

THE EFFECTIVENESS OF THE APPLICATION OF BLENDED LEARNING TO SUPPORT THE PROFESSIONALISM OF MATHEMATICS LECTURERS

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Abstract:

Investigations about the effectiveness of the application of blended learning today have been widely studied from the perspective of students. However, there is still little literature and findings on the effectiveness of blended learning in improving the professionalism of lecturers, especially in the field of mathematics. Furthermore, to support the implementation of blended learning, we use the Google Classroom application. Therefore, this study aims to investigate and describe the effectiveness of the application of blended learning to improve the professionalism of mathematics lecturers which includes dimensions of knowledge, beliefs, and attitudes. We used an Action Research design with one group post-test, where data were taken with several classes and the same treatment to achieve the research objectives. We involved two lecturers in the mathematics education study program with 34 students enrolled in the lecture. Furthermore, the research procedure includes three stages, namely preparation, implementation, and filling out data collection instruments. We used descriptive statistical analysis to obtain research objectives in the form of obtaining average scores, maximum values, minimum values, and standard deviations. Finally, the analysis results show: (1) the lecturer's knowledge is in the high category, (2) the lecturer's confidence is in the active category for each meeting, and (3) the expected attitude of lecturers in blended learning is in the positive category, so it can be concluded that the application of blended-learning is effective in improving the professionalism of mathematics lecturers.

Keywords: Linear Function, Mathematics Game, Conceptual Understanding, ADDIE

EFEKTIVITAS PENERAPAN BLENDED LEARNING UNTUK MENDUKUNG PROFESIONALISME DOSEN MATEMATIKA

Abstrak:

Penyelidikan tentang efektivitas penerapan blended learning saat ini, telah banyak dikaji dari sudut pandang mahasiswa. Akan tetapi, masih sedikit literatur dan temuan tentang keefektifan blended learning bagi peningkatan profesionalisme dosen, khususnya di bidang matematika. Selanjutnya, untuk mendukung pelaksanaan pembelajaran secara blended, kami menggunakan aplikasi Google

Classroom. Oleh karena itu, penelitian ini bertujuan untuk menyelidiki dan mendeskripsikan keefektifan penerapan blended learning untuk meningkatkan profesionalisme dosen matematika yang mencakup dimensi pengetahuan, keyakinan, dan sikap. Kami menggunakan desain penelitian Action Research dengan one group post-test, dimana data di ambil dari beberapa kelas dengan perlakuan yang sama untuk mencapai tujuan penelitian. Kami melibatkan dua dosen pada program studi Pendidikan Matematika dengan 34 mahasiswa yang terdaftar di perkuliahan tersebut. Selanjutnya, prosedur penelitian mencakup tiga tahapan, yakni persiapan, pelaksanaan, dan mengisi instrumen pengumpulan data. Kami menggunakan analisis statistik deskriptif untuk memperoleh tujuan penelitian berupa perolehan skor rata-rata, nilai maksimum, nilai minimum, dan standar deviasi. Terakhir, hasil analisa menunjukkan: (1) pengetahuan dosen berada pada kategori tinggi, (2) keyakinan dosen berada pada kategori aktif untuk setiap pertemuan, dan (3) sikap dosen yang diharapkan dalam blended learning berada pada kategori positif, maka dapat disimpulkan bahwa penerapan blended-learning efektif dalam meningkatkan profesionalisme dosen matematika.

Kata Kunci: Fungsi Linear, Game Matematika, Pemahaman Konseptual, ADDIE

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INTRODUCTION

Lecturers in the field of mathematics face challenges in modifying teaching during this pandemic. Where they try to integrate learning with pedagogical and technological aspects. Another challenge relates to an effective distance learning process at elementary, secondary, and tertiary levels. Lecturers often experience limitations in supporting their professionalism to face learning challenges during the pandemic. The development of studies on distance learning in mathematics education is a relatively new field of study. Several findings explain that the implementation of distance learning has the potential to change the classroom to face-to-face learning. Blended learning is one of five trends that represent current and future learning activities (Goos, O'Donoghue, Ni Riordain, Faulkner, Hall, & O'Meara, 2020). Therefore, there is an opportunity to develop lecturers' professionalism through distance learning via blended learning.

