Feasibility of Electroplating Learning Module Based on Case Method and Stakeholder Needs Oriented

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Abstract. This study aims to obtain the feasibility of electroplating learning module based on case method and stakeholder needs oriented. As a guide while creating modules using the ADD (analysis, design and development) development model, namely (1) needs analysis stage, namely conducting FGD with stakeholders and graduate users, (2) design stage, which includes creating learning goals, (3) development stage, specifically the creation of modules and the preparation of materials (4) evaluation stage, namely feasibility assessment by experting in learning materials, learning design, and learning media. The research subjects were 30 students majoring in Mechanical Engineering Education, Unimed who took part in the electroplating learning process. Data collection techniques in analyzing the needs and feasibility of are conducted through the distribution of surveys. The experts employed a Likert scale in their feasibility assessment criteria, which included category values of 5 (very good), 4 (good), 3 (fairly good), 2 (poor) and 1 (very poor), which were analyzed descriptively. The research results showed that the suitability of material experts was 84.8%,learning design experts 90.6%,and learning media experts 82.2%.

Keywords: feasibility, module, electroplating, case method, stakeholders.

1 Introduction

Education aims to change a person to have a better understanding of knowledge and behavior that is obtained through learning process activities. The learning process is important and essential for each person because the learning process is a method of imparting knowledge to students from lecturers [1]. The learning process is said to be successful if the process of transferring knowledge and behavior shows positive changes after the learning process takes place, [2].

Facing the industrial revolution 4.0 era, a learning process is required to create a creative, innovative and competitive generation, including the learning process in universities, by optimizing the use of instructional resources during the learning process. [3]. In line with this,

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Anas, (2019) stated the using case-based learning models significantly and favourably affects students' learning outcomes [4].

The learning process in universities, as stated by Mentari & Laily, (2016) turns out that some are still oriented solely to theory by implementing conventional learning as the variey of lectures (lecturing, question and answer, and discussions), [5]. The use of discussion methods, the implementation is still running in one direction which is indicated by low student participation. Learning competency requires active interaction between the lecturer who provides the learning material and the students as the object, the hope is that students can change their behavior for the better. [6]. As stated by Rusmana & Kurniawarsih, the purpose of learning media is to facilitate students' understanding of abstract concepts through concrete objects. [7]. Meanwhile, learning media according to Ramadani & Oktiningrum, [8] said that a tool/instrument used as an intermediary to convey messages or learning materials to students so that they are easier to understand. Learning media also affects how well students learn by making it simpler for them to comprehend the information that is being delivered. However, the reality is that the learning media used has not been able to make students think realistically.

According to Rokhim, Suparmi, & Prayitno, [9] a module is a learning media that is systematically arranged with easily comprehensible language according to the age level of the students. Through the module, it is expected that its use can accustom students to independent learning with or without teacher guidance. As explained by Istikomah & Purwoko, [10] that the module is arranged sequentially and can be studied independently in order to improve the learning results of students. In general, a module can be said to be a teaching unit that includes resources, techniques, and assessments that are methodically created to produce the desired competencies.

The arrangement of module has an important meaning in learning activities. As expressed by Sipayung & Simanjuntak [11], that by using modules in the teaching and learning process, hopefully on: (1) students will be capable of learning independently with or without teacher guidance; (2) the role of the teacher does not dominate in learning activities; (3) combining various student learning speeds; and (5) students can measure for themselves how much they understand the material being studied. In general, the purpose of holding learning using modules is to open up opportunities for students to learn at their own pace and in their own way. Therefore, it is possible that when working on the same problem, not every student will necessarily show the same results, even though the work starts at the same time. The teaching of the module provides an opportunity for individuals to learn according to their respective abilities in solving cases in the field in a variety of ways. In addition, modules are seen to be a highly effective way to help students overcome their challenges in learning because it is arranged in an interesting way, besides that the learning process only takes a little time.

The demands for college graduates needed by stakeholders during the Industrial Revolution 4.0 are those who have received education and training. What universities must do now is to innovate education and learning. Collaboration between universities and stakeholders provides benefits to both sides and looks for the best answers to issues that stakeholders are facing, which will ultimately affect the growth of the national economy [12]. Increasing the competitiveness of graduates in the fields of industry and business (stakeholders) requires synergizing the college curriculum and stakeholder needs. Universities must be more accessible to stakeholders, and vice versa, both in terms of attitudes and real actions, for example becoming a place for field work practice, internships for students.

