Conference Paper

Curriculum Design for the Applied Undergraduate Business Information System Study Program: Focus on learning Outcomes required in Indonesia

Meyti Eka Apriyani, Agung Nugroho Pramudhita*, Indra Dharma Wijaya

Technology Information Engineering, State Polytechnic of Malang, Indonesia

Corresponding author:
E-mail:
agung.pramudhita@polinema.ac.id

ABSTRACT

In Industry 4.0, where the internet and information technology have become primary needs, it is necessary to integrate information technology with the world of business and industry. The business world and industry need new skills. Higher Education, especially polytechnics as producers of expert workers, has not produced many graduates with competencies that are relevant to current conditions. Therefore, a curriculum is needed that can create graduates suitable for the needs of the business and industrial world. This research aims to design an integrated curriculum between business and industry that will be applied in the Applied Bachelor Program in Business Information Systems at the State Polytechnic of Malang. Qualitative research methods were used in this study, and literature studies and discussions were carried out with several industry curriculum experts and practitioners from the industry. The redesigned curriculum requires several analyses such as several data sources, namely curriculum evaluation which contains analysis from the previous curriculum, study materials or literature study and input from industry through tracer studies. The curriculum is made by paying attention to pedagogical learning and integrating industry, business and informatics. The redesigned curriculum also pays attention to the body of knowledge (BOK) by taking similar knowledge covering four main areas: information system strategy and management, information system development, operation, and evaluation of information system solutions. The results of this study are in the form of graduate profiles and a learning outcome matrix that is following the study material and the integration between business and informatics for applied undergraduate polytechnics.

Keywords: Curriculum, Information technology, learning outcome

Introduction

The curriculum is an essential component of education that is frequently overlooked. The curriculum occupies a strategic position because, in general, it is a description of a nation's vision, mission, and educational goals(Awwaliyah, 2019). The direction and objectives of the education curriculum will shift and change in tandem with the dynamics of social change caused by various internal and external factors. The curriculum must be flexible and futuristic due to its dynamic nature in responding to change. Due to a lack of adaptation to social changes, curriculum design inequality may impact how well educational output adapts to the relevant social contexts. In light of these factors, developing curricula becomes one of the government's fundamental responsibilities to control and advance education(Subkhan, 2020).

Similarly, educational leaders and observers must track every instance of societal change because it will all be considered when establishing the curriculum. Additionally, the community must participate actively and offer suggestions for addressing modifications. A learning program's curriculum is its lifeblood. Thus, it needs to be designed, implemented, and evaluated dynamically

to reflect the times, the requirements of science, technology, and the arts, as well as the competencies required by the community and employers of university graduates. The National Higher Education Standards (NHES) have changed to reflect the logarithmic trend of science and technology's rapid progress in the twenty-first century(Kemenristekdikti, 2015).

NHES has changed three times in six years, starting with Permenristekdikti No. 49 in 2014, then Permenristekdikti No. 44 in 2015, and finally to Permendikbud No. 3 in 2020, by the Ministry of Education and Culture's policy on Independent Learning-Campus Merdeka (MBKM)(Puspitasari & Sastromiharjo, 2021). For the general public, these changes are frequently misinterpreted as a requirement that the education curriculum must change whenever the Minister of Education changes(Simatupang & Yuhertiana, 2021). However, changing the educational curriculum is necessary as long as it does not contradict the educational philosophy or applicable regulations. Presidential Regulation Number 8 of 2012 concerning the Indonesian National Qualifications Framework (INQF) and Law Number 12 of 2012 concerning Higher Education encourage all universities to comply with these provisions (Primastuty et al., 2017). INQF is a statement of the quality of Indonesian Human Resources (HR), whose qualification levels are based on the level of ability stated in the formulation of learning outcomes.