The extensive development of blended learning has opened up opportunities for lecturers to be involved in the learning process. This is

because blended learning is a large-scale distance learning method, free and can be accessed by anyone and wherever they are in the world. Apart from that, blended learning can utilize Google Classroom which aims to increase connectivity and facilitate interaction between teachers and students or interaction between lecturers and students (Hollebrands & Lee, 2020). This shows that blended learning is in the external domain that supports the learning process, while the knowledge, beliefs, and learning practices are in the professional hands of the lecturers. Therefore, blended learning is a recommendation in efforts to improve learning because blended learning media can be a partner or can complement conventional learning in the classroom.

Several research studies recommend lecturer professional development designs that support distance learning. Professional development for lecturers in distance learning causes changes in learning practices (Luebeck, Roscoe, Cobbs, Diemert, & Scott, 2017; Renninger, Cai, Lewis, Adams, & Ernst, 2011). When lecturers are supported by an online learning community, they tend to be successful in implementing pedagogical strategies (Herrington, Herrington, Hoban, & Reid, 2009). Therefore, in designing professional development three important things are needed (Qian, Hambrusch, Yadav, & Gretter, 2018), namely: (1) using activities that are appropriate to the educator's background and experience; (2) aligning activities with the curriculum; and (3) using design to increase lecturer involvement. Furthermore, Powell and Bodur (2019) explained that when lecturers are involved in online classes, six aspects are needed to assess their professionalism, namely: relevance, authenticity, usefulness, collaboration, interaction, reflection, and context. All of this literature emphasizes that the professional development of lecturers in distance learning must use the content of the material that needs to be taught, carry out planning, understand student work results, and reflect on student experiences. From the findings of previous research, there is still little investigation into how the implementation of designs concluded by previous literature influences lecturers' unfamiliarity with blended learning. Next, we use the lecturer professional development model according to Hollebrands and Lee (2020) especially for the personal domain, namely: (1) knowledge; (2) belief; and (3) Attitude. For this research, we recommend blended learning as a support for distance learning that can improve knowledge, beliefs, and attitudes. Apart from that, blended learning contains discussion forums that allow them to be involved in reflecting on the learning process (Taranto &

Arzarelo, 2020). For us as researchers, blended learning is an opportunity in the learning process, so, naturally, we try to ask about the learning design needed to support distance learning.

Combining the various advantages of internet-based, multimedia-based learning and the use of mobile technology (mobile learning) with face-to-face learning is ultimately expected to increase students' creativity. Blended learning has been proven to be effective in improving the quality of learning outcomes. However, most research results examine its effectiveness from the student's perspective (Helgevold & Moen, 2015; Hew & Cheung, 2015; Luebeck, Roscoe, Cobbs, Diemert, & Scott, 2017). Meanwhile, from the teacher's perspective, such investigations are very rare.

In the last two years, lecturers have been required to design and offer online lectures through blended learning. This learning is designed based on the Connected Professional Development Model based on Clarke and Hollingsworth (2002), which contains the personal domain (knowledge, beliefs, and attitudes), the external domain (stimuli), and the practical domain (experience). Therefore, based on exposure and references from previous research, we are interested in filling the research gap regarding the effectiveness of implementing blended learning to improve the professionalism of mathematics lecturers. This research contributes to a new paradigm regarding lecturers' perspectives in blended learning.

METHOD

This type of research is action research. Action research is a form of investigation that improves a condition that participates in it. The research aims to investigate the effectiveness of implementing blended learning to improve the professionalism of mathematics lecturers. This analysis includes data regarding the assessment of lecturers' professionalism regarding the implementation of blended learning. The research design used is one group post-test, where data is taken from several classes and the same treatment is used to measure the effectiveness of blended learning for mathematics lecturers.