However, in order for collaboration between universities and stakeholders to meet its goals, universities must consolidate from the learning planning stage to its execution and evaluation. To improve the competitiveness of graduates in facing the competition of the world of work, universities are required to innovate in the learning process. The main indicator for universities in producing graduates is no longer quantity, instead, the calibre of graduates. The use of technology has an impact on graduates' competitiveness, innovation, and learning strategies by each university [13].

Universities need to implement learning patterns that prioritize concrete creativity based on empirical input from the industrial world so that students are equipped with meaningful knowledge in order to encourage students' enthusiasm to produce creative products, [14]. Peter McHardy and Teresa Allan [15] stated that the competencies expected by users include knowledge, problem solving, communication, and creativity.

The electroplating course is a mandatory course for students of Mechanical Engineering Education (PTM) Unimed with a weight of 3 credits. Information from stakeholders who use graduates, the competency of graduates in the field of electroplating needs to be improved. Given the reality in the field, there is a failure in the process of working on metal coating using electroplating. In order to enhance students' proficiency in the field of electroplating, a case method-based module that can be utilised as a guide for students to analyse the metal coating process utilising electroplating must be developed.

2 Research Method

2.1 Research Procedure

This research uses a research and development (R & D) approach, and for module development using the ADD (analysis, design, development) development model adapted from the ADDIE development model [16]. Three stages of ADD are used to determine the module's viability, namely (1) analysis, conducting an analysis of the main needs of the learning model, (2) design, (2) design, including establishing learning goals and creating interactive multimedia (3) development, developing material experts, learning design experts, and learning media experts as validators to create interactive multimedia.

Experts in learning media, learning design, and electroplating material are the subjects of the feasibility test for this module's development. Students enrolled in electroplating courses at the Universitas Negeri Medan of Mechanical Engineering Education Department, Faculty of Engineering, are the module's intended consumers. The lecturer that oversees the electroplating course is the topic who is an expert in electroplating, and their competency is the basis for choosing material specialists. Expertise in learning design and learning media technology, namely that of the Lecturer in Educational Technology, is the basis for choosing learning media and learning design specialists. Figure 1 depicts the research process.

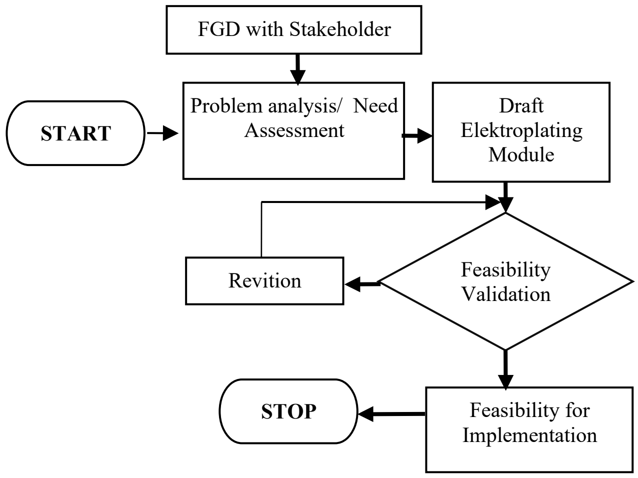

Fig. 1. Reaserch steps

2.2 Data Analysis Methods and Techniques

The data collection method in this study was analysed qualitatively, and the instruments used were related to each stage of the study: (a) a questionnaire consisting of a list of questions used for observation (b) a questionnaire from the Learning Object Review Instrument (LORI) version 1.5 used for the development and expert validation stagewith a Likert scale [17].

2.3 Feasibility Criteria

a. Analysis

Data analysis was carried out by applying descriptive analytic approaches, which entail evaluating quantitative data gathered from field tests and expert test questionnaires before providing a qualitative interpretation. Analysing the data comes next after it has been collected. The evaluation results of material experts, media experts, learning design experts, and questionnaire results are then used to gather quantitative data. Data from respondents collected through questionnaires were analyzed using descriptive statistics with the following formula criteria:

$$X = \frac{\Sigma x}{N}$$

(1)

Description:
X = Feasibility score
$\sum X$ = Total score for each subvariable N
N = Number of subvariables

The percentage range and qualitative criteria can be ascertained using the aforementioned computations, as indicated in Table 1.

