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Artificial intelligence-based learning model to improve the talents of higher education students towards the digitalization era

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ABSTRACT

Artificial intelligence (AI) technology is a hallmark of the 4.0 revolution. The two main issues in Indonesia are infrastructure that needs to be equipped with technology and intelligence-based curriculum integrated with business and industry programs, and lecturers as educators who do not want to use and develop AI technology in applying guided learning models. This research aims to create a learning model based on AI that will help college students develop their talents while maintaining the Pancasila principles in the age of digitization. This study contains four stages: data collection, data analysis, research analysis outcomes, and validation of research analysis results. This research developed an AI-based learning model for use in higher education consisting of four dimensions: input, process, output, and outcome. The input dimension includes components such as students, lecturers, organizations, and infrastructure ready to adopt AI-based learning models. The process dimension consists of the elements that influence the operation of the AI-based learning model system and the functionality provided by the learning model. The output dimension includes characteristics that may be directly measured and process feedback. Finally, the outcome comprises the predicted outputs from the AI-based learning model.

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1. INTRODUCTION

Indonesia scored 0.622 in the Human Development Reports' 2017 ASEAN education index, ranking sixth overall. Singapore had the highest score, which was 0.832. Brunei Darussalam ranks second with 0.719, followed by Malaysia 0.70. Thailand and the Philippines, both at 0.661, are in fourth place. This situation impacts the ASEAN region's economic competitiveness, which is still behind Singapore and Vietnam [1]. Based on these circumstances, a plan is required to raise educational and human resource standards. Innovation of a technology-based learning environment is one way to increase the education field's standard field [2]. The learning model in the education industry has evolved due to the advent of the digitalization era and artificial intelligence (AI) technology. AI in education can stimulate students' interest in studying, raising

the number of skills they produce [3]. This is a product of the "industrial 4.0" phenomenon, which has raised the bar for the talent of incoming students [4]. Universities must fundamentally change their educational programs to reflect this evolution to affect students' knowledge and leadership abilities [5]. Universities must be able to ensure that their graduates possess the fundamental competencies required in the industry [6]. Students with only one or two abilities cannot handle competition. Universities can use student success rates in AI-based learning as a guide when researchers' findings reveal that there is still room for improvement in the lecturers' and teaching staff's comprehension of the AI [7] infrastructure still, learning is of poor quality. Students at the postsecondary level need more AI-based skills and knowledge to enter the workforce. The first reason is that learning material, institutional funding, and lecturers' skill levels do not match the market demands [8].

Four sides need to be considered in facing the industrial revolution 4.0, namely: i) from the aspect of the learning supporting ecosystem, both from higher education management/management, infrastructure, training and education of lecturers and education staff to improve intelligence-based competencies provided by the university; ii) aspects of the curriculum based on AI so that students are trained to think critically; iii) aspects of the partnership between universities and *dunia usaha dan dunia industri* or the business world and industry (DUDI) with the hope that students have entrepreneurial skills; and iv) graduate students must have AI-based talents who are ready to work in the DUDI. This statement is supported by research conducted by Wahjusaputri *et al.* [2], that artificially based learning models in education, namely: i) assisting management; ii) help become tutors (virtual mentors) for students with programs that are tailored to the needs, pleasures, needs, and difficulties of students with direct feedback; iii) learning is more interesting, more innovative, and more adapted to real situations accompanied by more vivid pictures; iv) helping students think critically in solving a problem in learning (problem-solving); and v) AI technology can classify and detect students who have difficulty in capturing lessons in class, so that lecturers can immediately help more precisely [9], [10].

Based on the numerous challenges, AI is a solution for expanding the scope and reach of high-quality educational services [11]. AI technologies may produce tailored content and learning experiences field [12] using multiple interaction models based on student attributes. According to Alnaqbi and Yassin [13], students with AI abilities have the ability to adapt to digital technology and grasp the presence of the industrial revolution 4.0. i) communicating the necessity of understanding digital technology and teaching students that digital mastery is critical in the present digitalization era; ii) introduce online education. Students should feel at ease using digital technology for academic purposes, both theoretically and practically; and iii) cultivating the attitude necessary to employ AI-based technology in all learning models tailored to the advancement of business and industry fields [14]. Implementing the AI-based learning model in the manner described in Figure 1 [15].