This research was carried out with a natural cycle process of action research with only one cycle as proposed by Kemmis and MC Taggart. The subjects of this research involved 2 lecturers who taught linear programming and Islamic mathematics courses with a total of 34 students enrolled in the class. Next, blended learning lecture content was developed in the form of

lecture presentation slides, learning slides that were uploaded before the lecture started, assignments for students, chat rooms that were monitored while students were attending lectures, and learning tutorials (videos). Furthermore, to support the implementation of blended learning, an application is needed, namely Google Classroom.

This research uses three main indicators to measure the effectiveness of the application of blended learning, namely: (1) the knowledge dimension, (2) the belief dimension, and (3) the attitude dimension. These three aspects are a reference to assess the effectiveness of the application of blended learning for lecturers. As for data collection instruments, the ones used are (1) questionnaire sheets that measure learning design to measure the knowledge dimension; (2) questionnaire sheets of lecturer belief in the process and usefulness of blended learning to measure the belief dimension; and (3) lecturer questionnaire sheets on the implementation of student learning and activities during the application of blended learning to measure the attitude dimension. Furthermore, to test the validity of the instrument, validation is carried out by experts in the field of mathematics education to assess the instrument that has been designed. Validity and reliability tests are also performed on each item.

The knowledge dimensions are measured based on: (1) the ability to analyze student needs and learning planning in the Blended learning model; (2) the ability to implement blended learning models in the classroom; and (3) the ability to develop evaluation tools and conduct assessments through blended learning models. The belief dimension is measured based on: (1) ease of application of the blended learning model; and (2) insights into the application of blended learning models. Then, the attitude dimension was measured based on: (1) responses related to the implementation of the blended learning model in the classroom; (2) a comparison between blended learning models and other models; and (3) the ease and difficulty experienced by students during the application of the blended learning model.

The procedure in this research consists of 3 stages, namely: (1) Preparation stage, including initial analysis to determine content in blended learning, designing blended learning content for each meeting, preparing presentation slides using Google Classroom for students, and preparing data collection instruments. (2) Implementation stage, includes conveying to students about the learning that will be implemented during lectures, filling in blended learning content on Google Classroom, carrying out the lecture

process using blended learning and utilizing Google Classroom, and filling in data collection instruments to assess the effectiveness of blended implementation learning in class based on data collection instruments. (3) Data collection stage. Next, the data collected was analyzed using descriptive statistical analysis in the form of average scores, maximum scores, minimum scores, and standard deviation.

RESULT AND DISCUSSION

1. Description of Research Participants

Based on research data, 2 lecturers and 34 students participated in collecting research data. First, the two lecturers selected are lecturers who are categorized as professionals and have been nationally certified. Second, the 34 students who participated in the research were registered in semesters IV (24 students) and VI (10 students) and were taking classes in the Discrete Mathematics course. They were initially used to taking part in face-to-face learning. Therefore, the two lecturers are trying to implement blended learning in this class. They need 3-4 meetings to familiarize students with virtual face-to-face learning using the Google Classroom platform (for reading lecture material) as an independent study space and Zoom meetings as a virtual face-to-face study room.

Furthermore, in this research, we use three main indicators to measure the effectiveness of implementing blended learning, namely: (1) the knowledge dimension involves a questionnaire that measures learning design with blended learning given to lecturers; (2) the belief dimension involves a questionnaire that measures the belief and usefulness of blended learning for lecturers; and (3) the attitude dimension involves a questionnaire that measures the implementation of blended learning and student activities during the implementation of blended learning, which is given to lecturers and students in the form of response questionnaires. These three dimensions are a reference for assessing the effectiveness of implementing blended learning for lecturers.

2. Lecturer Learning Design with Blended Learning

The lecturer's learning design with blended learning is measured using a questionnaire that measures the dimensions of the lecturer's knowledge regarding the learning being implemented. The research results are shown in the following table.