Table 1. Module Feasibility Criteria Score Range 0 - 5

No.	Score Interval	Criteria
1	$x > 3{,}25$	Very Feasible
2	$2{,}5 < x \leq 3{,}25$	Feasible
3	$1{,}75 < x \leq 2{,}5$	Less Feasible
4	$x \leq 1{,}75$	Not Feasible

The developed product is said to be feasible if the level of feasibility achieved is at least within the criteria for feasibility or reaches the category > 2.5, then the product is feasible to be implemented. If the score obtained is less than < 2.5, then the product must go through a revision stage before it is feasible to be implemented. [18]

3. Results And Discussion

3.1.1 Analysis

This step involves examining what consumers need in order to access the most recent information. Focus Discussion Groups (FGDs) with lecturers, students, and graduate user stakeholders are used to gather information on these needs. Details gathered regarding curriculum needs (learning content), student characteristics, analysis and determining learning outcomes is presented in Figure 2.

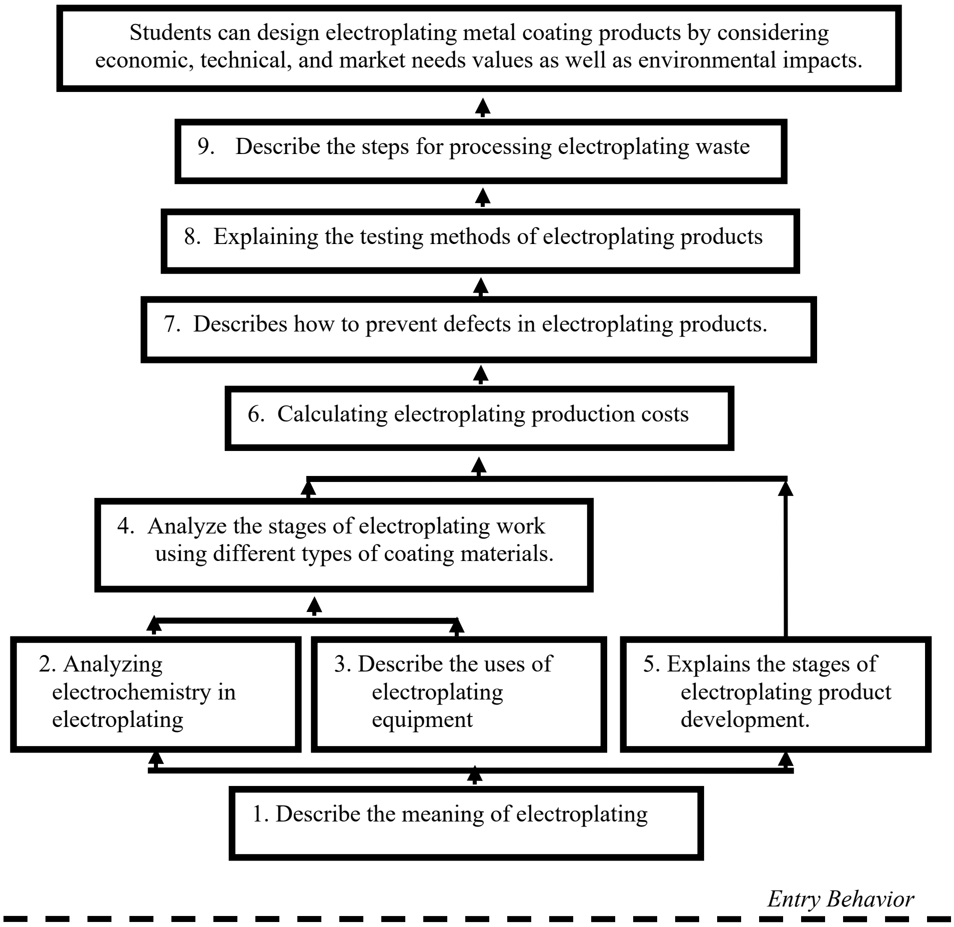

Fig. 2. Electroplating Learning Analysis

3.1.2 Design

The stage of module design begins by determining the content of the electroplating course. During the design phase, the assortment of resources utilised to fill the learning design module such as articles and images related to electroplating is carried out. The materials are obtained from several websites and teaching materials used previously.

