

The effectiveness of mDPBL as a multimedia-based learning approach.

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Suggested Citation:

Winarno, S., Andono, P.N., Muthu, K.S. & Ling, L.S. (2021). The effectiveness of mDPBL as a multimedia-based learning approach. *Cypriot Journal of Educational Science*. 16(5), 2946-2955
<https://doi.org/10.18844/cjes.v16i6.6479>

Received from August 11, 2021; revised from October 28, 2021; accepted from December 05, 2021.

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Abstract

This study is aimed to investigate students' perceptions towards the mDPBL approach as a multimedia-based learning approach. mDPBL approach is a combination of two different teaching approaches (i.e. DIA and PBL) with multimedia. Two departments were selected in this study (i.e. Informatics Engineering and Information System). The survey was divided into two phases, pre-survey and post-survey. 276 students participated in this study. The quasi-experiment method was used with two different ways teaching strategies (i.e. traditional and mDPBL approach). The study revealed that the majority of students have a positive impact on positive learning outcomes in the mDPBL approach. A significant increase in students' perceptions of the effectiveness of the mDPBL approach is proven by an increase in the average score of students' perceptions and perceived effectiveness of 2.67 points or 8.71%, respectively.

Keyword- Multimedia, Traditional approach, mDPBL approach

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1. Introduction

Universities today are in transition from a traditional approach to a more effective learning approach. Most universities have found multimedia as a more effective learning of teaching (Basaran, 2015). Multimedia has become feasible in integration into the teaching process. According to Neo and Neo (2001), multimedia has enhanced teachers' and students' interaction in the teaching and learning process. Teaching has been influenced with multimedia to help teachers and students learn effectively using various media and the internet (Rias & Zaman, 2013). Multimedia learning is changing the way teachers communicate with their students. With multimedia learning, they communicate and circulate information more effectively. According to Prinou and Halkia that the way teachers communicate information to students is an important change in the educational system. Multimedia can make the courses more interesting, effective and interactive (Prinou & Halkia, 2003). In addition, multimedia has improved students' understanding and interest (Nugraini, 2013). Suleman at all added that teachers need to utilize multimedia (e.g. texts, animation, graphics, sound, and video) to make courses more interesting, effective and interactive (Suleman at all., 2011). Previously, teachers' presented theories and concepts using a single text-based media as learning material (Neo & Neo, 2001).

Instructional design (ID) is used in an educational lesson to achieve learning objectives. ID includes instructional material and teaching approach. Multimedia as an instructional material makes learning more interesting. Nugraini (2013) and Ossai-Ugbah (2012) state that students' interest has improved through the usage of multimedia.

Besides, the teaching approach is an essential activity to achieve education goals (Roger, 2003). According to Edge and Richards (1993), the components of the teaching process are teachers and students. In other words, a teaching process is an approach that includes activities involving teachers and students in achieving learning objectives. Several studies revealed that one of the teaching approaches is the Direct Instruction Approach (DIA) (Flynn at all., 2012; Guses at all., 2015). Most of the researchers stated that DIA is teacher-centered rather than student-centered, in which a teacher delivers the instruction to students who are not required to respond (Rich at all., 2005). Most university follows a DIA (Vinay & Rassak (2015). Unfortunately, DIA is a traditional and monotonous approach. The study by Lu and Cowei and Jones (2008) showed that 66% of the respondents stated that the monotonous teaching approach has caused boredom and passive students, and 53% wanted to be more active in the teaching process. Then, the DIA approach causes low problem-solving skills (Choi at all., 2014). Delivering a lecture using DIA causes high lecture dependence. Teacher-centered activities cause limited students' engagement to develop ideas. Therefore, innovation is required to improve students' engagement in current teaching.

According to Leary (2012), DIA is teacher-centered approach. The instruction is based on the teacher's activities that the teacher presents the theory to a passive audience of students. A teacher-centered approach is different from a student-centered approach. The instruction in a student-centered approach is based on student's activities.