Table 1. Lecturer Responses regarding Dimensions of Knowledge about Blended Learning

Knowledge Dimensions	Questionnaire Items	Average Lecturer Response
Lecturer's ability to analyze student needs and plan learning in the Blended learning model	1, 2, 3, 4, 5, 9	Agree
Lecturer's ability to implement the blended learning model	6, 8, 11, 13, 14, 15, 16, 17, 18	Agree
Lecturer's ability to develop evaluation tools and carry out assessments through the blended learning model	7, 10, 12	Agree

Based on the table above, it was found that the average response from lecturers who participated in the research was agree. First, lecturers can analyze students' needs when they apply the blended learning model, namely: (1) needs related to teaching materials (materials and multimedia that will be used); (2) learning environment; (3) supportive learning activities. The aim of this needs analysis is to enrich the learning process in the classroom and improve the quality of learning. The analysis of student needs in learning stimulates lecturers to develop better learning plans. This planning includes (1) visual material content; (2) tasks; and (3) learning strategies. The purpose of this learning planning is to ensure that the teaching and learning process carried out in the classroom runs more effectively.

Second, the next aspect of lecturer knowledge is being able to implement the blended learning model in class. In this sense, lecturers can optimize the duration of time in class, where students are allowed to listen to the material they will study via the Google Classroom platform. This shows that students are allowed to study independently before and after the implementation of the blended learning model. Next, the duration of time students complete assignments also plays a role in implementing this model. In this case, when implementing it in class, the lecturer only needs 45 minutes to reconfirm the students' knowledge regarding the material being studied. The next 45 minutes are used by students to discuss directly (via face-to-face) or online (via Zoom meeting, or learning management system platform). Then the remaining time is used by students to complete independent assignments in the form of quizzes and assignments.

When implementing learning, lecturers can collaborate between blended learning methods, techniques, and models. In other words, lecturers involve discussion methods, independent assignment techniques, and learning directly and virtually in class. Apart from that, lecturers can also apply learning approaches and methods by considering individual differences in the class. Furthermore, the use of the blended learning model can certainly enrich the knowledge and skills of lecturers to focus on the areas being studied and also update the learning processes and phases in the classroom. This shows that through blended learning, lecturers can find solutions to problems by structuring, updating, and connecting content with classroom learning.

Third, the next aspect of lecturer knowledge is the ability to develop evaluation tools and carry out assessments through the blended learning model. So, lecturers can develop appropriate assessment tools in implementing blended learning. This assessment tool includes quizzes and student assignments at each meeting. Apart from that, most lecturers know about managing learning by implementing the blended learning model in the classroom. In other words, lecturers need to show that three aspects are important to develop, namely: (1) lecturers need to analyze student needs and plan learning in the Blended learning model; (2) lecturers must be able to implement the blended learning model in class; and (3) lecturers must be able to develop evaluation tools and carry out assessments through the blended learning model.

Lecturers need to analyze student needs and plan learning, implement blended learning models, and develop evaluation and assessment tools. The needs of students before implementing blended learning certainly need to utilize technology, including utilizing student learning styles (video, audio, kinesthetic), using video, quick feedback, or discussion classes (Hew & Cheung, 2015; Osguthorpe & Graham, 2003). Apart from that, learning planning certainly supports the success of the blended learning model, where in this research learning content that is of interest to students is first prepared and adapted to their learning style, for example, video presentations, textbooks, presentation slides, assignments, and discussions. This planning is an important point in implementing learning and of course has an impact on students during the learning process (Hollebrands & Lee, 2020).

3. Lecturers' Confidence in the Process and Benefits of Blended Learning

Lecturers' confidence in the process and benefits of blended learning was measured through a questionnaire. The research results show two dominant aspects influencing lecturers' beliefs during the implementation of the blended learning model, namely: (1) ease of implementing the blended learning model; and (2) insight into the application of the blended learning model. The results of this research are shown in the following table.

Table 2. Lecturer Responses to Process Beliefs and Usefulness of the Blended Learning Model

Dimensions of Belief	Questionnaire Items	Average Lecturer Response
Ease of implementing blended learning	1, 4, 7, 9, 10, 11, 12, 14	Agree
Increasing insight into the blended learning model	2, 3, 5, 6, 8, 9	Agree

Based on the table above, it was found that the average response from respondents was in the agreed category. This shows that lecturers show a positive response towards confidence in the process and use of the blended learning model. Furthermore, the results of this research were tested using an analysis of the validity and reliability of the instrument. The results found were that 14 questionnaire items were categorized as valid. Furthermore, based on the results of the reliability test, it was found that the data showed high reliability with a Cronbach's alpha value of 0.879. This shows that the instrument shows high reliability.

