Implementation of the blended learning approach in lathe machining learning

To cite this article: B S H Purwoko *et al* 2020 *J. Phys.: Conf. Ser.* **1700** 012032

View the article online for updates and enhancements.

Implementation of the blended learning approach in lathe machining learning

B S H Purwoko[1], T Sukardi[1], D Rahdiyanta[1], C T Harjanto[1], and D Saputra[1]

[1] Department of Mechanical Engineering Education, Universitas Negeri Yogyakarta, Indonesia

E-mail: bambang_shp@uny.ac.id

Abstract. The purpose of this research is to conduct an empirical study to analyze the influence of the aspects related to the application of the blended learning approach and individual student characteristics, especially origin school, on learning outcomes of Lathe Machining. This research is a Quasi Experiment using the Treatment by Level design. The research data analysis was conducted using 2-way ANOVA with one treatment variable and one attribute variable. This research was conducted at the Machining Workshop, Department of Mechanical Education, Faculty of Engineering, Universitas Negeri Yogyakarta. The results of this study indicate; 1) The learning outcomes of students who take learning using the Blended Learning approach are higher than students who take learning using the conventional approach; 2) There is an interaction effect between the learning approach and the origin of the school on learning outcomes of Lathe Machining; 3) The learning outcomes of students from vocational high schools who take blended learning approach are higher than students from vocational schools who take conventional approaches; 4) The learning outcomes of senior high school students who take learning with the blended learning approach are not different from those from vocational high school students who take the conventional approach.

1. Introduction

Efforts to improve the quality of education, especially the quality of learning, and learning outcomes cannot be separated from the teacher, and learning strategies are factors that have a significant effect on students [1]. The learning outcomes achieved by students are a reflection of the success of education, which has a direct effect on the issue of educational efficiency, both internal efficiency and external efficiency. Internal efficiency is an analysis that compares students who have succeeded in achieving goals, and students who have not succeeded in achieving predetermined learning goals. Meanwhile, external efficiency is comparing the qualifications of graduates produced by an education system, with the number and qualifications of graduates required by the world of work [2].

Regarding the issue of internal and external efficiency, especially the efficiency of educational programs for prospective vocational teachers in the field of mechanical engineering, we have made observations over the last three years of learning in the Lathe Machining course at the Department of Mechanical Engineering Education, Faculty of Engineering, Universitas Negeri Yogyakarta. The Lathe Machining course is typical in the Mechanical Engineering study program. This course provides the necessary experience so that students can have the competence to operate a lathe. This competency is one of the competencies in the field of mechanical engineering, which is much needed by the machining industry.

Learning Lathe Machining, there are still many college students who operate lathes not according to the correct procedure [3]. Students' concern for the maintenance of the tools and machines they use during practice also lacks so that several engine and equipment components have been damaged. Students' meticulousness and diligence are still lacking; this is known from the workpieces of practical results, most of which have deviant dimensions, beyond the defined deviation size limits. Apart from

some of these weaknesses, it is also known that in cognitive abilities, 75% of students are still in the low category. This can be seen from the Work Preparation Sheet prepared by students. They had difficulty determining the cutting parameters of each practice task they had to perform.

The results of the two preliminary studies on learning the practice of Lathe Machining show that there are still problems in the practice of learning machining, especially the practice of Lathe Machining. Lathe Machining lessons that begin with a brief explanation and demonstration of essential competencies in the workshop (shop-talk) are continued with direct practice on machines, still often lead to misconceptions for most students. This causes students to lack self-confidence and is not fully able to compile a Work Preparation Sheet. Only a small proportion of students in a group who actively work on assignments and actively interact with lathes, other students because they lack self-confidence and feel inadequate, tend to be passive and wait for more for examples from their friends in completing turning practical tasks.

Successful learning requires that the content, speed, techniques, and learning approaches are chosen must be adjusted to the capacities, interests and uniqueness of students [4]. Capacity as a manifestation of the ability of students is individual. It is manifested through various aspects of different biopsychological potentials that are used as information processors that can develop to solve problems, creating works that are useful for their environment [5].