As of today, the teaching and learning process of Dian Nuswantoro University (DNU) adopts the DIA. There are forty to forty-five students in one class with one lecturer. The lecturer teaches theoretical syllabus through lectures using verbal communication and whiteboard as a media. Moreover, the theory of the subject is taught in face-to-face instruction and sequenced deliberately. Lecturers delivering instructions to passive students can cause a high dependence on them. Teacher-centered activities cause the lack of students' engagement (Choi at all., 2014; Lu at all., 2008; Vinay & Rassak, 2015). mDPBL framework was selected to overcome the disadvantages of the current

teaching. The mDPBL teaching approach is a combination of teaching approach (i.e. DIA and PBL approach) with the utilization of multimedia learning (Winarno at all., 2018). Therefore, in this research, the students' perceptions of the effectiveness of the mDPBL approach an multimedia based learning approach is studied. The mDPBL teaching approach was designed and developed as an alternative approach for effective teaching in a multimedia-based learning activity.

1. Methods

2.1. Participants

The participants in this study consist of all fifth-semester students (N=276) from the Informatics Engineering and Information System departments of the Computer Science Faculty, DNU, Indonesia. Both of these departments are relevant for this research because of the inherent Computer Networks subject. This research applied a quasi-experimental approach. Two ways of teaching strategies were conducted, the Direct Instructional Approach (DIA) and teaching and learning through mDPBL approach. The DIA Method was participated by 140 students, while mDPBL approach was participated by 136 students. In addition, 5 lecturers participated in this study.

2.2. Design of Class Activity

Two ways of teaching strategies were conducted, the DIA approach and mDPBL approach. The teaching strategies covered the content of Computer Networks (i.e. routing) in both control and experimental groups. The conducted study length was sixteen weeks. The multimedia learning software was included in the Online Learning System (KULINO) provided by Dian Nuswantoro University web so that it could be accessed or downloaded directly by lecturers and students. The survey was divided into two phases, pre-survey and post-survey. The pre-survey was conducted to find the baseline data. Then, at a later date, post-survey was conducted to gather final information after certain treatments were applied.

2.3. mDPBL Framework and Activity Development

The teaching process of DNU was tested using mDPBL approach. It was designed as an alternative approach in a multimedia-based learning activity. The mDPBL approach framework is described in this following Fig 1

Based on Fig. 1, it describes the steps in the mDPBL approach. In Fig. 2, the activities in the mDPBL approach are implemented in four main activity stages. The first is introduction and identification. The lecturer divides students into small groups. Then, the lecturer presents concepts and theories using multimedia equipment. The groups might meet the problem and identify it. In the second stage, a real problem definition and solution are produced. The third stage is evaluation and conclusion. In this stage, groups present work reports and lecturers explain the conclusions of concepts and learning goals. In the fourth stage, learning outcomes are produced in the form of attitudes, interests, knowledge, and problem-solving skills from students. In fact, the implementation of the four stages of mDPBL is presented in Fig. 3 and Fig.4.