Table 2. Electroplating Learning Module Material

Chapter	Subject of Learning	Description
I	UNDERSTANDING ELECTROPLATING	This chapter discusses the general description of electroplating, the meaning of electroplating, the purpose of electroplating, and electrochemistry in electroplating.
II	ELECTROPLATING EQUIPMENT AND PROCESSES	This chapter discusses the equipment used in the electroplating process, how electroplating works, the initial stages of the electroplating process, the coating stage, and the final stages of the process.
III	DEVELOPMENT AND PRODUCTION COST OF ELECTROPLATISTS	This chapter discusses the development and production costs of electroplating, which includes discussing electroplating products and product development, designing electroplating products and calculating electroplating production costs.
IV	DEFECTS, TESTING AND WASTE OF ELECTROPLATING PROCESS	This chapter discusses the development and production costs of electroplating, which includes discussing electroplating products and product development, designing electroplating products and calculating electroplating production costs.

3.1.3. Development

The goal of the development stage is to bring the previously created design to life. One of the necessary processes in the module development process is (1) compilation, which is done by the developer using the gathered design and content. Figure 3. shows the learning design module's cover display..

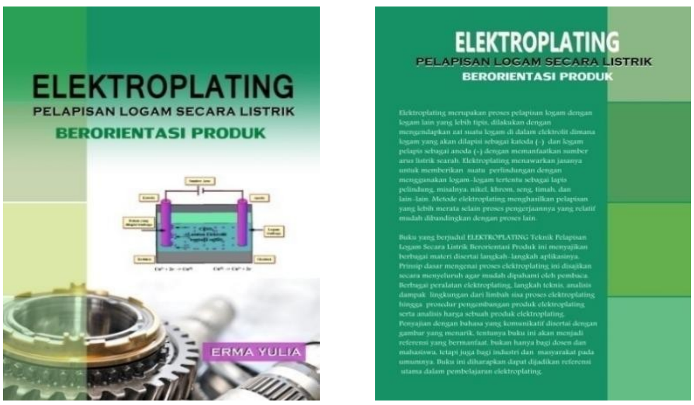

Figure 3. Front and Back Cover of the Electroplating Book

Material Expert Feasibility Results

The material expert's feasibility exam has three (three) components: assessment tools, learning material presentation, and learning material preparation. The average material expert feasibility assessment can be seen in Table 3.

Table 3. Material Expert Feasibility Assessment

No	Aspect	Score
1	Preparation of Materials	4,30
2	Presentation of Material	4,22
3	Assessment tools	4,21

The average score for the three factors evaluated by the material specialists was 4.24, or 84.80%, placing it in the very good category.

Results of the Learning Design Expert Feasibility Test

Learning objectives, learning techniques, material preparation, and evaluation instruments comprised the four (four) components of the learning design expert's feasibility test. The data in Table 4 displays the learning design expert's evaluation.

Table 4. Learning Design Expert Feasibility Assessment

No	Aspect	Score
1	Learning objectives	4,48
2	Learning strategies	4,57
3	Material preparation	4,52
4	Evaluation tools	4,54

The validation evaluation of the learning design expert was placed in the very good category since the expert's average score for the four (four) assessment components was 4.53, or 90.6%.

Results of the Learning Media Expert Feasibility Test

The feasibility from the learning media expert was divided into 3 (three) aspects, namely setting, cover and visual illustration. The diagram in Table 5 displays the learning media expert's evaluation.

Table 5. Material Expert Feasibility Assessment

No	Aspect	Score
1	Setting and Layout	4,10
2	Cover	4,17
3	Visual Ilustration	4,08

The learning media specialists gave the feasibility test an average score of 4.11, or 82.2%, placing it in the very good category. Table 6 displays the findings of the feasibility study conducted by specialists in learning design, materials, and media.