In order to create unlimited interaction between students and learning resources (shop-talk material), it is necessary to learn Lathe Machining applying multiple models of instruction. Multiple models of instruction are the practice of connecting and applying two or more different models to one unit or one learning program [6]. Lecturers choose two or more different learning models depending on the learning objectives, to be used in tandem in a learning unit or program.

Lathe Machining Subject, in which there are two groups of learning objectives, namely goals that contain more cognitive aspects, and goals that contain more skills aspects. The Lathe Machining course weighs three practical credits of a mandatory pass with a minimum score of C [7].

The knowledge that students must have regarding technical knowledge of lathe operation, such as techniques for sharpening chisels and installing chisels on lathes, taper turning techniques, screw-turning techniques, knurling techniques, workpiece clamping techniques, and techniques for working a workpiece (product). Technical knowledge is conveyed to students before practical activities on the lathe, namely during the short explanation stage in the workshop (shop-talk) and demonstration (demonstration). Students acquire skills to operate a lathe through practical practice operating a lathe to make a machine component. Exercises include turning the outside such as turning the shaft and shaft neck, tapering, threading and knurling, and inside turning.

Learning outcomes are the acquisition of learning abilities as indicated by changes in the ability to remember, and in understanding [8] [9] [10] [11]. Lathe Machining learning outcomes are defined as the abilities obtained after students follow the Lathe Machining course, which is indicated by; (a) cognitive test scores, covering memory, understanding, and application of basic knowledge of turning, which include sharpening techniques and chiselling on lathes, tapering techniques, thread turning techniques, knurling, and turning parameters; (b) the workpiece (product/machine component) assessment score resulting from training in lathe operating skills. The learning outcomes of Lathe Machining, namely the competence to operate a lathe, are determined from the sum of the test scores of the two competency elements, each of which is a test score for the basic knowledge of turning techniques (weight 35%), and the work object assessment score of the product from the skills training to operate a lathe (weight (weight). 650%).

Blended learning combines online learning and face-to-face learning, combining two or more delivery media (modalities), is used to describe a solution that combines several different delivery methods or media [12] [13] [14] [15]. Blended learning is also used to describe the learning process that mixes various activities based on activities, including face to face in the classroom, live e-learning, and self-regulating the course of learning. The proportion of face-to-face and independent online and offline learning to deliver learning materials is around 70% face-to-face and 30%

online/offline [16]. Blended Learning is significantly associated with more significant learning performance of STEM-disciplined students than with traditional classroom practice [17].

Online learning, one of the forms is learning using video. Learning the practice of Lathe Machining using video can improve student learning outcomes of Lathe Machining [18]. Meanwhile, students' perceptions of the application of online learning in Vocational Theory have a positive and significant correlation with learning outcomes [19].

2. METHODOLOGY

2.1. Research Design

This study uses Quasi-Experiment using the Treatment by Level experimental design [20]. There is one dependent variable, two independent variables, and one attribute variable in this study.

2.2. Time and Place of Research

The research was conducted at Department of Mechanical Engineering Education, Faculty of Engineering, Universitas Negeri Yogyakarta. The time for conducting research starts from the 03 February to the 31 July 2020.

2.3. Research Subjects and Objects

The population of this research is the second-semester students taking the Lathe Machining course, which consists of four classes of Lathe Machining practice, namely classes A1, A2, C1, and C2. Of the four classes, two classes were taken as samples, one class as the experimental class, and one class as the control class. The selection of classes as samples was carried out using random sampling. All members of this study population have the same opportunity to be selected as the research sample. To determine the experimental class and the control class from the two classes that have been selected to be the sample, it was carried out by random assessment.

2.4. Procedure

The dependent variable is the learning outcomes of students' Lathe Machining, consisting of learning outcomes in the cognitive domain (knowledge), and learning outcomes in the psychomotor domain (skills). The independent variable in this study is the treatment variable, consisting of experimental variables and control variables. The experimental variable in this study is the application of the Blended Learning Approach to Lathe Machining learning, namely learning the practice of Lathe Machining by providing shop-talk and online demonstrations via video and learning the practice of turning face-to-face in the workshop.

