilitate successful discussion in online learning. From the research studies that have been conducted, it is found that there is one online learning facility in Blended Learning that has not been used optimally, namely online discussion. Online discussion is a discussion activity that is carried out in an internet network, online discussion basically adopts a face-to-face discussion learning method but in online discussions students and facilitators are not required to be present in the same place [12]. Several studies have been conducted, found that online discussions can improve student performance and student learning outcomes. [13] online discussions can provide guidelines to help overcome errors in classroom learning and can also increase the range and quality of learning. [14] states that features in online learning, are effective to improving student learning outcomes. [15] online discussion in BLE, contributes to students preparing and confident while learning in face-to-face classes.

There are many positive effects of conducting online discussions related to improving the quality of learning, but several studies provide suggestions for increasing the effectiveness of online discussions so as to provide more optimal contribution related to improving student performance and learning outcomes. This research is an effort to optimize the use of online discussion to support the application of Blended Learning in Mathematics. This study aims to determine the characteristics of content and the implementation of online discussion strategy and describe their quality as an effort to improve student mathematics learning outcomes. The formulation of the problem in this study is as follows: 1) How are the characteristics of content in Blended Learning to improve student mathematics learning outcomes?, 2) How does the implementation of online discussion strategy in Blended Learning that effectively contribute to student mathematics learning outcomes?, 3) How is the validity, practicality, and effectiveness of online content and discussion strategy in Blended Learning to improve student mathematics learning outcomes?.

2. Method
This research is design research development type with Design Based Research (DBR) approach using the development procedure by [16] consists of four stages there are Initial Identification and Analysis Phase, Development Planning Phase, Iterating Cycle Phase, and Reflection Phase. Subjects of this research were students of VIII SMP Negeri 1 Mengwi in academic year of 2018/2019. Specifically, VIII-H class as limited try out, VIII-E class as first try out, and VIII-G class as second try out. Data collected in this study include product validity data, student and teacher satisfaction data.
using the product, data on student mathematics learning outcomes in the form of data understanding students' mathematical concepts and student attitudes in learning mathematics. The data were analyzed descriptively.

3. Finding and Discussion
The product development procedures which carried out in this study refer to the Design Based Research (DBR) approach according to [16]. First phase was done by doing problem analysis and initial identification through a literature review, it was found that most of them provide suggestions for increasing the effectiveness of online classes. This is one of the keys to the successful implementation of Blended Learning, especially in the online discussion feature. Therefore a decision was taken to be able to increase the effectiveness of online discussions by developing content and online discussion strategy. Second phase is designing the chosen solution that is developing content and online discussion strategy in Blended Learning. At this step, the prototype I compiled by the researcher was tested for its validity as a product development requirements. After it has been validated and declared worth using, pre-research is conducted to ensure the readiness of students and teachers. The results in terms of readiness for use, infrastructure, student and teacher responses related to the application of Blended Learning in mathematics learning are declared ready for further testing. Third phase is repetitive and refinement cycles. In this study, iterations were performed 3 times consisting of iteration 1 (limited try out), iteration 2 (first try out), and iteration 3 (second try out). Fourth phase is reflection for each end of the iteration so that improvements will be made for the next iteration. Below are the summary of iteration results.

| Table 1. Summary of Iteration Results |
|---------------------------------------|
| **Iteration** | **Participant** | **The Role of Students in Development Design** | **Main Findings** | **Design Decisions** |
| 1 | Student VIII H class at SMP Negeri 1 Mengwi (n=20) | Students as subjects to see the feasibility of products developed in learning. | • Students don't participate seriously in online discussion which is indicated by asking questions that are easily answered even by their friends.  
• Students expect exercise given before online quizzes. | • Providing motivation and emphasis that learning content is a work to be done and students' understanding of content will be assessed during online discussions. This is one of the strategy to encourage students' confidence in discussions.  
• Adding exercise content for students |
| 2 | Student VIII E class at SMP Negeri 1 Mengwi (n=34) | Students as subjects to see the quality of products developed. | • Statement from students which says "even though we don't understand, the important thing is that we are online"  
• Variations in video content are needed, especially for the steps | • Actual action should be given by giving additional assignments to students who are not serious in online discussions. This is a strategy to bring out positive competitiveness |
in finding the formula.

