Level of Curriculum Relevance for Diploma 3 (D3) Mechanical Engineering at Bali State Polytechnic (BSP) with Competencies for Industry, Business, and Work (IDUKA) in Bali

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***Abstract*--**This study aims to: 1) determine the level of relevance of the D3 Mechanical Engineering Study Program curriculum at the State Polytechnic with the competencies required by IDUKA. 2) the pattern of aligning the curriculum of the Diploma of Mechanical Engineering at the State Polytechnic Diploma Study Program with the competencies required by IDUKA. The research was conducted at the Bali State Polytechnic, using a mixed quantitative and qualitative descriptive method. The subjects are alumnus who has worked, IDUKA leaders where alumni work, and teaching lecturers in the Mechanical Engineering department. Samples were taken using Snowball Sampling. Data were collected through surveys using questionnaires and analysed descriptively. The results of the analysis show that the relevance of the D3 Mechanical Engineering Study Program curriculum with the competencies required by IDUKA is categorized as relevant. However, there are 3 competency subjects from the element of knowledge mastery competence that are categorized as less relevant. The curriculum needs to be aligned through synchronization involving IDUKA partners, the Chair of the Association of Chief Engineers (ACE), and the alumnus Association. Alignment can be carried out at least once a year, namely before the new school year or before the release of graduates at the end of the school year. The pattern is that IDUKA partners are asked to convey the latest competencies they need from prospective employees. The mechanism is that IDUKA is given a form to fill in the latest list of competencies they need.

Keywords: Curriculum, IDUKA, Competence, Relevance, Mechanical engineering

I. Introduction

Vocational education is a higher education program to prepare workers who are ready to work by applying expertise and skills in their fields. Pavlova (2009) stated that the tradition of vocational education is to prepare students to be ready to work by applying their skills and skills [1]. In general, it aims to prepare and produce graduates who have the skills to be able to enter IDUKA or to continue to higher education levels, but prioritize being ready to work, equipped with various knowledge and skills. So that the vocational education curriculum is required to always be able to adapt to the conditions, changes, and needs of IDUKA. The vocational education curriculum must be able to accommodate all the physical, non-physical, and moral needs of students and their future to be able to live safely, comfortably, happily, and in harmony with the community and the surrounding environment [2].

Vocational education has a very strategic role in handling the age of the workforce and educating them to become skilled, professional, and highly competitive workers in accordance with 21st-century skills. Vocational education must be able to equip graduates with skills in digital literacy, technological literacy, and human literacy through the revitalization of the Chrono system which includes the learning system, educational units, students, and educators as well as education staff [3]. The revitalization of the learning system includes, 1) curriculum and character education, 2) information and communication technology-based learning materials, 3) entrepreneurship, 4) alignment, and 5) evaluation [4].

The curriculum is a document developed in written form and used to plan and organize an organized experience for students and for their learning [5]. The curriculum is the lifeblood of a learning program so its existence requires dynamic design, implementation, and evaluation in accordance with the times, the needs of Science, Technology, and the Arts (IPTEKS) as well as the competencies needed by the community, as well as IDUKA. The curriculum is designed in synergy between government, industry and education. The material is always updated according to industry needs and contains the competencies needed to enter the world of work, business, and industry.

The curriculum must have relevance to: 1) The suitability of the curriculum with the demands, needs, conditions, and

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development of the community. 2) Conformity between the components of the curriculum, namely the content in accordance with the objectives, the process in accordance with the content and objectives, evaluation in accordance with the process, content, and objectives of the curriculum. [6]. The vocational education curriculum is structured in relation to the achievement of graduate competence, and the resulting learning outcomes, so it needs to be studied in depth according to the philosophy of vocational education so that the graduates it produces are able to survive and be absorbed in the world of work.

Curriculum development is an effort to find out how to plan and regulate the objectives, content, and learning materials as well as the methods used as guidelines for implementing learning activities that are in accordance with developments and needs to achieve certain goals in an institution. Development is carried out with reference to national education standards to realize national education goals. A curriculum is expected to provide a foundation, content and become a guideline for the development of student abilities optimally in accordance with the demands and challenges of community development [7].

Every curriculum development, besides having to be based on a number of foundations, must also apply or use certain principles. One of them is the general principles, namely: relevance, flexibility, continuity, practicality and effectiveness. These principles serve as a strong landscape for realizing a curriculum that suits the needs of students, lecturers, and IDUKA [6]. The principle of relevance means that a curriculum must be relevant or in accordance with the development of science and technology (IPTEK) so that students learn the truly latest science and technology enabling them to have insights and thoughts that are in line with the times.