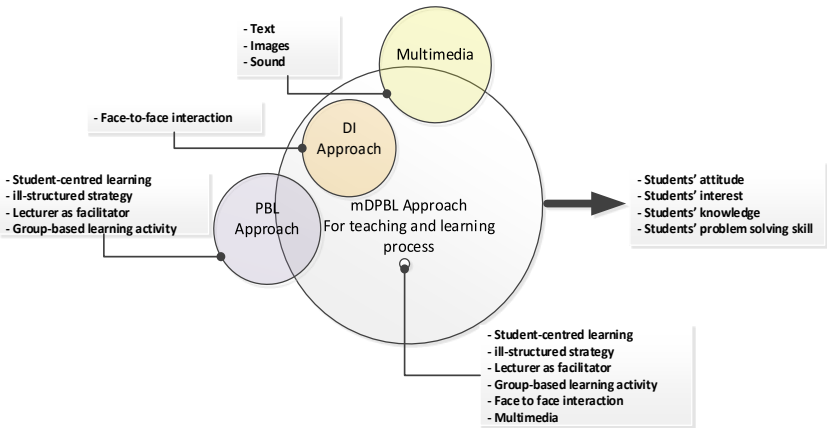


Fig. 1. mDPBL approach framework

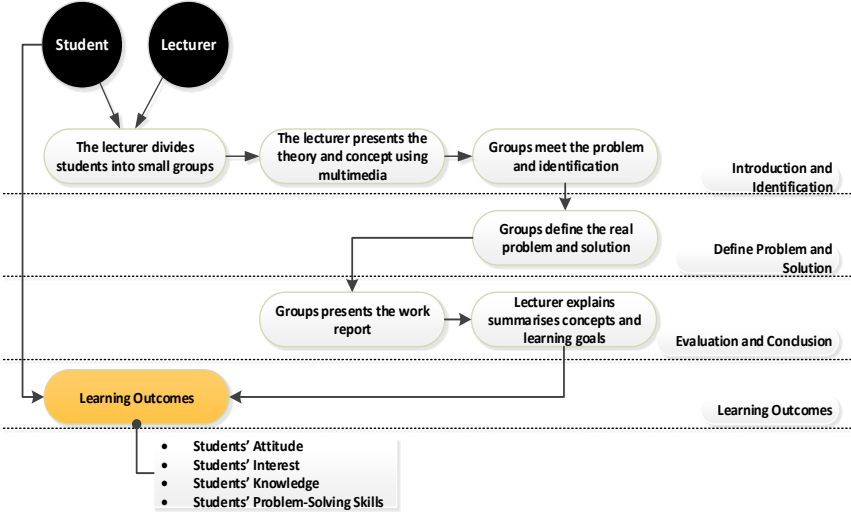


Fig. 2. Four main phases of the mDPBL approach

Fig.3 depicts mDPBL approach activity. Students are divided into small groups. The teacher presents the learning content using multimedia learning. The groups then presents the work report.



Fig. 3. mDPBL approach activity

Fig.4 depicts the contents of multimedia for Computer Networks subject such as the main menu, routing concept, types of routing, and algorithm of routing.



Fig. 4. Computer Networks learning contents

2.4. Data Analysis

This study used several approaches for analyzing the data collected, such as the Reliability and Validity Test, Test of Normality, Frequency and Descriptive Analysis, and T-test Analysis. Standardized questionnaires to determine the students' perceptions of the effectiveness of the mDPBL were administered before and after learning activities. Frequency and Descriptive Analysis and T-test Analysis were employed to compare the baseline measurements of the dependent variables between the two groups using five criteria for evaluation according to the Likert scale.

3 Results

The evaluation survey was to determine the students' perceptions and perception of the effectiveness of the mDPBL approach. The survey result of this study is summarized from experiment groups.

Table 1 shows a summary of the statistical analysis from the perception in the pre-and post-test. There are nine questions used and each question is a 1 to 5 points scale. The result of this analysis is the perception of mean score, respectively: $N=136$, $\bar{x}(S.D.) = 34.22 (3.01)$ of the pre-test and $N=136$, $\bar{x}(S.D.) = 36.88(2.83)$ of the post-test. The mean score difference between each test was 2.67 while the significance value is $p=.000$. The result shows that there is a significant difference in the

level of perception in the pre-and post-test of the experiment group as the $p = .000$ ($p < .05$). A significant increase in students' perceptions of the mDPBL approach is evidenced by an increase in the average score of students' perceptions of 2.67 points or 8.71%.

Table 1. The Independent Sample t-Test of Students' Perception

Variables	Mean	SD	t-test for Equality of Means			
			t	df	Sig. (2-tailed)	Mean Difference
Perception	34.22	3.01	7.47	266	.000*	2.67
Pre-Test	36.88	2.83				
Post-Test						

* Significant at $p < .05$

Fig 5 depicts a graph of the interaction in the means of perception toward mDPBL approach in each test of the experiment group. It shows that there is an interaction between the levels of perception in the experimental group. It illustrates a lower mean score in the pre-test than post-test. The results indicate the increase in students' perception toward mDPBL approach.