Lecturers' beliefs regarding the process and usefulness of the blended learning model show two aspects. First, lecturers' confidence in the ease/flexibility of implementing the blended learning model. This shows that they consider integrating the blended learning model in the classroom to be quite easy. From the aspect of flexibility, this is because the participating lecturers are lecturers who have integrity in developing learners and are still of productive age.

Second, lecturers' confidence in increasing insight in the blended learning model. In this case, the blended learning model provides an idea about the importance of integrating lesson material with students' daily lives. This has the impact of enriching lecturers' knowledge regarding content that

will be used in class, both directly (offline) and virtually (online/face-to-face), thereby encouraging students to study independently on the Google Classroom platform. In other words, the use of the blended learning model has a positive impact in terms of presenting lesson material. Furthermore, lecturers' confidence in increasing insight in the application of blended learning allows lecturers to get the opportunity to connect the concepts being studied and the relationships between these concepts.

The flexibility in implementing the blended learning model is due to the lecturers' qualifications and productive age. This makes it easier for lecturers to combine online and face-to-face learning so that students find it easy to access material and improve the quality of learning (Helgevold & Moen, 2015). Furthermore, the implementation of the blended learning model minimizes student anxiety in studying the material, where the lecturer has prepared all the material to be studied on the Google Classroom platform (for example, video presentations, textbooks, presentation slides, material presentations, and assignments). In this case, the overall content prepared by lecturers can encourage students to learn actively (Luebeck, Roscoe, Cobbs, Diemert, & Scott, 2017). Apart from that, students are allowed to study independently for a relatively long time, so that students can prepare at the right time to complete the assignment.

4. Student Responses During the Implementation of Blended Learning

Student responses regarding the implementation of blended learning were measured using a response questionnaire. The research results found that in general. Students support the implementation of the blended learning model during and after the Covid-19 pandemic. This is shown in the following table.

Table 3. Student Responses to the Application of the Blended Learning Model

Response Dimensions	Items	Average response
Implementation of the blended learning model	1, 6	Agree
Comparison of the blended learning model with other models	2, 7, 8	Agree
Ease and Difficulty of implementing the blended learning model	3, 4, 5	Agree

The research results show that students gave a positive response to the implementation of the blended learning model, namely: (1) the implementation of the blended learning model was effectively implemented during the pandemic; (2) the blended learning model is better than other learning models during the pandemic; and (3) the blended learning model makes it easier for students to understand the material. This finding is in line with the opinion of Martinez, Guinez, Zamora, Bustos, and Rodriguez (2020) that blended learning has become a reference for learning during the pandemic for students because of the various activities that can be carried out when implementing this learning, students are also allowed to complete various assignment models. Another finding is that blended learning can help students determine a comfortable position and conditions for studying when they study online (Helgevold & Moen, 2015). Furthermore, the blended learning model can facilitate students' three learning styles (visual, audio, and kinesthetic), making it easier for them to learn and understand the subject matter.

Next, students provided a comparison between the blended learning model and other learning models, where most students thought the blended learning model was better. This is because the blended learning model saves students' costs and time, where they can use the remaining time for other activities. Apart from that, the blended learning model makes it easier for students to manage their time between work, study, and other activities. Furthermore, the material obtained in classes that use the blended learning model has more diverse material, for example learning videos and e-books. Then, through the blended learning model it can help students to determine a comfortable position and conditions for studying. The results of this research show that students prefer face-to-face learning compared to online learning. This indicates that there is a tendency for students to meet directly with lecturers, where they can have time to ask questions about things they do not understand about the material being studied. However, for the post-pandemic situation, the use of the blended learning model is still being considered in the learning process. This is because students can flexibly decide whether to take classes face-to-face or online. For example, students can arrange their study schedule with other activities.