Universities, as producers of educated human resources, need to measure their graduates, whether graduates who are The resulting 'ability' is equivalent to the 'ability' (learning achievement) that has been formulated in the INQF qualification level. Creating a graduate profile, translated into creating Graduate Learning Outcomes, is the first step in curriculum preparation. The INQF descriptor's ability formulation is expressed in learning outcomes, where competence is incorporated into or constitutes a component of learning outcomes (LO). Permendikbud No. 3 of 2020's National Higher Education Standards (NHES) article 5, paragraph (1), states that the Graduate Competency Standards (GCS) are the minimum requirements regarding the qualifications of graduates' abilities, which include attitudes, knowledge, and skills stated in the creation of Graduate Learning Outcomes, uses the term competence in higher education (Puspitasari & Sastromiharjo, 2021). The description of learning outcomes in the IQF contains four elements, namely, elements of attitudes and values, elements of workability, elements of scientific mastery, and elements of authority and responsibility. Meanwhile, in NHES, the LO formulation is included in one of the Graduate Competency Standards (GCS) standards. In NHES, LO consists of elements of attitude, general skills, special skills, and knowledge. Elements of general attitudes and skills have been formulated in detail and listed in the attachment of NHES. In contrast, elements of special skills and knowledge must be formulated by forums of similar study programs, which are characteristics of study program graduates. Based on the LO, the curriculum of a study program can be developed (Ali, 2018).

Currently, the existing curriculum is still not based on OBE (Outcome Based Education). The OBE curriculum is a curriculum that is by stakeholders' expectations, based on the progress of the times and changes in the job market (Vaijayanthi & Murugadoss, 2019). The basic principles of the OBE curriculum are: focus on learning outcomes, backward design or curriculum designed about clear learning outcomes, learning engagement, and expanded opportunities. While the benefits of OBE are a more targeted and coherent curriculum, graduates will be more relevant to the needs of graduate users, and continuous quality improvement can be carried out. Curriculum changes are based on data from several survey data from alumni when they first worked.

Based on Fig 1. the majority of graduates are IT, staff, it turns out that the expectations of the institution the graduates must have the ability in the field of analysis or equivalent to the supervisor level. Therefore, curriculum changes based on OBE are needed, where curriculum changes are adjusted to industry demands in the field of analysis.
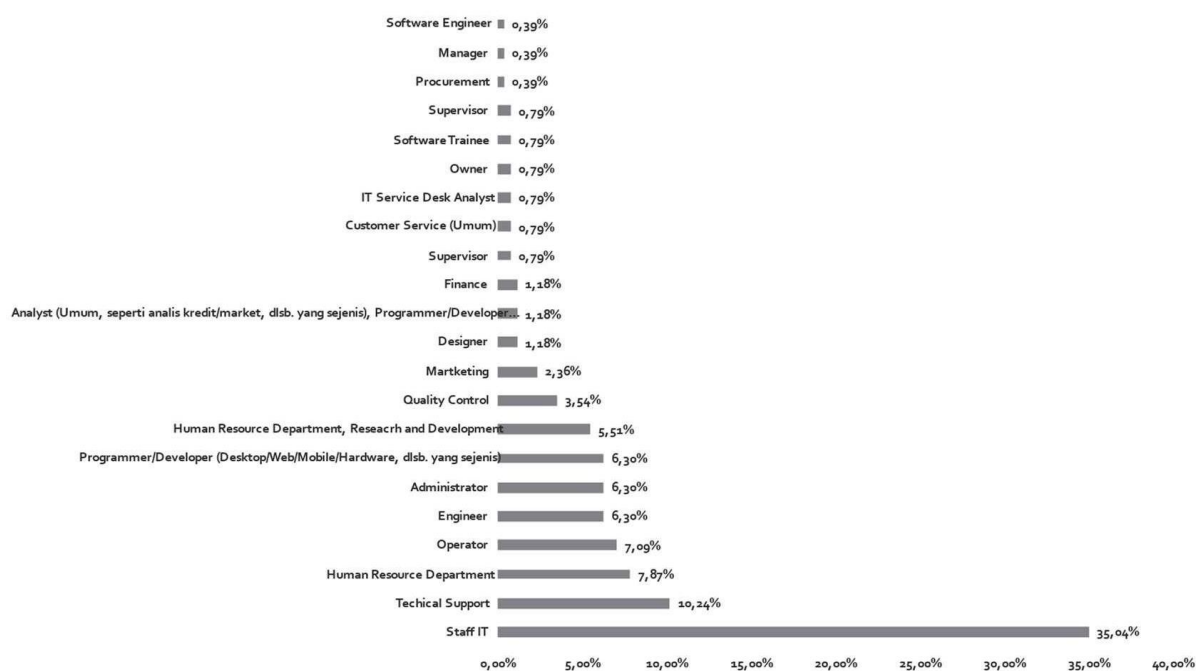
Figure 1. Alumnae job placement based on tracer study