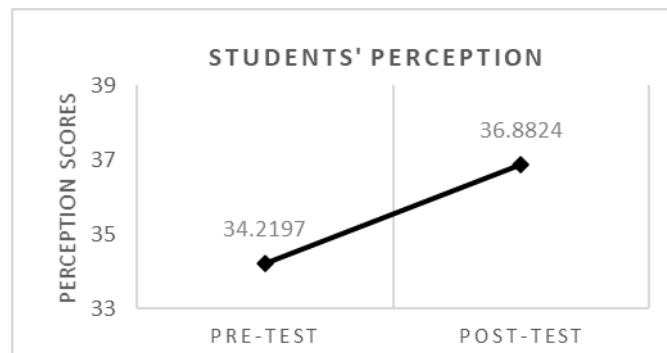


Fig. 5. Students' perception of mDPBL approach

Table 2 shows a summary of the statistical analysis from the effectiveness of the pre-and post-test. There are ten questions used and each question is a 1 to 5 points scale. The result of this analysis is the effectiveness mean score respectively: $N=136$, $\bar{x}(SD) = 37.36$ (2.59) of the pre-test and $N=136$, $\bar{x}(SD) = 40.02$ (3.29) of the post-test. The mean score difference between each test was 2.67. The significance value is ($p=.000$). The result shows that there are a significant difference in the level of perception in the pre-and post-test of the experiment group as the $p = .000$ ($p < .05$). Positive learning outcomes are significant in terms of students' perceptions of the effectiveness of the mDPBL approach. The students' average score perceived the effectiveness of 2,67 points (8,71%).

Table 2. The Independent Sample t-Test of Students’ Perceived Effectiveness

Variables		Mean	SD	t-test for Equality of Means			
				t	df	Sig. (2-tailed)	Mean Difference
Perceived effectiveness	Pre-Test	37.36	2.59	7.36	266	.000*	2.67
	Post-Test	40.02	3.29				

* Significant at $p < .05$

In Fig 6, a graph of the interaction in the means of effectiveness with the mDPBL approach is presented for each experimental group. It indicates that there is an interaction between the effectiveness of the experimental group. It illustrates that the average score of the post-test is superior to that of the pre-test. The results showed an increase in the perception of the effectiveness of the mDPBL approach.

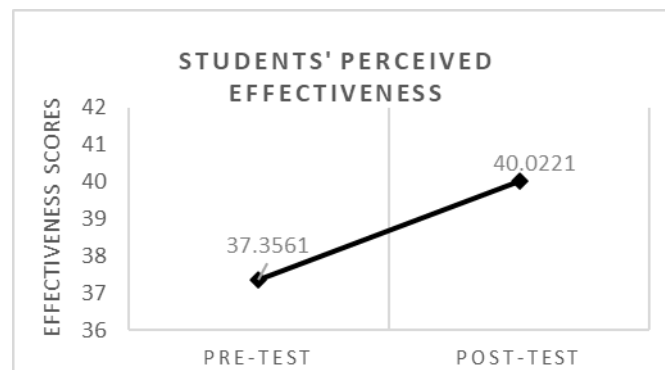


Fig. 6. Students’ perceived effectiveness toward mDPBL approach

4 Discussions and Limitations

Learning to use multimedia as teaching materials can increase students' interest in learning and make the learning process more interesting (Nugraini, 2013; Ossai-Ugbah, 2012). In this study, in one of the subjects, namely Computer Networks, the researcher applied the mDPBL approach. The mDPBL approach is a multimedia-based learning approach which is designed as an alternative approach to effective teaching.

Before using the mDPBL learning approach, it appears that students' perceptions of Computer Networks learning have a lower response. However, there is a significant increase after the mDPBL approach is applied. It is proven by the results of the pre-test on the experimental group students which showed similar perceptions and perceived effectiveness in Computer Networks learning. Then, after using the mDPBL approach, there were numerous positive responses to the experimental group of students during the post-test. Therefore, it was proven that the perception and perceived effectiveness of the mDPBL teaching approach were better. This result is similar to Suleman at all (2011) that multimedia enhanced students’ perception toward teaching and learning process.