After introducing a model of AI-based instruction, this research may boost student potential by encouraging the creation of novel products and businesses (creation of new industry) [16]. Internalizing and learning science, emotion, and skills through training in technical skills in the business world constitute the core of AI-based education [17]. This study develops an AI based learning model using identifying critical success factors (CSF) in implementing the learning model. The CSF are then compiled into a model consisting of the dimensions of input, process, output, and outcome fields [18]. This research is expected to contribute to the development of AI-based learning models as the embodiment of a good learning ecosystem to increase student talents so that they are ready to work after graduating from the higher education [15]. In addition, it can also be a guide for higher education institutions in maximizing the implementation of AI-based learning models [19].

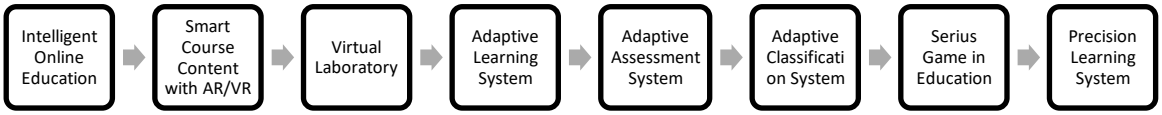

Figure 1. AI-based learning model

2. METHOD

The research methodology combines quantitative and qualitative research in a mixed-methods approach. Meta-ethnography, a qualitative approach, was employed in this study to compile a broad list of success characteristics [20]. By generating or developing several latent variables that explain the link between variables, the quantitative method seeks to provide light on the relationship between the variables

being considered. Certain professionals used a questionnaire to verify the list of success elements [21]. Data collection, data analysis, presentation of the findings of the research analysis, and validation of the findings of the research analysis comprise the four stages of this study [22].

2.1. Data gathering

Data collection is the process of gathering information from the field to address questions related to research. To ensure the quality of data, it is essential to have accurate data collecting and qualified data collectors. When collecting data, researchers must be diligent patient, and not give up. Researchers employed two methods of data gathering, from primary sources utilizing the Interview and focus group discussion (FGD) method and secondary data pertinent to the literature review and documentation approach that researchers sought out.

2.1.1. Literature review

The literature study aims to look at recent studies (secondary data) on the growth of AI in Indonesia and, in comparison, to other nations. Researchers used internet media to carry out secondary data studies. Due to its ability to search for data sources swiftly and effectively, researchers consider the internet a good medium. Researchers utilized two types of secondary data: published papers, which may be found in books, scholarly journals, reports from government agencies, or popular stories in The Conversation Indonesia media. Mass media is employed as a source of information [5] to lessen bias in literature research.

2.1.2. Interview

Information collected or received during interviews is recorded in the interview field notes (www). The interview aims to understand more about the phenomena of using learning models based on AI. The informants were then confirmed the interview findings. This study conducted the interviews to further the findings from earlier data collected during observation [23].

2.1.3. Documentation

In research, documentation is a document that presents information about original research results or directly from the source. Documentation is different from archiving in a library. Even some experts argue that the notion of documentation is the collection of documents on a particular subject. Researchers will gather the necessary data, facts, and information using documentation research techniques in photographs, archives, and other sources [24].

2.2. Preparation of research instruments

The study's instrument is a significant success element in applying an AI-based learning model discovered during the literature review stage [5]. Critical success elements in deploying AI-based learning models comprise six dimensions, namely the dimensions of students, lecturers, AI-based learning quality, learning material, and organization [25]. There are 33 essential parameters that govern the development of AI-based learning models across these six domains as shown in Table 1. These important elements are then combined into a study instrument in the form of a questionnaire constructed using a Likert scale from 1 to 5, 1 (very unsuitable), 2 (not appropriate), 3 (not appropriate), 4 (appropriate), and 5 (very in accordance).