The principle of curriculum relevance is its relevance to the world of work. The curriculum must have a match between what is taught in schools / madrasas with what is desired by the world of work. The relevance of the curriculum to the world of work is one of the principles of curriculum development carried out so that the curriculum implemented on campus as a formal educational institution becomes meaningful. With this principle, graduates will have knowledge that is appropriate and compatible with IDUKA, a place to accommodate or absorb graduates. A dynamic and up-to-date curriculum is a curriculum that always follows the times, namely the development of science and technology [8]. The curriculum must be flexible and always perfected to achieve an increase in the quality of education both locally and nationally [8]. An effective curriculum is a curriculum that is always adaptive to the demands of the life of the community, nation, and IDUKA.

Currently, the D3 Mechanical Engineering Study Program implements the 2016 revised 2017 KPT based on the SNPT which has generally been constructed with a long and evolving process. However, until now, the level of relevance to the competencies required by IDUKA is unknown. On the other hand, the market for the D3 Mechanical Engineering curriculum product is IDUKA, IDUKA continues to change, improving people's living standards, technological advances, infrastructure, and openness to changes in the demographic landscape are triggers for IDUKA's changing needs for human resource competencies. It is important to assess the relevance of the D3 Mechanical Engineering curriculum with IDUKA so that the effectiveness and efficiency of education in PNB can increase. To find out the extent of the gap between the curriculum competency targets and the competencies required by IDUKA.

The research aims to determine: 1) the level of relevance of the D3 Mechanical Engineering study program curriculum in PNB with the competencies required by IDUKA in Bali, and 2) obtain a pattern of aligning the PNB Mechanical Engineering D3 study program curriculum with the competencies required by IDUKA in Bali.

II. METHOD

This type of research includes quantitative descriptive research with survey methods and is designed to last one year. The subjects are Lecturers, alumni and IDUKA where alumni work. Samples were taken using snowball sampling. Data is collected through internal and external surveys using online or offline questionnaires.

The research data is sourced from alumni who have worked, IDUKA leaders where the alumni work, and lecturer staff of the Mechanical Engineering department. Data were collected using the following methods: online or offline surveys. The instrument was prepared by the researcher himself based on the competency formulation in the curriculum. Furthermore, the data were analysed using descriptive statistics. Data from each competency is classified into five categories with an ideal normal curve [9]. While the level of relevance and mastery of competence is determined using the criteria developed by Akbar as shown in Table I. [10].

TABLE 1. RELEVANCE CRITERIA

No	Interval	Category Level of Relevance
1	85,01 % – 100 %	Very relevant/high
2	70,01 % – 85,00 %	Relevant/ high
3	50,01 % – 70,00 %	Less relevant / low
4	05,01 % – 50,00 %	Irrelevant/ very low

III. RESULTS AND DISCUSSION

The research instrument is in the form of 3 types of questionnaires (attached) whose validity has been tested through theoretical testing. The three questionnaires have content validity of 0.88, 0.87, and 0.89, all of which are categorized as very high. Each questionnaire is distributed online or offline to each subject.

The curriculum is a written document used to plan and organize the experiences of learners in an organized manner for their learning [5]. Curriculum as a set of educational programs containing various teaching materials and learning experiences, planned systemically on the basis of applicable norms and is used as a guide in the learning process to achieve educational goals. The curriculum that is prepared is not only related to the results of the competency achievements of graduates, it is also related to the resulting learning outcomes. The preparation of the current curriculum has referred to the Indonesian National Work Competency Standards (SKKNI) or international standards. The curriculum for the D3 Mechanical Engineering study program sets out 41 competencies that must be possessed by graduates. The level of mastery of competence in students when they pass the D3 mechanical engineering program, on average, reaches 80.7%, categorized as high.

Soft skills are abilities that an individual has naturally related to intelligence, both emotional and social, communication or other individual interactions. Soft skills are the innate characteristics of each individual in the form of non-technical skills, and a series of other non-technical skills. The various soft skills of graduates of the BSP Mechanical Engineering study program observed in this assessment, namely: 1) critical thinking and problem solving skills, 2) collaboration and leadership, 3) agility and adaptability, 4) initiative and entrepreneurial spirit, 5) oral communication or written, 6) access and analyse information, 7) curiosity and imagination, 8) mathematical thinking skills, 9) work ethics and etiquette, 10) decision-making abilities, and 11) data and fact identification abilities. The alumni response to the eleven soft skills averaged 88.89%, categorized as very supportive of carrying out work at IDUKA. Curriculum support for the development of the eleven soft skills is an average of 80.8% which is categorized as supportive.