Table 6. Expert Feasibility Test

No	Expert	Average Score	(%)
1.	Material Experts	4,24	84,8 %
2.	Learning design expert	4,53	90.6 %
3.	Learning media experts	4,11	82,2 %

3.2. Discussion

The results of the electroplating module development can improve student competency in accordance with the competency of graduates needed by stakeholders. The case-method-based electroplating module is focused on stakeholder needs has fulfilled the elements of a proper module, including: (1) Title; (2) Instructions for learning (student instructions); (3) To be attained competencies; (4) Supporting data; (5) Exercises; (6) Work instructions or worksheets; and (7) Evaluation, in accordance with the opinion of Setianingsih [19]. The electroplating module developed based on industry needs can improve student competency, this is in line with research conducted at Vocational High Schools (SMK) by Sugiyarti, G., et al. [20], This highlights the value of industry participation in the module creation process in order to ensure that graduates possess skills that are applicable to stakeholders.

Teaching the module provides an opportunity for individuals to learn at their own pace in solving problems based on case studies, in a variety of ways. In addition, the use of modules is considered very appropriate to overcome students' difficulties in learning because it is arranged in an interesting way, besides that the learning process only takes a little time. The creation of instructional modules for electroplating that are modified to industry needs can improve the competence and work readiness of students and students in vocational and technical education. Collaboration between educational institutions and industry is very important to ensure the connection between educational resources and the workplace, according to research conducted by Rosyid, M. A., & Purwanto, H. [21].

This study produces a case method-based electroplating module according to stakeholder needs that can enrich teaching materials for lecturers, students and stakeholders, in accordance with research conducted by Rahmatullah, M. [22] which discusses the development of industry-based modules for engineering students, with a focus on improving practical skills needed in the industrial work environment. This study emphasizes that this module must be designed with direct input from industry to ensure its relevance and effectiveness. The process of developing this case method-based electroplating module still has several limitations, including the subjects involved in the trial process are still very limited, namely students of the Mechanical Engineering Education Department, Universitas Negeri Medan with a total of 35 people, so the feasibility of the developed module needs to be retested on subjects in other study programs at different universities.

4. Conclusion

The following conclusions can be made in light of the research's findings and the prepared module's discussion:

a. The needs analysis's findings indicate that textbooks/modules/dictates for electroplating the case method-based modules are available yet, thus it is necessary to develop electroplating the case method-based modules. The development of the module resulted in a design of an electroplating the case method-based modules with material that is in accordance with stakeholder needs.

b. The feasibility of the electroplating the case method-based modules oriented to stakeholder needs, the development's outcomes were deemed very viable for implementation. The findings of the validation of learning design experts 4.21 (84.2%), learning media experts 4.27 (85.4%), and material experts 4.26 (85.2%) all support this. With the doable criteria included, the average value of 4.25 (85%) was derived from the expert assessment.

References

[1] N. I. Naumkin, N. N. Shekshaeva, S. I. Kvitko, M. V. Lomatkina, V. F. Kupryashkin, dan I. V. Korovina.: Designing the Teaching Model of Multilevel Gradual Training of Students in Innovative Engineering. Integr. Educ., vol. 23, no. 4, hlm. 568–586, Des doi: 10.15507/1991-9468.097.023.201904.568-586 (2019).

[2] Antinluoma, M., Ilomaki, L., Lahti-Nuuttila, P., & Toom, A.: Schools as Professional Learning Communities. Journal of Education and Learning, 7(5). (2018). https://doi.org/10.5539/jel.v7n5p76

[3] Lase, D. Pendidikan di Era Revolusi Industri 4.0. SUNDERMANN: Jurnal Ilmiah Teologi, Pendidikan, Sains, Humaniora Dan Kebudayaan, 12(2), 28–43. (2019). https://doi.org/10.36588/sundermann.v1i1.18

[4] Anas, M.: Penerapan Model Pembelajaran Kooperatif Berbasis Kasus Berpusat Kepada Mahasiswa Pada Mata Kuliah Auditing 1. Prosiding Seminar Nasional Manajemen, Ekonomi, Akuntansi, 427–435. Retrieved. (2019).
from http://ojs.senmea.fe.unpkediri.ac.id/index.php/senmea/article/view/54

[5] Mentari, S., & Laily, N.: Pengembangan Bahan Ajar Berbasis Kasus (Case Based) Pada Mata Kuliah Aspek Hukum Ekonomi Dan Bisnis. Journal of Accounting and Business Education, 2(1). (2016). https://doi.org/10.26675/jabe.v2i1.6053

[6] Rahayu, G. D. S., & Firmansyah, D.: Pengembangan pembelajaran inovatif berbasis pendampingan bagi guru sekolah dasar. Abdimas Siliwangi, 1(1), 17–25 (2019).

