Improving Learning Outcomes of Corrosion and Coating Engineering through Blended Learning Module Based on Materials of Mechanical Engineering Educational Students, Faculty of Engineering, Universitas Negeri Medan

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Abstract. This study aims to improve learning outcomes of corrosion and coating techniques through the application of a module-based blended learning model. The subjects of this study were 31 students of mechanical engineering education, Faculty of Engineering, Universitas Negeri Medan. Based on the research results can be described that the learning outcomes of 31 students got a B = 3 students (9,68%), got a C = 25 students (80.64%), got an E = 3 students (9,68%). Average student assessment of lecturers' teaching activities before applying the module ($\bar{x}$) = 2.26. The average observer's assessment of student activities before applying the module ($\bar{x}$) = 2,20. The average student assessment of the module display ($\bar{x}$) = 3,36. The average student assessment of the application of the module ($\bar{x}$) = 3,31. The average student assessment of the lecturer's teaching activities ($\bar{x}$) = 3,62. The observer's average assessment of student activities in class ($\bar{x}$) = 3,68.Student learning outcomes from 31 students, got an A = 13 students (41,94 %), got a B = 17 students (54,84%), got an E = 1 student (3,22%). Based on this research activity, it can be concluded that the use of corrosion modules and coating techniques with blended learning models can improve learning outcomes of corrosion and coating techniques.

Keywords: blended learning, module, learning outcomes, corrosion and coating techniques

1 Introduction

One of the engineering courses that must be attended by all students in the Mechanical Engineering Department is Corrosion and Coating Engineering. The Thermodynamics course contains the basic concepts of corrosion, the factors that cause corrosion, the functions and types of materials for the coating process and coating techniques, and methods and actions to reduce the corrosion rate. Thus, teachers can provide clear information about corrosion and coating engineering course materials to students, so that later they can be useful in solving corrosion problems in production machines and metal materials.

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The fact shows that the author as a teacher of this course often experiences disappointment, because it turns out that students cannot solve the questions given to students. Also based on observations, it turns out that student learning outcomes in attending lectures are still low. This is based on experience, that from 2017 academic year to 2021 academic year the results of studying corrosion and coating techniques for Mechanical Engineering students are as follows: :

Table 1. List of Study Results of Corrosion and Coating Engineering for Mechanical Engineering Students *)

No	Academic Year	Grade										Number of Participants
		A	%	B	%	C	%	D	%	E	%	
1	2017/2018	1	2,5	4	10	7	17,5	5	12,5	23	57,5	40
2	2018/2019	1	3,12	2	6,25	6	18,7	6	18,8	17	53,1	32
3	2019/2020	3	2,27	4	9	11	25	14	31,8	14	31,8	44
4	2020/2021	2	6,38	7	14,8	10	21,3	9	19,1	18	38,3	47

Notes: *) Source of documentation for the Department of Mechanical Engineering, Faculty of Engineering, Universitas Negeri Medan

It is believed that this situation may recur in the even semester of the 2022 academic year since blended learning activities often require a lot of discipline from students to ensure that the teaching and learning of corrosion and coating procedures proceeds well. Coating techniques must be met during the teaching and learning process takes place. Corrosion and coating engineering courses require homework [1]. Homework is needed to maintain the continuity of the teaching and learning process during lectures, with homework students are also expected to have more time to reflect and think about definitions or theorems that are abstract to real applications by doing practice questions and reading articles [2]. Homework is usually directed to the application of corrosion and coating techniques to real life events. Therefore, giving homework can also stimulate disciplinary creativity and student independence in terms of investigating or developing ideas to make corrosion conditions and coating techniques a reference for developing creative ideas in real life [3].

In order for the teaching and learning process to meet the demands of the nature, or characteristics of corrosion and coating techniques, namely hierarchical (continuous and systematic) [4], lots of exercises and homework assignments taking into account the constraints of the Covid-19 pandemic condition coupled with adaptation to current learning models, it is necessary to know the above problems precisely and accurately without having to eliminate the existing obstacles, action research is needed (Classroom Action Research) [5] as an effort to improve learning corrosion and coating techniques in the Mechanical Engineering Study program, Faculty of Engineering Unimed. Given the limitations in terms of manpower, experience, sources of teaching materials and pandemic conditions, this research is limited to the title: improving learning outcomes of corrosion and coating engineering through blended learning module based on materials of mechanical engineering educational students, Faculty of Engineering, Universitas Negeri Medan. Based on this background, the title of this research is “Improving Learning Outcomes of Corrosion and Coating Engineering through Blended Learning Module based on Materials of Mechanical Engineering Educational Students, Faculty of Engineering, Universitas Negeri Medan”.