2.3. Data analysis

Research instruments that have been compiled into a questionnaire and distributed will be analyzed using the aikens formula. Aiken (1985) introduces the Aiken's V formula, which is used to compute the content validity coefficient. This coefficient is determined by a panel of n experts who assess each item in relation to how well it reflects the construct being assessed. The Aiken formula delineates the CSFs that arise from the process of integration and is verified to ascertain the relevance of each CSF using SPPS Version 26 [22].

2.4. Validation data

The validation of the research results was carried out by holding FGD. The selection of resource persons for each FGD is first carried out by mapping the types of stakeholders who understand the development of AI technology, namely operators, regulators and academics. Researchers evaluate expert expertise based on three criteria, namely research experience, educational background, and expertise in the field of AI. Based on these criteria, the researcher selected three experts to confirm the results of the study. The three experts came from academics (researchers), industry professionals (Tanoto Foundation and The Conversation Indonesia) and the government represented by National Research and Innovation Agency (BRIN). The selection of sources was carried out by researchers taking into account the contribution of the internal groups and related agencies (BRIN). To trigger the dynamics of FGD resource discussions, the

researcher explained the developments, practices, challenges, and opportunities of AI-based learning models in Indonesian universities, especially UHAMKA University and Pancasila University in Jakarta, using a question guide.

Table 1. Instrument CSF [26]–[34]

Dimension	Critical success factor	1	2	3	4	5
Student	Attitude towards e-learning					
	Experience and knowledge of computers					
	internet self-efficacy					
	Self-study and self-discipline					
Learning content	Quality of the content					
	Adaptability of the course					
	Curriculum-aligned materials					
	Learning materials are available and up to date					
Technology	Internet connectivity					
	Dependable technological framework					
	Online communication technologies that are currently accessible					
	Technical support in teaching					
The quality of AI-based learning models	User-friendly interface					
	Functionality of the system					
	Interactive functionality of the system					
	Language support					
	System response					
	Simplification of learning					
	Student learning evaluation					
	Calculation of teaching results					
	Automatic reporting					
	Evaluation of learning content					
Organization	Training with Industry					
	University leadership support					
	University policy					

3. RESULTS AND DISCUSSION

3.1. Students condition of University of Muhammadiyah Prof. Dr. Hamka and Pancasila University

All learning models have been carried out through online learning systems since the COVID-19 pandemic until the adaptation to the new normal, according to the results of a survey of 100 UHAMKA and Pancasila University students (67% men, 33% women), stating that 87% of students prefer face-to-face learning. Based on the Figure 2, it appears that the advantages of the online learning process do not really touch the quality of student learning. Only 20.4% of students stated that they were happy with online learning because it provided a more flexible and relaxed learning atmosphere, only 9.7% of students stated that the teaching materials were well documented, 9.5% of students stated that online learning was more efficient in terms of time, and only 7% of students stated that they were more daring to ask questions during online learning than when studying face-to-face. Students with a significant number (accumulative total of 55%) stated that the online learning process was poor due to the unpreparedness of the lecturers in giving online lectures which was shown in the giving of excessive assignments, replacing lectures with assignments, lecturers who were less interactive in delivering material, as well as changing course schedules [35].