Third, students think that the blended learning model makes it easier for them to understand the lesson material. This is due to the variety of material that students receive, for example, video presentations from lecturers

which can be viewed at any time, making it easier for students who study audio to understand the material. Meanwhile, for students whose learning type is visual, this learning is also facilitated, where they get lecturer presentation materials, teaching presentation slides, and books. Furthermore, students whose learning type is kinesthetic will also benefit from this learning model by learning face-to-face via Zoom meetings. When viewed in terms of obstacles, the main obstacles faced by students who are network-constrained have been overcome by providing material on the Google Classroom platform, where they can complete assignments, read material, and discuss according to the time they spend studying. Thus, it was found that the three aspects of student responses to the implementation of the blended learning model contributed to the implementation process, comparison with other models during the pandemic, and convenience for students. This shows that the blended learning model has a positive impact on students.

5. Effectiveness of Implementing Blended Learning for Lecturers

Analysis of the effectiveness of implementing blended learning was carried out by assessing the dimensions of student knowledge, confidence, and responses. From the knowledge aspect, it was found that on average they had high knowledge of the application of the blended learning model, where lecturers carried out: (1) analysis of student needs and planning of the blended learning model; (2) implementation of the blended learning model in the classroom; and (3) developing evaluation and assessment tools. From the aspect of confidence, it was found that the average lecturer's confidence in implementing the blended learning model was in the high category, where lecturers were more flexible in implementing the model and increased insight into its application. In terms of student responses, it shows that on average students gave a positive response to the implementation of the blended learning model, where students gave a good assessment of the implementation, comparison with other models, and considerations for post-pandemic learning. This is by the data in the following table.

Table 4. Dimensions of Application of the Blended Learning Model

Dimensions of Lecturer Knowledge	Average rating
Lecturer's ability to analyze student needs and plan learning in the Blended learning model	High
Lecturer's ability to implement the blended learning model	
Lecturer's ability to develop evaluation tools and carry out assessments through the blended learning model	
Dimensions of Lecturer Confidence	Average rating
Ease of implementing blended learning	High
Increased insight into the blended learning model	
Student Response	Average rating
Implementation of the blended learning model	Positive
Comparison of the blended learning model with other models	
Ease and Difficulty of implementing the blended learning model	

These results indicate that the application of the blended learning model can increase lecturer professionalism when viewed from the dimensions of knowledge, confidence, and response of students involved in the class. The blended learning model offers the opportunity to deconstruct traditional learning. During the COVID-19 pandemic, this model has certainly become a reference in the learning process (Borba, Askar, Engelbrecht, Gadanidis, Llinares, & Aguilar, 2016; Cevikbas & Kaiser, 2020). The blended learning model provides an experience for lecturers to restructure the learning process by utilizing technology for synchronous and asynchronous learning. At the same time, the blended learning model is seen as effective in facilitating increased student understanding in class (Martinez Guinez, Zamora, Bustos, & Rodriguez, 2020). This is because this learning model combines direct, virtual, and face-to-face interaction and encourages individuals to work independently (Goos, O'Donoghue, Ni Riordain, Faulkner, Hall, & O'Meara, 2020). This shows that the blended learning model can integrate appropriate instructional methods involving lectures, discussions, and other independent activities (Hew & Cheung, 2015).

CONCLUSION

Based on the research results, it can be concluded that: the blended learning model is effective in increasing lecturer professionalism based on knowledge, confidence, and student responses. This can be seen from the lecturers' knowledge regarding the management of blended learning an average of high knowledge regarding the application of the blended learning model, where lecturers carry out: (1) analysis of student needs and planning of the blended learning model; (2) implementation of the blended learning model in the classroom; and (3) developing evaluation and assessment tools. Furthermore, the average lecturer's confidence in the process and usefulness of the blended learning model is categorized as high, where lecturers are more flexible in implementing the model and increasing insight into its application. Then, students gave a positive response to the implementation of the blended learning model, where students gave a good assessment of the implementation, comparison with other models, and considerations for post-pandemic learning.

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