2 Method

This research is an action research. Action Research was carried out at the Mechanical Engineering Study Program, Faculty of Engineering, Universitas Negeri Medan. The research subjects in this study were Mechanical Engineering Education Students. The subjects of this research are Mechanical Engineering Education students who take corrosion and coating courses in the even semester of 2021/2022 totaling 31 students.

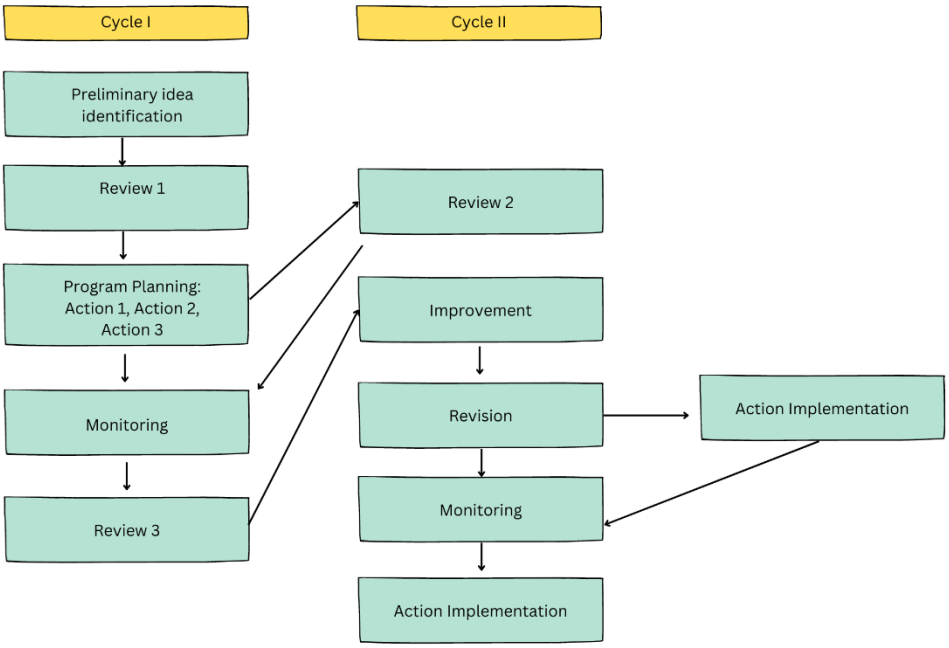

Figure 1. diagram of action research

3. Result and Discussion

3.1 Implementation Result and Research Findings in the Pre-cycle

In accordance with the planner of this research for a follow-up study (research accent) which consists of 2 cycles of action starting 8 February 2022 - 11 June 2022, this research was a collaboration between researchers and mechanical engineering education students, Faculty of Engineering, UNIMED, the number of research subjects in the application of the module teaching materials are, 2 lecturers and 31 students. The procedure carried out in this research consists of (1) planning, (2) implementation/action, (3) Reflection. Each cycle in this study was evaluated to determine student understanding of the lecture material, and to determine student responses to lecturer activities and student activities. Pre-cycle activities begin by holding a pre-test with reference to the material contained in the lesson plan.

a) The learning outcomes of 31 students, got a B = 3 students (9,68%), got a C = 25 students (80,64%), got an E = 3 students (9,68%)

b) The average student assessment of lecturers' teaching activities before applying the module ($\bar{x}$) = 2.26.
c) The average observer's assessment of student activities before applying the module ($\bar{x}$) = 2,20.

From the results of student learning shows that 3 students 9,68% who still meet the criteria for completeness. Fill in the value data in accordance with the provisions in the rector's regulation No. 004 Tahun 2022 NM = 0,05F1 + 0,2F2 + 0,25F3 + 0,5F4, in this activity, 3 students got B grades, this is possible because of the 31 students there were 3 students who repeated, this finding became the basis for researchers to carry out activities in the next cycle, after holding FGD with (1) corrosion course lecturers and layering, the head of the study program to take action in the next cycle, the graduation criteria have not been achieved in accordance with the SK completeness criteria Filling in the value data in accordance with the provisions in the Rector's Regulation No. 004 Tahun 2022 NM = 0,05F1 + 0,2F2 + 0,25F3 + 0,5F4, furthermore, it was agreed from the results of the FGD that researchers would use the teaching materials module to improve student learning outcomes.