Table 1. Analyst job availability

IT Analyst Profession	Number of Job Available (jobstreet.co.id)
Data scientist	407
Data Analyst	2504
System Analyst	397
Business Analyst	2357
Business Intelligence	397

In the table above, there are IT analyst professions that are needed in several industries locally and nationally. Professions are grouped according to the ACM IS2020 association standard which shows that one type of analyst profession consists of data scientists, data analysts, system analysts, business analysts, and business intelligence. The source of vacancy data obtained from jostreet.co.id and local job vacancy requests shows that the IT analyst profession consists of data scientists in 2021. From the data above, several professions are in the field of analysis. Most job vacancies are found in business analysts. A business analyst is a profession that requires a more in-depth analysis of their business activities to achieve targets according to company expectations and even more. As a result, curriculum adjustments based on OBE are required, where curriculum changes are matched to industrial demands in the field of analysis.

Material and Methods

The description of the learning outcomes above is the basis for making LO for the business information systems study program. The making of learning outcomes is adjusted to the scientific vision that the study program has determined by the NHES foundation, the scientific field of the study program, the field of work, and requirements analysis. The preparation of the LO also involves several stakeholders in formulating how to form the LO by the wishes of the stakeholders. The LO that is developed must be adjusted to the qualification level of the INQF for the Business Information System study program with a qualification level of level 6, the equivalent of a bachelor's program. This study focuses on developing an LO advised by the literature and stakeholder participation. The development of LO is also based on the findings of the evaluation

of the study program's curriculum through tracer studies, feedback from users of graduates, alumnae, and subject-matter experts, as well as measurements of the existing curriculum's LO's achievement. The review also looks at how science and technology have advanced in the relevant field, what employers need, and how each institution's vision and core principles have evolved.
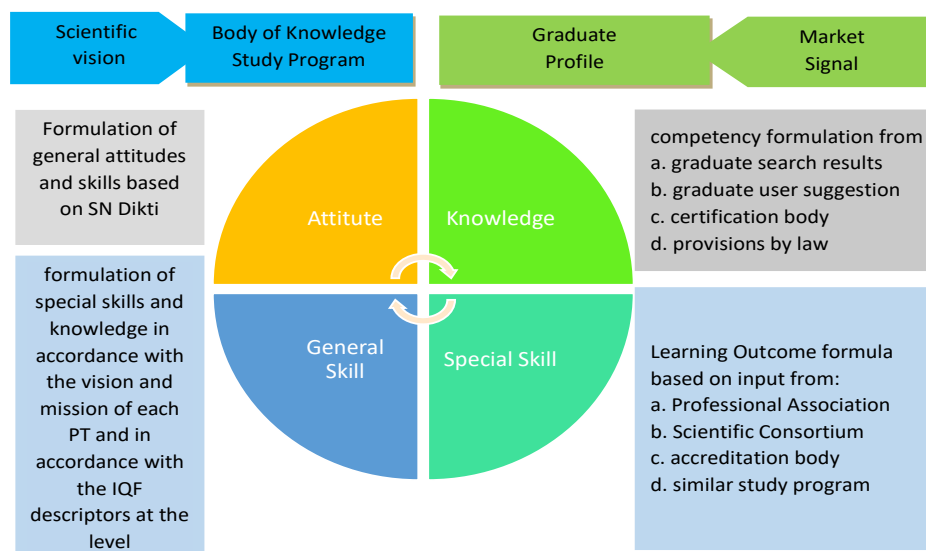

Figure 2. Learning outcome formulation methodology

The graduate profile that is set becomes the direction in the formulation of the LO (Achievements) Graduate Learning or Learning Outcome/Student Outcome (LO/SO)) because of attitudes, knowledge, and skills that build the knowledge and skills required. A critical component in education that is often overlooked is the curriculum.