The BSP Mechanical Engineering D3 Study Program implements the 2016 revised 2017 Higher Education Curriculum based on the SNPT. The resulting competencies are called Learning Outcomes (LO). Learning outcomes for D3 level (Level 5 - KKNI) Diploma 3 Mechanical Engineering Study Program based on KKNI-based learning outcomes. There are 41 points of competence classified into elements of competence in attitudes and values, work skills, mastery of knowledge, and authority and responsibility which include elements: attitudes and values, work skills, mastery of knowledge, authority and responsibility. The response from IDUKA as a graduate user on the subject of competence from each element of learning achievement with the competencies needed by the company is presented in Table II.

TABLE II. CURRICULUM RELEVANCE OF D3 MECHANICAL ENGINEERING STUDY PROGRAM AT BALI STATE POLYTECHNIC WITH COMPETENCE REQUIRED FOR IDUKA IN BALI

Elements of Competence	Average Score	Percentage (%)	Category
I Attitudes and values			
Profesional Ethics	4.48	89.5	Very Relevant
Average I		89.5	Very Relevant
II Job skills			
Safety and Health at Work	4.62	92.4	Very Relevant
Mechanical Technology	4.05	81.0	Relevant
Electrical and electronics practice	4.24	84.8	Relevant
Engineering Materials Knowledge	4.10	81.9	Relevant

Elements of Competence	Average Score	Percentage (%)	Category
Electric Motor Practice and Control (PLC)	4.43	88.6	Very Relevant
Convertion Energy Practice	3.95	79.0	Relevant
Maintenance & Repair Techniques	4.29	85.7	Very Relevant
Mechanical Technology Practice	4.14	82.9	Relevant
Hydraulic and Pneumatic	4.38	87.6	Very Relevant
Basic Automotive Maintenance Practices	4.48	89.5	Very Relevant
Electrical Engineering and Automotive Electronic	4.67	93.3	Very Relevant
Maintenance & Repair Management	4.14	82.9	Relevant
Automotive Electrical & Electronics Practice	4.57	91.4	Very Relevant
Practice Overhaul and Tune Up	4.52	90.5	Very Relevant
Hydraulic & Pneumatic Practice	4.33	86.7	Very Relevant
Workshop management	4.57	91.4	Very Relevant
Technopreneurship	4.33	86.7	Very Relevant
Average II		86.8	Very Relevant
III Knowledge mastery			
Applied Chemistry	3.19	63.8	Less Relevant
Applied Physics	3.05	61.0	Less Relevant
Applied Mathematica	3.43	68.6	Less Relevant
MKU 2210Engineering Mechanics	3.67	73.3	Relevant
Engineering Drawing	4.10	81.9	Relevant
CAD-Based Machine-1 Drawing	4.00	80.0	Relevant
CAD-Based Machine-2 Drawings	4.05	81.0	Relevant
Machine element	3.95	79.0	Relevant
MKK 1*Practise of Mechanical Technology*	4.14	82.9	Relevant
Mechanical Technology Practice-2	4.29	85.7	Very Relevant
Fluid Mechanics	4.05	81.0	Relevan
Engineering Thermodynamics	4.33	86.7	Very Relevant
Basic Electrical and Electronics	4.38	87.6	Very Relevant
Heat transfer	4.29	85.7	Very Relevant
Combustion Engine	4.48	89.5	Very Relevant
Energy Conversion Machines	4.43	88.6	Very Relevant
Electric Motor and Control (PLC)	4.33	86.7	Very Relevant
Average III		79.7	Relevant
IV Authority and responsibility			
English *Language*	4.43	88.6	Very Relevant
Indonesian Language	3.67	73.3	Relevant
Maintenance & Repair Management	4.33	86.7	Very Relevant
On The Job Training	3.57	71.4	Relevant
Seminar on Proposal for Final Project	3.71	74.3	Relevant
Final project	3.57	71.4	Relevant
Average III		77.6	Relevant
Average I, II, III, and IV		83.42	Relevant

Based on Table II, the average percentage score of IDUKA's response to competence in the D3 curriculum of the PNB Engineering Study Program is 83.49% which is categorized as relevant. Regarding the elements: competence, attitudes and values, 89.5% are categorized as very relevant, 86.5% work skills are categorized as very relevant, knowledge mastery is 80.2% are categorized as relevant, the elements of authority and responsibility are 77.6% are categorized as relevant. There are 3 competency subjects from the element of knowledge mastery competence which are categorized as less relevant. The three subjects are: Applied Chemistry, Applied Physics, and Applied Mathematica. The level of relevance of the D3 mechanical engineering study program curriculum at PNB reached 83.49%, categorized as relevant to the competencies required by IDUKA.