The control variable is the application of the Conventional Approach to Lathe Machining learning. The conventional approach is interpreted as the approach that has been used in learning Lathe Machining, namely the provision of shop-talk and demonstrations by lecturers directly on lathes. While the attribute variable is the origin of the school before being accepted into the Department of Mechanical Engineering Education, FT UNY, in this case, it comes from vocational high school and comes from senior high school. This variable is an attribute of each student that can influence the results of the study but cannot be manipulated. Therefore there is no need for treatment.

2.5. Data, Instruments, and Data Collection Techniques

This research data includes two kinds, namely data on student learning outcomes of Lathe Machining in the cognitive realm, and data on student learning outcomes in the psychomotor domain. Data on learning outcomes of Lathe Machining in the cognitive domain were collected using a cognitive test in the form of multiple-choice tests, while the data on learning outcomes in the psychomotor domain were collected using the workpiece assessment observation sheet. Data collection in this study involved two instruments, namely a multiple-choice test for students' learning outcomes of Lathe Machining in the cognitive domain, and the workpiece assessment observation sheet used to measure the quality of the product/workpiece that was successfully done.

2.6. Data Analysis Technique

The data analysis in this study used 2 Path ANOVA with one treatment variable and one attribute variable. However, in order for the data to be analyzed using ANOVA 2x2, the analysis

requirements test will be conducted first, namely the normality test and the homogeneity test of the data.

3. Results and Discussion

The data collected in this study are the learning outcomes of students who are the research subjects (Y). The description of the learning outcomes of Lathe Machining includes the highest score (Y_H), lowest score (Y_L), mean score ($\bar{Y}$), and standard deviation price (s^2), see Table 1.

Table 1. Lathe Machining Learning Outcomes Test Score.

School Origin (B)		Learning approaches (A)		ΣB
		Blended Learning (A₁)	Conventional (A₂)	
Vocational high school (B₁)	n	7	7	14
	YH	86.00	76.00	-
	YL	76.00	70.00	-
	$\bar{Y}$	82.00	72.00	77.00
	s2	12.67	9.41	-
	ΣY	574.00	504.00	1078.00
	ΣY2	47144	36310.64	83454.64
Senior high school (B₂)	n	6	8	14
	YH	72.60	76.00	-
	YL	60.20	60.10	-
	$\bar{Y}$	65.96	67.26	66.70
	s2	23.13	46.25	-
	ΣY	395.74	538.10	933.84
	ΣY2	26217.36	36508.33	62725.69
ΣA	n	13	15	28
	YH	86.00	76.00	-
	YL	60.20	61.10	-
	$\bar{Y}$	77.00	69.47	71.85
	s^2	85.27	39.27	-
	ΣY	1078.00	1042.10	2011.84
	ΣY2	83454.64	72818.97	146180.33

Information:

A₁   : A group of college students who use a blended learning approach
A₂   : A group of college students using a conventional approach
B₁   : A group of college students from vocational high school
B₂   : A group of senior high school college students
n   : The number of college students in each group
Y_L : The lowest score of the learning achievement test for Lathe Machining in each group
Y_H : The highest score of the learning achievement test for Lathe Machining in each group
$\bar{Y}$: The mean value of the Lathe Machining learning outcomes test
s^2 : Standard Deviation

Hypothesis testing in this study includes three tests. First, testing the hypothesis about the main effect, namely; the influence of treatment variables in this case, the Blended Learning approach and the conventional approach on learning outcomes of Lathe Machining. Second, is testing the hypothesis about the interaction effect, namely testing to determine whether there is an interaction between the blended learning approach, conventional approaches, and school origins on learning outcomes of Lathe Machining. Third, testing the simple effect hypothesis. The test was carried out after it was known that there was an interaction between the blended learning approach, the conventional approach, and the school's origin on the learning outcomes of Lathe Machining.

The analysis technique used for hypothesis testing is 2-way Variant Analysis (ANOVA). The results of the calculation of the 2-way Variant Analysis (ANOVA) step are summarized and presented in Table 2.

Table 2. Summary of 2 Path ANOVA Test Results.