- Added variations of video link content.

| 3 | Student VIII G class at SMP Negeri I Mengwi (n=34) | Students as subjects to see the quality of products developed. |
|---|---------------------------------------------------|----------------------------------------------------------------|
|   |                                                   | - Some students copy questions and responses from friends. |
|   |                                                   | - Most students get satisfying online quiz results. |
|   |                                                   | - There is a need for active teacher participation during discussions, so that teachers can directly give appreciation and reprimand to students. This is as one of the strategies relating to involving teachers to moderate discussion. |

From the results of the development procedures carried out was obtained Blended Learning content that can be used as a guide by students in online classes, which requires students to study independently. Content that has been developed is:

**Picture 1. Text**

![Command box](image1.png)

**Picture 2. Interactive Media Content**

![Image](image2.png)

Picture 1. It contains the developed text content. This content is not only reading text, but also the text which characterized as a summary of material focused on the ability of students to construct their knowledge. So in this text content, it is equipped with a command box and links to identify further material.
Picture 2. Containing the developed interactive media content. The characteristic of this content is to actively involve students in learning abstract concepts with illustrations. So this content does not seem monotonous for students because students can explore to gain an understanding of the material being studied.

![Lathan balok fix](image)

**Picture 3. Exercise Content**

Picture 3. Containing the developed exercise content. This content has characteristics in the form of instant feedback that students get after answering given exercise. So that it can help students to know the extent of their understanding of the material being studied before taking online quizzes.

This research also produces an effective online discussion strategy to optimize the implementation of online discussions with the following steps.

| Table 2. The Developed Online Discussion Strategy |
|-----------------------------------------------|
| **STEP** | **GOALS** |
| **Step 1:** Setting goals for online discussion | Determining the expected discussion structure so that online discussions will be focused |
| **Step 2:** Preparing role for online discussion | Understanding the purpose of online discussions |
| **Step 3:** Preparing content that facilitates students to learn independently | Providing information in the form of discussion material as a provision for students to learn independently. |
| **Step 4:** Motivating students to have the confidence to hold discussions | Engaging students to be more active in online discussions so that their implementation becomes more effective. |
| **Step 5:** Involving teachers to moderate discussions | Showing students that the teacher is not just an observer. This indirectly encourages students to be actively involved in online discussions. |
| **Step 6:** Emerging positive competitiveness by giving point and additional task | Showing students the benefits and consequences received in doing online discussions, so as to increase interest in being active in it. |
| **Step 7:** Evaluating by giving online quizzes | Students can evaluate their understanding after having a discussion by answering online quizzes. |

Table 2. Containing the developed online discussion strategy. These steps support one another. The main key to a successful online discussion is to generate student interest in engaging in online
discussions. In this research, the fact that positive competitiveness among students is generated by giving real rewards and punishment can increase students’ interest in engaging in online discussions. Products in the form of content and online discussion strategy developed has been tested for validity by involving experts. In the validation process, the validator provides an assessment of the product developed by filling out the validation format which contains several aspects: in accordance with the curriculum applied in schools, characteristics shown by the product in accordance with Blended Learning, and the linkages between various components in the product.

Table 3. Summary of Product Validity Assessments

| Product                | Validator 1 | Validator 2 | Average Score | Criteria |
|------------------------|-------------|-------------|---------------|----------|
| Conten                 | 3,27        | 3,73        | 3,50          | Valid    |
| Interactive Media Content | 3,87   | -           | 3,87          | Very Valid |
| Online Discussion Strategy | 3,17  | 3,50        | 3,34          | Valid    |
|                        |             |             | 3,57          | Valid    |

Table 3. containing the summary of product validity assessments. The results obtained indicate that the average score given by the three experts belongs to the valid criteria. Obtained valid criteria, because the product developed contains characteristics that provide opportunities for students to constructing their knowledge independently and contains the basic competencies that must be achieved in mathematics learning activities, so that the products developed can be used well in learning.

Assessment related to the practicality of the product is done by giving a questionnaire and interviews with students and teachers at the end of the try out.