In this study, there were several limitations that can be identified. The mDPBL was defined as a combination of teaching approaches (i.e. DIA and PBL) that includes multimedia learning. The mDPBL approach was designed to increase students' attitude, interest, knowledge as well as to increase the lecturer's role as a facilitator. In addition, it was designed to build problem-solving skills. This study was limited in terms of the animated content on topics in the multimedia learning for Computer Networks subject. The animation lessons only consist of routing topics. Those topics are learned by students from the third-year or fifth-semester students who have taken Computer Networks for the first time. Secondly, this study is also limited in terms of the student group as participants. It was based on high Computer Networks achievement. Lastly, this study had limitations in terms of the research samples, which were restricted to only two departments at the Dian Nuswantoro University, Indonesia.

5 Conclusions

mDPBL is a learning approach developed on the basis of DIA and PBL. It is enhanced on a multimedia basis. In this study, mDPBL was designed as a multimedia-based learning approach to make effective teaching on Computer Networks subject. The findings obtained in this research are that students' perceptions of Computer Networks learning have a low response before using the mDPBL learning approach with the experimental group. Based on this, it can be said that the experimental group students showed similar perceptions and perceptions of the effectiveness of the Computer Networks mDPBL teaching approach on the pre-test. Furthermore, a positive response was generated in students' perceptions and perceived effectiveness after the mDPBL approach was applied. This indicates that the experimental group students showed better perceptions and perceptions of the effectiveness of the mDPBL teaching approach than the experimental group in the post-test.

Almost all students have a positive impact on learning outcomes for the mDPBL approach. A significant increase in students' perceptions and perceptions of the effectiveness of the mDPBL approach is evidenced by the increase in the average score of students' perceptions and perceived effectiveness of 2.67 points or 8.71%, respectively. Students who initially felt that Computer Networks learning, particularly in routing, was ineffective, received higher effectiveness ratings after using the mDPBL learning approach for group learning. This increase was positive result from the use of the mDPBL teaching approach, especially in multimedia lesson in Computer Networking subjects. Therefore, the mDPBL approach was designed as a multimedia-based learning approach to make effective teaching.

6 Acknowledgements

This research was supported by DNU. The authors hold in high regard for our colleagues from DNU and MMU who provided insight and expertise that greatly assisted this research.

References

Basaran, B. (2015). Students' aptitude to edutainment. *IECT. Procedia-Social and Behavioral Sciences* 176, pp.772-778. <https://doi.org/10.1016/j.sbspro.2015.01.539>