3.2 Implementation Result and Research Findings in the Cycle 1

1) In this activity, learning is still carried out as in pre-cycle activities. By using the blended learning model with the teaching materials module, the results obtained are as follows
2) Average student assessment of the module display ($\bar{x}$) = 3,36.
3) Average student assessment of the application of the module ($\bar{x}$) = 3,31.
4) Average student assessment of lecturers teaching activities ($\bar{x}$) = 3,62.
5) Observer's average assessment of student activities in class ($\bar{x}$) = 3,68.
6) Student learning outcomes from 31 student, get an A = 13 students (41,94 %), got a B = 17 students (54,84%), got an E = 1 student (3,22%)

Before the teaching material module is given, it must first receive an assessment from the validator experts selected in this study, namely material and design experts as for the validator:

Tabel 2. Validator's List

Validator's Names	Description
Dr. Ir Erma Yulia M.T,	Lecturer of the Faculty of Engineering-UNIMED
Dr. Keysar Panjaitan M. Pd,	Lecturer of the Faculty of Engineering-UNIMED

The number of indicators validated regarding the display of teaching materials consists of 14 indicators. The data in the pre-cycle compared with the data in the first cycle found that the criteria for the effectiveness of the learning activities carried out were in accordance with the SK for completeness criteria. Fill in the value data in accordance with the provisions in the Rector's Regulation No. 004 Tahun 2022 NM = 0,05F1 + 0,2F2 + 0,25F3 + 0,5F4, with the number of students who achieved graduation of 96.78%. Thus, student learning outcomes in the pre-cycle and first cycle can be seen in Figure 2 below:

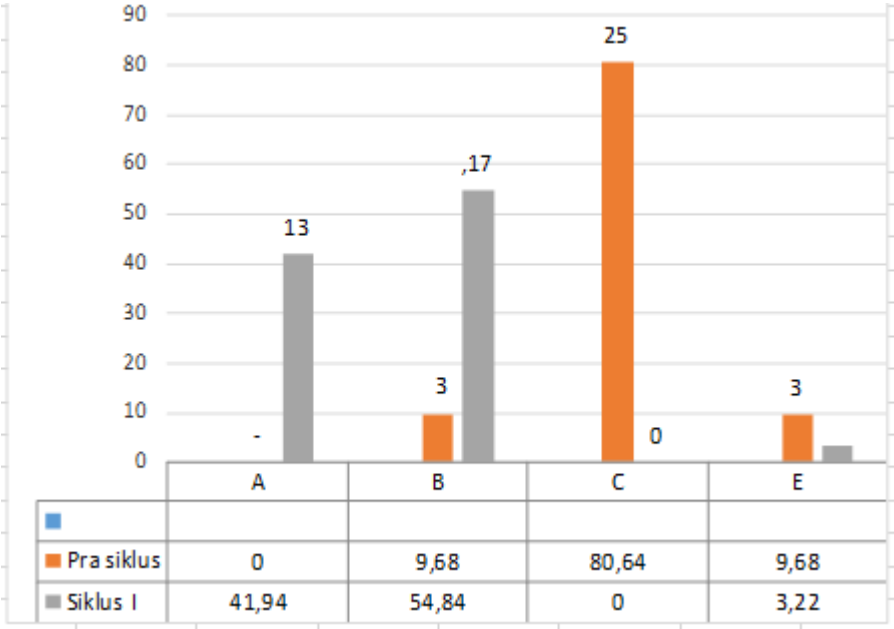

Figure 2. diagram of pre-cycle and cycle I

The results of this study found that the application of the teaching materials module can improve student learning outcomes of mechanical engineering education in corrosion and coating courses, this study supports [6] on the development of narrative text teaching materials based on local wisdom for class X students of SMK Medan. This study also supports the findings [7] research which found that teaching materials can improve the quality of student thesis in the fine arts department of FBS. From the results of the discussion of the research carried out, it can be concluded that the application of the module-based blended learning model can improve student learning outcomes of mechanical engineering education in corrosion and coating courses [8], [9], [10].

The findings of this study support the research which found an increase in learning outcomes and learning motivation of elementary school students [11], [12], the results of this study also support the findings that the use of modules as teaching materials can improve learning outcomes of mechanical engineering and manufacturing student majoring in mechanical engineering [13], Faculty of Engineering, Universitas Negeri Padang. Furthermore, another research suggests that teaching materials can change the behavior of students to achieve learning objectives, further adding that teaching materials given to students can encourage students to practice giving feedback [14], [15].