Inequality in curriculum design due to a lack of response to social changes may have consequences for the birth of educational output in adapting to the social conditions in question(Fodor et al., 2021). Based on these considerations, curriculum development becomes one of the government's main tasks to regulate and develop education (Ulum, 2020). Likewise, leaders and observers of education must follow every episode of social change because all of that will be considered when designing and developing the curriculum. In addition, active community participation is also highly expected to contribute ideas in responding to any changes. The curriculum is the lifeblood of a learning program, so its existence requires dynamic design, implementation, and evaluation by the times, the needs of Science, Technology, and Arts as well as the competencies needed by the community and users of university graduates. The rapid development of science and technology in the 21st century follows a logarithmic pattern, causing the Higher Education Standards (NHES) also to track these changes.

Outcome-Based Education (OBE) is outcome-centered education not just material that must be completed. OBE measures learning outcomes and makes it possible to develop new skills that prepare them on a global level. OBE approach emphasizes the sustainability of the learning process in an innovative, interactive, and effective manner. And OBE affects the overall educational process of curriculum design; formulation of learning objectives and outcomes; educational strategy; design of learning methods; assessment procedures; and the educational environment/ecosystem (Rao, 2020). Previous curriculum development uses the traditional way where the curriculum comes from one generation to the next while the development of the OBE curriculum is based on needs while working. In the learning process for curriculum development methods traditionally help complete material based on the syllabus while for curriculum development OBE can help students achieve predetermined outcomes. The process of curriculum

development, has principles by principles of relevance, flexibility, continuity, practicality, and effectiveness. The principle of relevance is seen in the results of obtaining an education that is functional. The relevance of the curriculum can be outward and inward to the curriculum itself. The principle of flexibility is seen in the flexibility / non-rigidity in providing freedom of action for the doses and its students. The principle of continuity is seen in the continuity of learning between one generation to the next and from one stratum to the next. The practical principle is seen in the ease with which it is to be implemented, using relevant tools at a small cost. This principle is also called the principle of efficiency.

The mechanism for preparing an OBE-based curriculum is based on university policies and analysis on the assessment of self-evaluation of study programs on accreditation forms. Furthermore, a "tracer study" of market needs was also carried out along with input from graduate users (Stakeholders). After that, benchmarking was carried out on several related universities that have implemented an OBE-based curriculum. With the results of the graduate profile, it is hoped that students can complete the entire learning process with the suitability of the IQNF level and pass the learning. Furthermore, from the existing graduate profile, the study program curriculum development team made learning outcomes that were adjusted to the LO element in SN-Dikti. The curriculum team also makes study materials as components/materials that must be taught to achieve the planned LO. The existing study materials become courses as a forum for the consequences of study materials that will be studied by students and taught by lecturers. From the course, an assessment method emerges which is a process of identifying and determining the penetration and utilization of study materials by learners through accountable parameters and measuring variables.