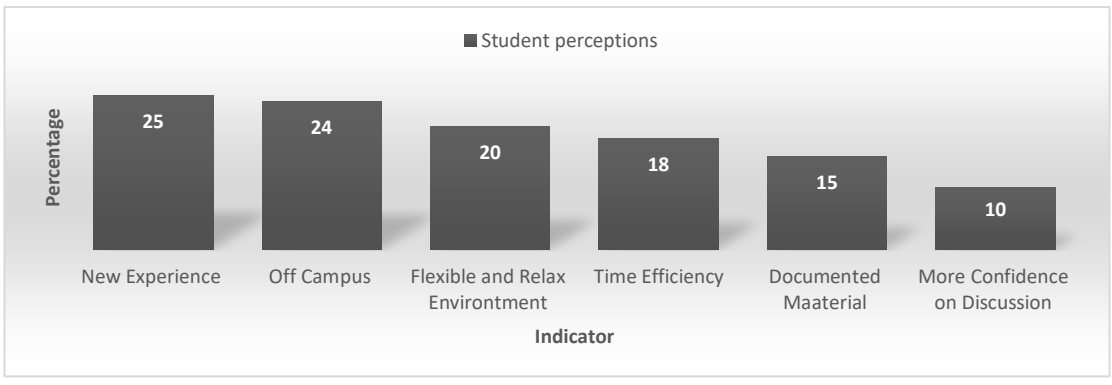

Figure 2. Student perceptions of the advantages of the online learning process

Based on the Figure 3, the calculation of the success factors of AI-based learning models on the resources of UHAMKA and Pancasila University students is as follows:

- For the student feature dimension, it shows that the experience and knowledge of computers at UHAMKA University students who answered very well were 31%, while Pancasila University was 39%.
- In the technological factor dimension (T3), it shows that the available online communication tools, UHAMKA students answered very well, only 24% while Pancasila University students were 33%.
- In the dimension of the quality component of the AI learning model, UHAMKA students who replied correctly received a score of 18%, whereas Pancasila students received a score of 53%.
- In terms of organizational aspects, it demonstrates that campus rules addressing the employment of AI based learning models, which replied extremely well, were held by 24% of UHAMKA students and 25% of Pancasila students.

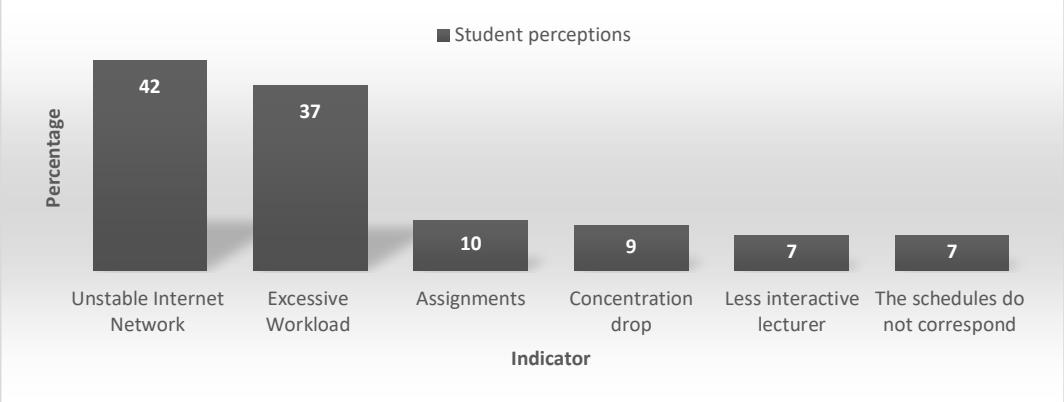

Figure 3. Student perceptions of the shortcomings of the online learning process

3.2. Critical success factors in artificial intelligence-based learning models for students of UHAMKA and Pancasila University

The development of AI-based learning models based on success factors based on the dimensions of lecturer resources, technology, learning content, and quality of learning models, researchers will be able to boost the advantages of success factors into competitiveness in every private university. The scope to determine the level of success of the AI-based learning process is based on a Likert scale ranging from 1 to 5. The scale includes the following ratings: 1 (very poor), 2 (poor), 3 (acceptable), 4 (good), and 5 (very good), there are five categories containing 25 different factors identified, these CSF are divided into five categories including student factors, learning content factors, technology infrastructure, AI learning quality, and organization. The definition of each factor is also determined and used as the basis for the design questionnaire survey as shown in Table 2.