- Winarno, S., Andono, P.N., Muthu, K.S. & Ling, L.S. (2021). The effectiveness of mDPBL as a multimedia-based learning approach. *Cypriot Journal of Educational Science*. 16(5), 2946-2955 <https://doi.org/10.18844/cjes.v16i6.6479>
- Choi, E., Lindquist, R., & Song Y. (2014). Effect of Problem-Based Learning vs Traditional lecture on Korean nursing students' critical thinking, problem-solving, and self-directed learning. *Nurse Education Today*, 34, pp.52-56. <https://doi.org/10.1016/j.nedt.2013.02.012>.
- Edge, J., & Richards, K. (1993). *Teachers develop teacher research: Papers on classroom research and teacher development*. Oxford: Heineman International. https://julac.hosted.exlibrisgroup.com/prime-explore/fulldisplay?vid=CUH&docid=CUH_I721390461340003408&lang=en_US&context=L
- Flynn, R. J., Marquis, R. A., Paquet, M. P., Peeke, L. M., & Daubry, T. D. (2012). Effects of individual direct-instruction tutoring on foster children's academic skills: A randomized trial. *Children and Youth Services Review*, 34, pp.1183-1189. <https://doi.org/10.1016/j.childyouth.2012.01.036>
- Guses, A., Dogar, C., & Gunesm K. (2015). A New Approach for Learning: Interactive Direct Teaching Based Constructivist Learning (IDTBCCCL). *Procedia-Social and Behavioral Sciences*, 197, pp., 2384-2389. <https://doi.org/10.1016/j.sbspro.2015.07.296>
- Leary, H.M. (2012) "Self-Directed Learning in Problem-Based Learning Versus Traditional Lecture-Based Learning: A Meta-Analysis". All Graduate Theses and Dissertations. 1173. <https://digitalcommons.usu.edu/etd/1173>
- Lu, T. N., Cowie, B. & Jones, A. (2008). Senior high school student Biology learning in interactive teaching. *Research Science Education*, Vol. 40, pp. 267-289. <http://dx.doi.org/10.1007/s11165-008-9107-8>
- Neo, M., & Neo, K. T.K. (2001). Innovative teaching: Using multimedia in a problem-based learning environment. *Educational Technology & Society* 4 (4), ISSN 1436-4522. https://www.researchgate.net/publication/26392247_Innovative_Teaching_Using_multimedia_in_a_problem-based_learning_environment
- Nugraini, S. H. (2013). E-audiovisual for teaching and learning biology in Indonesia senior high schools. Dissertation, Multimedia University. <https://scholar.google.co.id/citations?user=st26Uv8AAAAJ&hl=en>
- Ossai-Ugbah, N. B. Ogunrombi, S. A. & Ameh, I. O. (2012). Motivating use of audio-visuals in a Nigerian technological University library. *Journal of Educational and Social Research*. Vol.2.No. 1. <https://www.richtmann.org/journal/index.php/jesr/article/view/11791>
- Prinou, L. & Halkia, K. (2003). Images of "cell division" on the internet [Online]. Available: http://cblis.uniza.sk/cblis-cd-old/2003/4.PartC/Papers/Visualization_of_science_ideas/Prinou.pdf.
- Rias, R.M., & Zaman, H.B. (2013). Looking at the Effects of Various Multimedia Approach in Student Learning: A Case Study. ICUIIM, January 17-19, Kota Kinabalu, Malaysia. <https://dl.acm.org/doi/10.1145/2448556.2448583>
- Rich, K. S., Keim, R. G., & Shuler, C. F. (2005). Problem-based learning versus traditional educational methodology: a comparison of preclinical and clinical periodontics performance. *Journal of Dental Education*, 69(9), pp.649-662. <https://pubmed.ncbi.nlm.nih.gov/15947211/>
- Rogers, P. L. (2003). *An Overview of Teacher-Designers: How Teachers Use Instructional Design in Real Classrooms*. Bemidji State University. <http://teachinginterchange.org/astute/downloads/EncyclopediaVol1.pdf>
- Suleman, Q., Aslam, H. D., Sarwar, S., Shakir, M. M. N. & Hussain, I. (2011). Effectiveness of educational technology in teaching chemistry to secondary school students in khyber pukhtunkhwa (Pakistan). *American Journal of Scientific Research*. Issue 41. 2011, (pp. 115-131). *Euro Journals Publishing, Inc.* https://www.researchgate.net/publication/275966911_Effectiveness_of_Educational_Technology_in_Teaching_Chemistry_to_Secondary_School_Students_in_Khyber_Pukhtunkhwa_Pakistan

Winarno, S., Andono, P.N., Muthu, K.S. & Ling, L.S. (2021). The effectiveness of mDPBL as a multimedia-based learning approach. *Cypriot Journal of Educational Science*. 16(5), 2946-2955 <https://doi.org/10.18844/cjes.v16i6.6479>

Vinay, M., & Rassak, S. (2015). A technological Framework for Teaching-Learning Process of Computer Networks to Increase the Learning Habit. *International Journal of Computer Applications*,117(4). <https://doi.org/10.5120/20539-2904>.

Winarno, S., Muthu, K. S., & Ling, L. S.(2018). Impacts of mDPBL Approach towards Computer Networks Teaching and Learning Process. *International Journal of Emerging Technologies in Learning*. Vol.13, No.3, pp 207-215. DOI: [10.3991/ijet.v13i03.7944](https://doi.org/10.3991/ijet.v13i03.7944).