[7] Rusmana, I. M., & Kurniawarsih, M.: Pengembangan Media Pembelajaran Komik Matematika Siswa Kelas IV Sekolah Dasar Berbasis Budaya. Jurnal Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika, 1(1), 39–48 (2020).

[8] Ramadani, Z., & Oktiningrum, W.: Pengembangan Media Pembelajaran Matematika "Minitim Kabar" untuk Meningkatkan Hasil Belajar Kognitif Siswa. Alifmatika: Jurnal Pendidikan Dan Pembelajaran Matematika, 2(2), 152–168 (2020). https://doi.org/10.35316/alifmatika.2020.v2i2.152-168

[9] Rokhim, A. R., Suparmi, S., & Prayitno, B. A. Pengembangan Modul IPA Berbasis Problem Based Learning pada Materi Kalor dan Perpindahan untuk Meningkatkan Kemampuan Berpikir Kritis Siswa SMP Kelas VII. INKUIRI: Jurnal Pendidikan IPA, 7(1), 143–150 (2018).

[10] Istikomah, I., & Purwoko, R. Y.: Sigil: Pengembangan E-Modul Berbasis Realistik pada Materi Lingkaran Untuk Siswa Kelas VIII SMP. JP3M (Jurnal Penelitian Pendidikan Dan Pengajaran Matematika), 6(2), 91–98 (2020).

[11] Sipayung, T. N., & Simanjuntak, S. D.: Efektivitas Pembelajaran Kooperatif Dengan Menggunakan Modul. AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 6(3), 393–398 (2017).

[12] Diana dan Luqman Hakim.: Strategi Kolaborasi Antara Perguruan Tinggi, Industri dan Pemerintah : Tinjauan Konseptual Dalam Upaya Meningkatkan Inovasi Pendidikan dan Kreatifitas Pembelajaran di Perguruan Tinggi, Prosiding Konferensi Nasional Ekonomi Manajemen dan Akuntansi (KNEMA) Journal KNEMA (2017) https://jurnal.umj.ac.id/index.php/KNEMA/

[13] Carneiro, A.: How does knowledge management influence innovation and competitiveness? Journal of Knowledge Management, 4(2), 87–98 (2000). doi.org/10.1108/ 13673270010372242

[14] Wu, S. & Wu, L.: The Impact of Higher Education on Entrepreneurial Intentions of University Students in China. Journal of Small Business and Enterprise Development, 15(4): 752–774 (2008).

[15] McHardy, Peter and Teresa Allan.: Closing the gap between what industry needs and what HE provides: Education + Training; Volume 42.Number 9.; 2000;.pp. 496±508; MCB University Press.ISSN 0040-0912 (2000).
[16] bert M. Gagne, et.al.: Pinciples of Instructional Design. Fifth Edition. New Jersey, USA: Thomson Wadsworth, p 21 (2015)
[17] Nesbit J, Belfer K. &., Leacock T.: Learning Object Review Instrument (LORI) User Manual v 1.5 (2007).
http://www.transplantedgoose.net/gradstudies/educ892/LORI1.5.pdf
[18] Sriadhi.: Learning Multimedia Assessment Instrument. Medan: Universitas Negeri Medan (2018)
[19] Setianingsih, S.: Pengembangan Modul Berbasis Edutainment pada Pokok Bahasan Bangun Datar. UIN Raden Intan Lampung (2019).
[20] Sugiyarti, G., et al.: Pengembangan Modul Pembelajaran Berbasis Kebutuhan Industri untuk Meningkatkan Kompetensi Siswa di SMK. Jurnal Pendidikan Teknologi dan Kejuruan, 23(2), 125-132 (2020).
[21] Rosyid, M. A., & Purwanto, H.: Penerapan Modul Berbasis Industri pada Pendidikan Vokasi untuk Meningkatkan Keterampilan Kerja. Journal of Educational Research and Evaluation, 5(2), 112-123 (2021).
[22] Rahmatullah, M.: Pengembangan Modul Pembelajaran Berbasis Industri untuk Meningkatkan Keterampilan Praktis Mahasiswa Teknik. Jurnal Teknologi Pendidikan, 22(4), 45-56 (2020).