The content-validity coefficient for each of the 5 success factors was calculated using Aiken's V formula. The calculations were performed on the data obtained from 100 students from UHAMKA and Pancasial University. The data was collected using a Likert scale with 5 categories. The minimum value for the content validity coefficient (V) that is considered significant is 0.50 (V > 0.50). The questionnaires that had been supplied were completed by all 100 pupils. The success factors of AI-based learning models are presented in Table 2:

- For the student feature aspect, it shows that experience and knowledge of computers is the most important aspect with an average value of 0.9145.
- The aspect of learning content components indicates that the learning resources are readily accessible and current, with an average value of 0.857.
- On the aspect of technology, it is indicated that there is technological support in teaching, with an average value of 0.727.
- On the aspect of quality, AI-based learning models demonstrate a remarkable ability to adapt to learning needs, with an average value of 0.895. Additionally, these models are capable of generating student achievement report profiles, with an average value of 0.822.
- The organizational component of the institution involves conducting training sessions with industry partners to facilitate the implementation of AI-based learning models. This dimension has an average score of 0.798.

Table 2. Results of content-validity success factors in the application of AI-based learning models for students of UHAMKA and Pancasila University 2022

Aspect	Critical success factor	V Coeffi. UP	V Coeffi. UHAMKA
Student	Attitude towards e-learning	0.548	0.529
	Experience and knowledge of computers	0.710	0.714
	internet self-efficacy	0.600	0.726
	Self-study and self-discipline	0.690	0.699
Educational content	Quality of the content	0.774	0.744
	Adaptability of the course	0.726	0.604
	Curriculum-aligned materials	0.742	0.726
	Learning materials are available and up to date	0.767	0.748
Technological	Internet connectivity	0.657	0.721
	Dependable technological framework	0.579	0.733
	Online communication technologies that are currently accessible	0.816	0.715
	Technical support in teaching	0.646	0.677
Quality AI-based learning model	User-friendly interface	0.566	0.758
	Functionality of the system	0.781	0.788
	Interactive functionality of the system	0.742	0.814
	Language support	0.749	0.588
	System response	0.694	0.706
	Simplification of learning	0.770	0.660
	Student learning evaluation	0.731	0.786
	Calculation of teaching results	0.722	0.827
	Automatic reporting	0.727	0.788
	Evaluation of learning content	0.803	0.796
Organization	Training with Industry	0.771	0.699
	University Leadership Support	0.665	0.656
	University Policy	0.806	0.738

3.3. Discussion

The entrance of the 4.0 industrial revolution at this time, with its technological qualities based on AI, has altered many facets of life. This evolution necessitates a fundamental shift in today's society. The expansion of industries that employ trains as a lever for their business operations is expanding, as is the growth of businesses that manufacture and sell AI-based goods and industries that develop AI-based technologies. This expansion has an impact on the industry's requirement for top AI skills [13]. The amount of digital data, the emergence of numerous start-ups that generate a lot of data, and increased internet penetration are all elements pushing the development of AI. Because of the rising internet prevalence, more and more data is generated, which may be utilized to train and build AI. There are five major hurdles for the advancement of AI in higher education, namely:

First, in terms of human resources, lecturers, and students have not been effectively taught by AI knowledge and learning. Second, in terms of curriculum, the development of teaching materials/curriculum continues to discourage talent competency in the field of AI; teaching materials are required to become ready-to-use graduates, entrepreneurs, and researchers based on talents and future demands. Third, in terms of infrastructure. Data processing using AI at Indonesian universities necessitates the use of powerful tools that are not generally available, and the cost of advanced AI processing infrastructure is still fairly expensive. Fourth, every university in Indonesia still has a limited supply of reliable data when it comes to the learning process for developing AI models. The availability of data has become both a strength and a barrier for the development of AI-based learning in every university in Indonesia. Fifth, owing to the engagement of internal institutions and government involvement in the area of AI, which is currently restricted to the element of applying AI applications, is the regulation/governance of the implementation of AI-based learning. Furthermore, due to the high cost of funding, governance for the access, usage, and verification of data quality is still unavailable. The fifth factor is ethics. According to [36] research, the ethical discourse on AI is still inadequate in Indonesia, particularly in the government sector. It is critical to conduct ethical discourse on AI as soon as possible in order to identify ethical limitations on the use of AI, including in terms of work; the use of AI as a tool for the invasion of privacy and individual autonomy, as well as the use of AI to create dangerous weapons devices, must also be discussed.