Source of Variance	Db	JK	RJK	Fh	Ft (α=0,05)
Inter-A	1	134,14	134,14	5,64	4,26
Inter-B	1	882,12	882,12	37,12	4,26
Interaction (A x B)	1	110,9	110,9	4,67	4,26
Betwwen Groups (A)	3	1127,18	375.73	15,81	3,01
In Group (D)	24	570.00	23,76	-	-
Total Reduction (TR)	27	1698.00	-	-	-
Mean/Correction (R)	1	146138.63	-	-	-
Total (T)	28	147836.13	-	-	-

3.1. Main Effect Hypothesis Testing

One-sided hypothesis testing, then the F_{count} (F_hA) price must be converted into a t price with the formula; $t_{hA} = \sqrt{FhA}$ [21]. The results of the calculation using the conversion formula for the price of F to the price of t, obtained $t_{hA} = \sqrt{5,64} = 2,38$; with comparison $t_{table(0,05,24)} = 1,71$. The result of the conversion calculation shows that t_{count} (t_{hA}) = 2,38 is greater than $t_{table(0,05,24)} = 1,71$ (t_{count} (t_{hA}) > $t_{table(0,05,24)}$). Therefore H_0 is rejected and H_1 is accepted, it means the hypothesis which states; The learning outcomes of students who take the blended learning approach are higher than those who take the conventional approach, are accepted or supported by data.

3.2. Interaction Effect Hypothesis Testing

The interaction effect of A and B on Y shows that the value of F_{count} is 4.67 and the price of Ftable with db of the numerator = 1, db of the denominator = 24, and α = 0,05 is 4,26. It appears that the price of F_{count} is greater than F_{table} (F_{count} > $F_{table(0,05)(1,24)}$), then H_0 is rejected, and H_1 is accepted which means that there is an interaction effect between the learning approach and the school origin on learning outcomes of Lathe Machining. The learning outcomes of Lathe Machining are not only influenced by the learning approach but are also determined by the student's school of origin. Thus the research hypothesis which states; There is an interaction effect between the learning approach and the origin of the college students learning outcomes of Lathe Machining is accepted or supported by data.
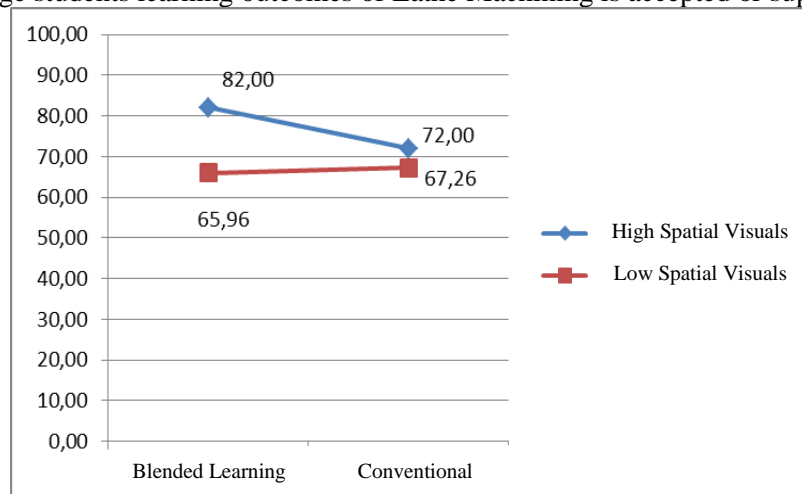

Figure 1. Graph of the Interaction of Learning Approaches and School Origins on Learning Outcomes

3.3. Simple Effect Hypothesis Testing-1

The results of the calculation of the simple effect-1 hypothesis testing showed that the $t_{0(A1B1xA2B1)}$ price was 5.47 it was more significant than the $t_{table(0,05,24)}$ of 1.71, so that H_0 was rejected, and H_1 was accepted. This means the simple effect-1 hypothesis of this study which states: The learning outcomes of Lathe Machining students from vocational high schools who take the blended learning approach are higher than those who take conventional learning approaches, are accepted or supported by data.

3.4. Hypothesis Testing Simple Effect-2

The results of the calculation of the simple effect-2 hypothesis testing obtained the $t_{0(A1B1xA2B1)}$ price -0,36 which was more significant than the $t_{table(0,05,24)}$ price -1,71, so that H_0 was accepted, and H_1 was rejected. This means that the simple effect-2 hypothesis in this study which states: The learning outcomes of senior high school students who take blended learning approaches are lower than those who take conventional approaches are rejected or not supported by data.