In relation to blended learning, a research found that there are differences in learning motivation between students through blended learning compared to students taught conventional learning [16], [17], there are differences in learning outcomes between students who are taught blended learning compared to students who are taught conventional learning, there is an increase in learning outcomes. student learning motivation from the application of blended learning, there is an increase in student learning outcomes due to the application of blended learning. A study showed that there was an increase in student learning outcomes in

the Applied Physics course by applying the Blended Learning model using the Moodle application [18].

4. Conclusion

Based on the results of it can be concluded that at the pre-cycle stage, students were not able to learn optimally, because students were not familiar with the blending learning model. In the first cycle of 31 students, 3 (9,685) students scored B and the average student assessment of the module display ($\bar{x}$) was 3,36.r while the average student assessment of the application of the module ($\bar{x}$) was 3,31. The average student assessment of lecturers teaching activities ($\bar{x}$) was 3,62, while the bserver's average assessment of student activities in class ($\bar{x}$) was 3,68. Student learning outcomes from 31 people, get an A was 13 students (41,94 %), got a B was 17 students (54,84%), got an E = 1student (3,22%). In short, the application of the materials module with the blended learning model can improve corrosion and coating learning outcomes. Therefore, the suggestions are for mechanical engineering education majors to support the application of corrosion modules and coating techniques as one of the teaching materials for corrosion and coating engineering courses. For course lecturers, in addition to using the teaching material module, it is hoped that it can also be used for other learning media that are able to provide a faster understanding for students participating in lectures. For students who use corrosion modules and coating techniques to use them properly, and if there are those who do not understand the use of modules, they can be discussed with researchers as lecturers in corrosion and coating engineering courses.

References

[1] Atwi Suparman, 2011. *Desain Instruksiona.,* Jakarta : PAU dan Dirjen Pendidikan Tinggi Dikbud.

[2] Bancin, Syawal Budi. 2019. Tesis Peningkatan Kemampuan Guru Dalam Menyusun Proposal Penelitian Tindkan Kelas (PTK) Melalui Supervisi Akademik Teknik Focus Group Discussion (FGD) Kepala Madrasah di Madrasah Aliyah Negeri (MAN) Kabupaten Karo.

[3] Driscoll, M. C. (2005). Advanced Web-Based Training Strategies. Blended Learning as a Curriculum Design Strategy.

[4] Elliot, John. 2003. *Action Research For Educational Change.* Buckingham Philadelphia : Open University Press.

[5] Green Wood, Gordon E & Forrest W. Parkay. 2019. *Case Studies For Teacher Dicision Making.* New York : Random House.

[6] Haryono, 2016. *Teknologi Komunikasi Pendidikan, Seri Pustaka Teknologi Pendidikan No. 1 : Belajar Blended learning.* Jakarta : Pustekkom & Rajawali.

[7] Hopkins, D. 2003. *A Teacher's Guide To Classroom Research.* Second Edition. Bickingham Philadelphia : Open University Press.

[8] Kemmis, Stephen & Robin McTaggart. 1990. *The Action Research Planner.* Victoria : Deakin University.

[9] Martuah (2016), Pengaruh Multimedia Terhadap Hasil Belajar Kimia Organik. *Malang : Jurnal Pendidikan Vol 1. No 4 April 2016*

[10] McNiff Jean, 2008. *Action Research : Principles And Practice.* London : MacMillan Education.

[11] Pannen dan Purwanto, 2007. *Mengajar Di Perguruan Tinggi, Bagian 4 Penulisan Bahan Ajar.* Jakarta : PAU dan Dirjen Dikti Dikbud.

[12] Rogers, Carl R. 2003. *Freedom To Mean For The 80'S.* Colombus : Charles E. Merrill and Howel.
[13] Rogers, Carl R. 2007. *Antara Engkau Dan Aku*. Terjemahan Agus Cremmers. Jakarta : Gramedia.
[14] Saragih D. Jurnal (2021). Jurnal Birli vol 4 no 4
[15] Saragih, Daulat 2021. Penerapan Model Kesenirupaan Untuk Meningkatkan Ragam Penelitian dan Mutu Skripsi Mahasiswa di Jurusan Seni Rupa FBS Unimed.
[16] Siswoyo Hardjodiporo. 2007. *Action Research : Sistesis Teoritik.* Jakarta : IKIP Jakarta.
[17] Sugiarto, Letna (2013), Pengaruh Bahan Ajar Hasil Belajar Kontruksi Pola. *Semarang : Fashion Education Jurnal Vol. 20 No.1 Tahun 2013*
[18] Yin Robert K. 2004. *Case Study Research : Design and Methods.* Beverly Hills, California : Sage.