Table 4. Summary of Student Response Questionnaire Results

| Try Out               | Average Score | Category |
|-----------------------|---------------|----------|
| Limited Try Out       | 2,62          | Practical|
| First Try Out         | 3,09          | Practical|
| Second Try Out        | 3,21          | Practical|

Table 5. Summary of Teacher Response Questionnaire Results

| Try Out               | Average Score | Category    |
|-----------------------|---------------|-------------|
| Limited Try Out       | 3,17          | Practical   |
| First Try Out         | 3,42          | Practical   |
| Second Try Out        | 3,58          | Very Practical |

Content and online discussion strategy developed received positive responses from teachers and students. Table 4, indicated the average score of student response questionnaire on limited try out, first try out, second try out which categorizes as practical. While in table 5, indicated the average score of the teacher's questionnaire response on limited try out and first try out which categorize as practical, on second try out which categorize as very practical. A more accurate response related to the practicality of the product, researcher obtained from the results of interviews with students.
Table 6. Student Interviews Results about Products

| Researcher | How do you respond about the content provided? |
|------------|-------------------------------------------------|
| Student    | There are many variations, so learning does not feel boring, so it is more interest for learning. Access is also easy to learn at any time. |

| Researcher | What is your response to the online discussion being implemented? |
|------------|-------------------------------------------------------------------|
| Student    | Jadi memahami kalau sharing itu penting sehingga lebih mengerti materinya, bertanya dengan teman dan guru juga jadi mudah. |

| Researcher | How do you respond to the content provided to facilitate your independent learning? |
|------------|----------------------------------------------------------------------------------|
| Student    | Very helpful, because the delivery is clear, easy to understand and so there is no difficulty when studying alone. |

Table 6. containing results of interviews with students. Obtained information that the products are practical that are used by students due to the wide-variety content, interesting display content, and accessible content which can be accessed anywhere and anytime. This finding is supported by studies of [5] and [17] which are conducted relating to the application of BL. They found that BL makes it easy for students to access learning material anytime and anywhere. Meanwhile, according to the teacher’s view, the content and online discussion strategy adopted can support the implementation of online learning in Blended Learning and increase student interest in learning. The implementation of online discussions at BLE is very helpful in developing independent learning attitudes for students [15]. The availability of online discussions that can be a general forum for building students’ initial cognition before face-to-face meetings. It is very potential to build more effective learning and focus in improving student learning performance.

The effectiveness of the product in this study was obtained by collecting data on students 'affective learning outcomes through observation sheets and data on students' cognitive learning outcomes through mathematics learning outcomes tests. Obtained Results that the product developed in this study can be said to be effective, because it is able to achieve the specified learning goals. In this case, it can improve student learning outcomes in the cognitive and affective domains. The increasing is indicated by the acquisition of students' cognitive learning score on limited try out, first try out, second try out are 76,60; 79,70; and 82,76. While the results of observation obtained an average score of affective learning outcomes of students are 75, 25 which classified as good; 81,75 classified as very good ; and 83,5 classified as very good. There are several things that support the effectiveness of the products being developed including (1) the provision of written online discussion impacts on the implementation of more targeted discussions and minimize students doing things that are not expected, (2) The interestingly content appearance that is different from other content so that students’ interest in learning increases. (3) The variety of content facilitates students in independent learning, (4) Teacher involvement in online discussions and the use of punishment and rewards as an online discussion strategy. This result is supported by research findings of [15] that content can help teachers develop more effective learning activities and supports student independence by reflecting the comfortness felt by students when they have to study independently through online learning sessions. [18] found that the instructor can enhance online discussion by providing positive and direct feedback to facilitate Blended Learning. [19] the students’ responses were positive to BLTV, students were more enthusiastic and motivated. They were also braver and more independent in stating their opinions or difficulties during online discussion. [20] the right strategy in online classes can overcome the difficulties of starting blended learning activities related to low student interest when engaging in online discussion.

This research produces blended learning content that can facilitate students to learn independently and effective online discussion strategy to increase students' interest in being actively
involved in online discussions which has an impact on improving student mathematics learning achievement. Thus, it can be concluded that the quality of content and online discussion strategy are the important roles in improving student mathematics learning outcomes.

4. Conclusion
This research succeeded in developing products in the form of content and online discussion strategy in Blended Learning that are valid, practical, and effective and has characteristics that distinguish it from other content and online discussion strategy.

The content developed consists of: text, interactive media, video link, and exercises. Each of these contents has mutually supportive characteristics. This diversity of content is able to provide students with an initial understanding of the material presented and facilitate students to learn independently.

In addition, this research also developed an effective online discussion strategy. The online discussion strategy adopted was able to increase students’ interest in engaging in online discussions and make students aware of the benefits of online discussions.