The learning outcomes of Lathe Machining with the Blended Learning approach are higher than the conventional approach

The learning outcomes of students who follow learning using the Blended Learning approach are higher than those who take learning using the conventional approach. This is evidenced by the results of ANOVA calculations at the source of the variance between A obtained $F_{count} = 38,24 > F_{table} = 4,28$ at $\alpha = 0,05$, and the results of the descriptive analysis which show that the mean learning outcomes of students who take learning with the blended approach learning $\overline{Y}_{A1} = 86,83$, learning outcomes of students who follow learning using the conventional approach $\overline{Y}_{A2} = 78,17$. The results of the data analysis empirically show that the blended learning approach has an effect and has a better impact on student learning outcomes of Lathe Machining.

Effect of Interaction between Learning Approaches and School Origin on Learning Outcomes of Lathe Machining

There is an interaction effect between the learning approach and the origin of the school on learning outcomes of Lathe Machining. It is known from the two-way ANOVA calculation at the source of variance A x B, the price of $F_{count} = 35,42 > F_{table} = 4,28$ at $\alpha = 0,05$. For college students from vocational high schools, college students who take the blended learning approach to learn outcomes of Lathe Machining are higher than college students who take learning with the conventional approach. In contrast, for college students from senior high school, college students who take learning using the blended learning approach have more learning outcomes of Lathe Machining lower than college students who take learning with conventional approaches.

The learning outcomes of students from vocational high schools who follow the blended learning approach are higher than conventional approaches

The learning outcomes of college students from vocational high schools who take learning with the blended learning approach are higher than college students from vocational high schools who take learning with the conventional approach. Evidenced by the results of the Dunnet t-test; namely $t_{count} = 4,34 > t_{table} = 1,71$, and the results of the descriptive analysis show that the mean value of $\overline{Y}_{A1B1} = 86,83 > \overline{Y}_{A2B1} = 78,17$. The results of this data analysis indicate that to improve the learning outcomes of college students from vocational high schools, it is more appropriate if the learning of Lathe Machining is carried out using a blended learning approach.

The learning outcomes of high school students' Lathe Machining with the blended learning approach are lower than conventional approaches

The learning outcomes of high school students who take learning with the blended learning approach are not different from those from high school students who take learning with the conventional approach. This is evidenced by the results of the Dunnet t-test which shows $t_{count} = -0,36 > t_{table} = -1,71$. Although the results of the descriptive analysis show that the mean value of $\overline{Y}_{A1B2} = 65,96$ is smaller

than $\overline{Y}_{A2B2} = 67,26$. The mean learning outcomes of senior high school students who took the blended learning approach looked different and lower, but the difference was not significant. For low-spatial visual college students, they can still take part in Lathe Machining learning using the blended learning approach well.

4. Conclusion

Based on the research that has been done, it is concluded that first, the learning outcomes of students who take the blended learning approach are higher than those who take learning using the conventional approach. Second, there is an interaction effect between the learning approach and the origin of the school on learning outcomes of Lathe Machining. Third, the learning outcomes of students from vocational high schools who take learning with the blended learning approach are higher than students from vocational schools who take learning with conventional approaches. Fourth, the learning outcomes of high school students who take learning with the blended learning approach are no different from students from high school who take learning with conventional approaches.

References

[1] Smaldino, S.E., Lowther, D.L., and Russell, J.D. (2011). *Instructional technology & media for learning.* 9th. New Jersey: Pearson Educatian Inc.

[2] Suryadi, Ace., and H A R Tilaar. *Analisis Kebijakan Pendidikan, Suatu Pengantar.* Cetakan 2. (Bandung: Remaja Rosdakarya, 1994). h. 32

[3] Paryanto, Bambang Setiyo Hari Purwoko, Edy Purnomo. (2018). Integrasi Nilai Karakter Dalam Praktik Pemesinan Frais Melalui Model Pembelajaran Competence Based Training. Jurnal Dinamika Vokasional Teknik Mesin, Volume 3, Nomor 1, April 2018

[4] Castil, Maria L. G., (2016). *"Mentors' Multiple Intelligences (MI) Teaching Styles and Students' Multiple Intelligences*." *International Journal of Education and Learning* (Copyright © 2016 SERSC) Vol.5, No.2. h.h: 37-46.