Results and Discussion

Before the curriculum of the Business Information System Study Program, previously the study program is named Informatics Management, and had the Graduate Profile as follows:

Table 2. Graduate profiles of the informatics management study program

Graduate Profiles of Informatics Management Study Program				
Programmer	Network Administrators	IT Technical Support	IT Team Leader	Database Developer

After the process of designing the OBE-based curriculum mentioned before and also following the Information Systems curriculum guidelines (IS 2020), which identify professions for Information Systems graduates, ACM IS 2020 provides graduate programs for Application Developers, Business Analysts, Business Process Analysts, Business Process Analysts, and Database Administrators (Shankararaman et al., 2021). Based on the industry requirements, feedback LO users of graduates, alums, and subject-matter experts, Business Information Systems Curriculum development teams at State Polytechnic of Malang select the graduate profiles as follows:

Table 3. Graduate profile of business information system study program

No	Graduate Profile	Competence	Scientific Group	Knowledge Area
1	Software Engineer	Backend development, Frontend development, Fullstack development, Android development, Hybrid development, Quality Assurance, UI/UX, Project management	Software Engineering Web & Mobile Programming	Human-Computer Interaction, Software Engineering, SocialIssues & Professional Practice Algorithm & Complexity, Discrete Structures, Programming Languages, Software Development Fundamentals, Platform-
	To be continued…			

		based Development (Mobile & Web)		
2	Business Analyst	DB administration, Fraud Engineering, Bussines Intelligence, System Analysis, System Architecture, Bussines Management	Information Management	Information Management, Platform-based Development(Industrial System)
3	Data Scientist / Data Analyst	Data Analysis, Data Engineering, Intelligent System	Intelligent System	Intelligent System, Computational Science
4	Technopre-neuer	Technopreneur System Information	All	All

The reference for curriculum development and learning outcomes (Learning Outcomes) is formulated based on the Indonesian National Qualifications Framework and National Higher Education Standards which include the components of attitudes, knowledge, and skills (Kemenristekdikti, 2015). In its preparation, the Business Information System Study Program uses the basis of Permendikbud No. 3 of 2020 concerning National Higher Education Standards. The components of general attitudes and skills refer to these regulations, while the components of specific knowledge and skills refer to learning outcomes compiled by study program associations and developed/added according to the characteristics of the Study Program (Puspitasari & Sastromiharjo, 2021). Graduate learning outcomes function to support the profile of study program graduates and are also used as the main reference for developing learning content standards, learning process standards, learning assessment standards, lecturers and education staff standards, learning facilities and infrastructure standards, learning management standards, and learning financing standards (Matthews & Mercer-Mapstone, 2018). The various aspects of attitudes, knowledge, general skills, and special skills included in the learning outcomes of the Business Information System Study Program at the State Polytechnic of Malang are defined as follows.

Table 4. Learning outcomes matrix

Aspect	Learning Outcomes
Attitude correct and cultured behavior resulting from internalizing and actualizing values and norms reflected in spiritual and social life through learning, student work experience, research, and community service related to learning *To be continued...*	1. Fear of God Almighty and being able to show a religious attitude; 2. upholding human values in carrying out tasks based on religion, morals, and ethics; 3. contribute to improving the quality of life in society, as a nation, as a state, and in the advancement of civilization based on Pancasila; 4. to act as citizens who are proud and love their homeland, have nationalism and a sense of responsibility to the state and nation; 5. appreciate the diversity of cultures, views, religions, and beliefs, as well as the opinions or original findings of others; 6. cooperate and have social sensitivity and concern for society and the environment; 7. obey the law and discipline in the life of society and the state; 8. internalize academic values, norms, and ethics;