References
[1] A. T. Hilliard, ‘Global Blended Learning Practices for Teaching and Learning, Leadership and Professional Development.’, *Journal of International Education Research*, vol. 11, no. 3, pp. 179–188, 2015.
[2] M. P. Prasetio, M. E. Najoan, A. S. Lumenta, and A. M. Rumagit, ‘Perancangan dan Implementasi Content Pembelajaran Online Dengan Metode Blended Learning’, *Jurnal Teknik Elektro dan Komputer*, vol. 1, no. 3, 2012.
[3] S. Kantun and R. S. ASP, ‘Implementasi Blended Learning Untuk Meningkatkan Kreativitas dan Hasil Belajar Pada Mata Pelajaran Ekonomi Peserta Didik Kelas Xi Ips-2 Sman 5 Jember Semester Gasal Tahun 2015/2016’, *Jurnal Pendidikan Ekonomi: Jurnal Ilmiah Ilmu Pendidikan, Ilmu Ekonomi dan Ilmu Sosial*, vol. 9, no. 2, 2016.
[4] N. Vaughan and D. R. Garrison, ‘Creating cognitive presence in a blended faculty development community’, *The Internet and Higher Education*, vol. 8, no. 1, pp. 1–12, Jan. 2005.
[5] M. Eryilmaz, ‘The Effectiveness of Blended Learning Environments.’, *Contemporary Issues in Education Research*, vol. 8, no. 4, pp. 251–256, 2015.
[6] N. Orabuchi, ‘Department Of Family Sciences College Of Professional Education’, p. 229, Dec. 2013.
[7] N. E. Ekawati, ‘Application of Blended Learning with Edmodo Application Based on PDEODE Learning Strategy to Increase Student Learning Achievement’, *FRM*, vol. 8, no. 1, Apr. 2018.
[8] N. P. Napier, S. Dekhane, and S. Smith, ‘Transitioning to blended learning: Understanding student and faculty perceptions.’, *Journal of Asynchronous Learning Networks*, vol. 15, no. 1, pp. 20–32, 2011.
[9] F. Kalelioğlu and S. Akbaba-Altun, ‘Experiences of pre-service teachers in case based discussion groups in blended learning environment’, *Turkish Online Journal of Qualitative Inquiry*, vol. 3, no. 3, pp. 15–32, 2012.
[10] J. B. Umoh and E. T. Akpan, ‘Challenges of Blended E-Learning Tools in Mathematics: Students’ Perspectives University of Uyo’, *JEL*, vol. 3, no. 4, p. p60, Nov. 2014.
[11] K. Woods and K. Bliss, ‘Facilitating Successful Online Discussions’, vol. 16, p. 17, 2016.
[12] Y. Yuberti, ‘Online Group Discussion pada Mata Kuliah Teknologi Pembelajaran Fisika’, *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, vol. 4, no. 2, pp. 145–153, 2015.
[13] E. Javadi, J. Gebauer, and N. Novotny, ‘Comparing Student Interaction in Asynchronous Online Discussions and in Face-to-Face Settings’, *Information Systems Education Journal*, vol. 15, no. 3, p. 64, 2017.
[14] D. Djuniadi, ‘Fitur Motivasi Pembelajaran Online dengan Pendekatan Pre-defined Set’, *Jurnal Pendidikan Vokasi*, vol. 2, no. 1, 2012.

[15] I. M. G. Sukawijaya and I. G. P. Sudiarta, ‘Developing blended learning environment to improve learning performance and self-reliance for junior high school students’, *Journal of Physics: Conference Series*, vol. 1040, p. 012030, Jun. 2018.

[16] J. A. Herrington, S. McKenney, T. C. Reeves, and R. Oliver, ‘Design-based research and doctoral students: Guidelines for preparing a dissertation proposal’, p. 10, 2008.

[17] M. Fazal and M. Bryant, ‘Blended Learning in Middle School Math: The Question of Effectiveness’, p. 16, 2019.

[18] A. P. Rovai, ‘Facilitating online discussions effectively’, *The Internet and Higher Education*, vol. 10, no. 1, pp. 77–88, Jan. 2007.

[19] D. M. Apsari, Ig. P. Sudiarta, and I. G. P. Suharta, ‘The Effect of Blended Learning Using Tutorial Video towards Problem Solving Ability Reviewed of Students’ Logical Intelligence’, vol. 7, no. 79, p. 4, 2018.

[20] H. Kanuka and L. Rourke, ‘Using Blended Learning Strategies to Address Teaching Development Needs: How Does Canada Compare?’, *Canadian Journal of Higher Education*, vol. 43, no. 3, pp. 19–35, 2013.