[5] Semiawan, Conny R. (2008). "Perkembangan Anak." *Makalah, Seminar dan Lokakarya Nasional Pendidikan Anak, Kerjasama Dtjen PLSP Depdiknas*.

[6] Arends, Richard I. (2009). *Learning to teach.* Seventh Edition. New York: McGraw Hill Companies, Inc.

[7] *Kurikulum 2009 Fakultas Teknik Universitas Negeri Yogyakarta.* Yogyakarta: Fakultas Teknik Universitas Negeri Yogyakarta.

[8] Gagne, Robert M., Walter W. Wager, Katharine C. Golas, and John M. Keller. (2005). *Principle of instructional design.* Fifth. Belmont, California: Thomson Learning, Inc.

[9] Hergenhahn, B.R., and Mathew H. Olson. (1993). *An introduction to theories of learning.* Englewood Cliffs, New Jersey: Prentice Hall, Inc.

[10] Mayer, Richard E. (2009). *Multimedia learning prinsip dan aplikasi.* Edited by Baroto Tavip Indrojarwo. Translated by Teguh Wahyu Utomo. Yogyakarta: Pustaka Pelajar

[11] Anderson, Lorin W., and David R. Krathwohl. (2001) . *A taxonomy for learning, teaching, and assessing a revision of Bloom's taxonomy of education objectives.* Abgridged Edition. New York: Addison Wesley Longman, Inc.

[12] Harriman, Gray. (2004). *http://www.grayharriman.com/blended_learning. htm#top.* 2004. (Access 18 Mei 2014)

[13] Saliba Gina, Lynnae Rankine and Hermy Cortez. *Fundamentals of Blended Learning.* (Sydney: University of Western Sidney, 2013). hh. 4-5. from:http://www.uws.edu.au/.../0004/467095/Fundamentals_of_Blended_Learning.pdf, (Diakses 17 Januari 2017)

[14]   *University   of   Wolverhampton*.   (2008),   from   www.wlv.ac.uk/blu: http://www.wlv.ac.uk/default.aspx?page=19735#whatblendedlearning, (Diakses 14 Mei 2014).

[15] Lalima; Kiran Lata Dangwal., 2017., Blended Learning: An Innovative Approach., Universal   Journal   of   Educational   Research   5(1):   129-136,   2017., https://pdfs.semanticscholar.org/94b9/b0c62fb4a8cf57341449b9ba1c37b8762d4d.pdf?_ga=2.265759692.250240008.1602494061-1932597986.1602494061

]16] Sloan. (2014). *http://www.sloan-c.org/resources/survey.asp.*

[17] Vo, H. M., Zhu, C., & Diep, N. A. (2017). The effect of blended learning on student performance at course-level in higher education: A meta-analysis. *Studies in Educational Evaluation*, *53*, 17–28. https://doi.org/10.1016/j.stueduc.2017.01.002

[18] Ridwan Oktavian Hananta dan Thomas Sukardi. (2018). *Pengembangan Model Media Video pada Pembelajaran Praktik Pemesinan Bubut.* Jurnal Dinamika Vokasional Teknik Mesin   Volume   3   Nomor   2   Oktober   2018   Hal   121-129. https://journal.uny.ac.id/index.php/dynamika/issue/view/1599

[19] Sukardi dan Muhammad Hudan Rahmat. (2019). *Pencapaian Hasil Belajar Teori Kejuruan Ditinjau dari Persepsi Mahasiswa pada Pembelajaran Online*. Jurnal Dinamika Vokasional Teknik Mesin Volume 4 Nomor 2 Oktober 2019 Hal 111-116. https://journal.uny.ac.id/index.php/dynamika/issue/view/1751

[20] Supardi., 2016., *Aplikasi Stastitika dalam Penelitian, konsep statistika yang lebih komprehensif.* Edisi Revisi. (Jakarta: Change Publication,).

[21] Kadir., 2010., *Statistika: Untuk penelitian Ilmu-Ilmu Sosial.* Jakarta: Rosemata Sampurna.