The results of the data analysis of IDUKA responses to the soft skills of graduates averaged 72.4% categorized as high, but there are 4 soft skills, namely: critical thinking and problem solving abilities, initiative and entrepreneurial spirit, oral and written communication, and curiosity and imagination is categorized as lacking or weak. These four kinds of soft skills need to be improved.

IDUKA expectation for the development of the D3 Mechanical Engineering study program curriculum of PNB, that all competency subjects, elements of competence in attitudes and values, work skills, mastery of knowledge, as well as authority and responsibility are stated to be relevant, but students' soft skills need to be developed. The priority of soft skills that need to be developed in order of percentage as shown in Table III.

TABLE III. ORDER OF SOFT SKILLS THAT NEED TO BE DEVELOPED IN THE D3 MECHANICAL ENGINEERING STUDY PROGRAM CURRICULUM BSP

No	Variety of Soft Skills	Percentage (%)
1	Critical thinking and problem solving skills	81.0
2	Communicating orally and in writing	66.7
3	Decision making ability	66.7
4	Agility and adaptability	61.9
5	Collaboration and leadership	57.1
6	Ability to identify data and facts	57.1
7	Mathematical thinking skills	47.6
8	Initiative and entrepreneurial spirit	23.8
9	Curiosity and imagination	19.0
10	Access and analyze information	14.3
11	Work ethic and etiquette	9.5

Based on Table III, critical thinking and problem solving skills are among the top priorities that really need to be developed. Besides that the critical thinking and problem solving abilities of graduates are in the weak category, this ability is one of the skills required in the 21st century. Essentially critical thinking is an active process where individuals think about things in depth, ask questions for themselves, get information that suitable for himself rather than accepting things from outside himself [11]. These skills are fundamental skills in the 21st century, including the ability to access, analyse, synthesize information, be trained and mastered. Critical thinking skills describe other skills such as communication and information skills, as well as the ability to examine, analyse, interpret, and evaluate facts. In the era of bad 21 where the flow of information is very abundant, students need to have the ability to choose the right and correct sources and information, find quality sources and evaluate sources from aspects of objectivity, reliability, and up-to-date.

Problem solving skills include identification skills and the ability to search, select, evaluate, organize, and consider various alternative solutions and interpret information. Problem solving really requires teamwork, communication, effective and creative collaboration from one person and another. Problem solving really requires critical thinking skills, critical thinking is a fundamental skill in solving problems. An individual must be able to effectively and efficiently apply the right tools and techniques to solve a problem. Soft skills, the ability to think critically and solve problems, are essential to be developed through integration in each subject, the competency elements of the D3 Mechanical Engineering curriculum.

Harmony is the connectivity between one element and another or the relationship between one institution and another. The alignment of vocational education is related to the suitability between the competencies or skills learned and the competencies required by IDUKA. The closer the alignment, the easier it will be for graduates to get a job after graduation.

Alignment is directed at increasing collaboration with industry, affirmation programs, and job matching for graduates. The alignment of the PNB Mechanical Engineering D3 Study Program curriculum with the competencies required by IDUKA in this study includes the breadth and depth of the competencies taught by PNB compared to the competencies required by IDUKA based on the level 5 KKNI certification scheme that has been established by BNSP. The breadth includes the different types of competencies required by IDUKA and the types of competencies that have been taught by PNB. The depth of competence includes the level of competence required by the world of work and the level of depth of competence that has been developed at BSP.

Curriculum alignment activities with IDUKA, can be carried out with a synchronization pattern, carried out 2 times a year, namely before the new school year and before the release of graduates. In the format, IDUKA is asked to convey the latest competencies they need from prospective employees. The mechanism is that IDUKA is given a form to fill out with the latest list of competencies it needs. Then a meeting was held by inviting ACE and alumni associations who have worked to synchronize the competencies required by IDUKA, with the direction of curriculum development on campus. The results of the synchronization will be used as material for curriculum development.

IV. Conclusion

The level of relevance of the D3 mechanical engineering study program curriculum at PNB reached 84.14%, categorized as relevant to the competencies required by IDUKA. However, there are 3 competency subjects from the element of knowledge mastery competence which are categorized as less relevant.

The curriculum needs to be aligned through synchronization involving IDUKA partners, the Chair of the Association of Chief Engineers (ACE), and the alumnus Association. Alignment can be carried out at least once a year, namely before the new school year or before the release of graduates at the end of the school year. The pattern is that IDUKA partners are asked to convey the latest competencies they need from prospective employees. The mechanism is that IDUKA is given a form to fill in the latest list of competencies they need.

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