Aspect	Learning Outcomes
	9. demonstrate a responsible attitude towards work in the field of expertise independently;
	10. internalize the spirit of independence, struggle, and entrepreneurship.
Knowledge systematic mastery of concepts, theories, methods, and/or philosophies of a particular field of science obtained through reasoning in the learning process, student work experience, research, and/or community service related to learning	1. Able to apply logical, critical, systematic, and innovative thinking in the context of developing or implementing knowledge and technology that pays attention to and applies humanities values following expertise
	2. Able to show independent, quality, and measurable performance;
	3. Able to examine the implications of the development or implementation of scientific-technological knowledge that pays attention to and applies humanities values by their expertise based on scientific rules, procedures, and ethics to produce solutions, ideas, designs, or art criticisms, compile scientific descriptions of the results of their studies in the form of a thesis or final project report, and upload them on the college website; compile a scientific description of the results of the study mentioned above in the form of a thesis or final project report, and upload it on the college website;
	4. Able to compile a scientific description of the results of the study mentioned above in the form of a thesis or final project report and upload it on the college page
	5. Able to make decisions appropriately in the context of solving problems in their expertise based on the results of information and data analysis;
	6. Able to maintain and develop networks with mentors, colleagues, and colleagues both inside and outside their institutions;
	7. Able to be responsible for the achievement of the results of group work and supervise and evaluate the completion of work assigned to workers under their responsibility;
	8. Able to carry out the process of self-evaluation of work groups under their responsibility, and able to manage to learn independently
	9. Able to document, store, secure, and rediscover data to ensure validity and prevent plagiarism;
General Skill skills that every graduate must possess to ensure the equality of graduates' abilities according to the level of the program and the type of higher education.	1. Mastering the theoretical concepts of the field of knowledge of Business Information Systems in general and theoretical concepts in the field of Multiplatform System Development or E-Business in-depth, and able to formulate procedural problem-solving.
	2. Have knowledge and expertise as a System Developer / System Developer in the business field
	3. Know about applying the basic concepts of databases and programming principles to develop business information systems implemented in computer-based software

To be continued…

Aspect	Learning Outcomes
Special Skill *A specific skills must be possessed by every graduate by the scientific field of the study program.*	1. Able to communicate using international languages orally and in writing and have a TOEIC certificate 2. Able to analyze business needs for the implementation of information systems with information system analysis methods that begin with the process of identifying and describing information needs to produce information technology solutions in an organization or institution; 3. Able to develop business information system applications by applying the principles and methods of software engineering as one of the business solutions in the organization 4. Able to design and produce innovation in the field of technology-based entrepreneurship or as a Technopreneur

Learning outcomes are one of the important components in the preparation of the curriculum and abilities possessed by each study program graduate which is the internalization of attitudes, mastery of knowledge, and skills following the level of study program obtained through the learning process. Based on input from the results of the focus group discussion, it was explained that the Focus Group Discussion process carried out with several speakers from the industrial world, experts from information system associations, and academics from other universities, could be obtained graduate profiles and learning achievements of the Business Information System curriculum. Learning Outcomes are developed based on the needs of students to improve their competencies following their interests and focus of study by providing graduate profiles and achievements of learning the Business Information System curriculum. Learning Outcomes are developed based on the needs of students to improve their competencies following their interests and focus of study by providing study interests and achievements freedom for students to choose courses that focus on educational studies, sociology, social action, and business opportunities in the field of education through concentration options. A main limitation that users ought to be aware of is that the tool is focused on the revised version of Bloom's Taxonomy of the cognitive domain (Giffin, 2002). Learning outcomes designed in the business information system study program are the depiction of student learning outcomes that will be achieved during learning. Learning outcomes are generated after defining a graduate profile that is by the needs of the business and the industrial world. By aligning the learning outcome to the needs of business and the industial world it will be more beneficial for users of graduates. It is in line with the research carried out by Gumilang, et al who develop learning outcome for IE students in the state polytechnic of Jember using the lean method and aligning it to their customers (Gumilang et al., 2020) and supported by research about life-based learning by Yoto, et al. (2019) that the end-users of graduates will benefit more from a curriculum that is more aligned with the demands of business and industry.

Conclusion

Based on the discussion results, it was explained that the process of curriculum development was carried out after discussion sessions with several speakers from the industrial world, experts from information system associations, and academics from other universities. Graduate profiles obtained include software engineer, business analyst, data scientist/analyst, and technopreneur. The Business Information System Curriculum Learning Outcomes include several points in terms of attitudes, knowledge, general skills, and special skills.

References

Ali, L. (2018). The design of curriculum, assessment and evaluation in higher education with constructive alignment. *Journal of Education and E-Learning Research, 5*(1), 72-78. https://doi.org/10.20448/journal.509.2018.51.72.78

Awwaliyah, R. (2019). Pendekatan pengelolaan Kurikulum Dalam Menciptakan Sekolah Unggul. *INSANIA: Jurnal Pemikiran Alternatif Kependidikan, 24*(1), 35–52. https://doi.org/10.24090/insania.v24i1.221

Fodor, S., Szabó, I., & Ternai, K. (2021). A competence-oriented, data-driven approach for sustainable development in University-level education. *Sustainability (Switzerland), 13*(17), 9977. https://doi.org/10.3390/su1317997

Giffin, S. D. (2002). A taxonomy of internet applications for project management communication. *Project Management Journal, 33*(4), 115-120.

Gumilang, M. A., Etikasari, B., Antika, E., Puspitasari, T. D., Utomo, A. H., & Hidayat, W. N. (2020). Learning outcomes development for informatics engineering students by using lean-startup model. *4th International Conference on Vocational Education and Training, ICOVET 2020*. https://doi.org/10.1109/ICOVET50258.2020.9230245

Kemenristekdikti. (2015). *Peraturan Menteri Riset, Teknologi, dan Pendidikan Tinggi Republik Indonesia Nomor 44 Tahun 2015 tentang Standar Nasional Perguruan Tinggi*. In Kemen-ristekdikti.

Matthews, K. E., & Mercer-Mapstone, L. D. (2018). Toward curriculum convergence for graduate learning outcomes: academic intentions and student experiences. *Studies in Higher Education, 43*(4), 1-16. https://doi.org/10.1080/03075079.2016.1190704

Primastuty, I. H. I., Noor, I., & Mindarti, L. I. (2017). The Implementation of Indonesian National qualification framework curriculum in Higher Education Institution. *Russian Journal of Agricultural and Socio-Economic Sciences, 68*(8),115-120. https://doi.org/10.18551/rjoas.2017-08.15

Vaijayanthi, R. P., & Murugadoss, J. R. (2019). Effectiveness of curriculum design in the context of outcome-based education (OBE). *International Journal of Engineering and Advanced Technology, 8*(6), 648-651. https://doi.org/10.35940/ijeat.8090.088619

Puspitasari, N. A., & Sastromiharjo, A. (2021). Permendikbud Implementation No. 3 Year 2020 in the preparation of Indonesian Course Lesson Plan. *Hortatori: Jurnal Pendidikan Bahasa Dan Sastra Indonesia, 5*(1), 71-78. https://doi.org/10.30998/jh.v5i1.622

Rao, N. J. (2020). Outcome-based education: An outline. *Higher Education for the Future, 7*(1), 5-21. https://doi.org/10.1177/2347631119886418

Shankararaman, V., Leidig, P. M., Anderson, G., & Thouin, M. (2021). IS2020: Competency-based information systems curriculum guidelines. *Proceedings - Frontiers in Education Conference, FIE, 2021-October*. https://doi.org/10.1109/FIE49875.2021.9637150

Simatupang, E., & Yuhertiana, I. (2021). Merdeka belajar kampus merdeka terhadap perubahan paradigma pembelajaran pada pendidikan tinggi: Sebuah tinjauan literatur. *Jurnal Bisnis, Manajemen, Dan Ekonomi, 2*(2), 110-120. https://doi.org/10.47747/jbme.v2i2.230

Subkhan, E. (2020). What is new on curriculum policy and how it affects curriculum studies? *Indonesian Journal of Curriculum and Educational Technology Studies, 8*(1), 56-61. https://doi.org/10.15294/ijcets.v8i1.38298

Ulum, M. (2020). Kebijakan Standar Nasional Pendidikan. *Syaikhuna: Jurnal Pendidikan Dan Pranata Islam, 11*(1), 1-5. https://doi.org/10.36835/syaikhuna.v11i1.3845

Yoto, Marsono, & Tjiptady, B. C. (2019). Work-based learning through life-based learning in vocational education to reduce unemployment rates in the industry 4.0 era. *International Journal of Innovation, Creativity and Change, 8*(1), 114-119.