Graduates' talent achievement students in AI-based learning cover four domains: knowledge mastery, attitudes and values, responsibility, and job capacity. The domain of student mastery of knowledge can be realized through theoretical lectures using AI learning online or offline, however, the other three domains may not be fully fulfilled since internalization of the three domains is not possible. Many students require engagement with stakeholders outside of college (internships, work practices, and community service), practicums to develop skills, and research for final projects that cannot be done online. At the very

least, integrated learning between offline and online environments must be feasible. The lack of a virtual laboratory for applying AI learning, as well as other challenges, makes it difficult to meet graduate learning goals. As a result, simplification or reorganization of the curriculum is required immediately, particularly in order to meet the learning outcomes of AI in Indonesian institutions.

The focus of AI talent development will be on product development, the production of new products, and entrepreneurship (the creation of new industries). The development of AI abilities requires an ecosystem that can support the learning and innovation processes in order to reach specified competencies (competency standards). The quad helix partnership combining academics, business, government, and community is required for the establishment of the ecosystem (ABCG).

The ecosystem requirements include the ability to: i) support education to produce student talent and entrepreneurs; ii) support product growth and the creation of new products; and iii) provide financial resources, facilities, and infrastructure, including tools, tools, and data, in order to improve talent competence in the field of AI. It is believed that the ecosystem would be able to develop competent talent, which will then sustainably support the occurrence of cycles in the ecosystem. The formation of a learning ecosystem and an innovation ecosystem begins with the formation of an initial entity to serve as the ecosystem's driving force. Setting up management and financial procedures is the primary beginning point. Therefore, ecosystem entities should begin by combining government and industry. Based on the outcomes of data processing and field study findings, the researchers developed the following AI-based learning model for use in higher education, as shown as in Figure 4.

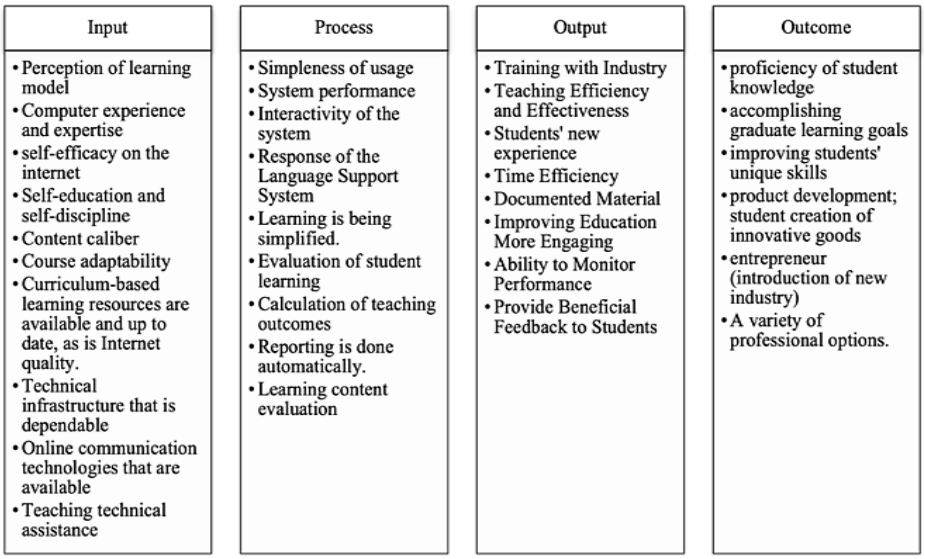

Figure 4. AI-based learning model for use in higher education

4. CONCLUSION

The entrance of the 4.0 industrial revolution at this time, with its technological qualities based on AI, has altered many facets of life. This evolution necessitates a fundamental shift in today's society. The expansion of industries that employ trains as a lever for their business operations is expanding, as is the growth of businesses that manufacture and sell AI-based goods and industries that develop AI-based technologies. Based on the phenomena of the numerous challenges, AI is a solution for expanding the scope and reach of high-quality educational services. Using multiple interaction models based on student attributes, AI technologies may be used to produce tailored content and learning experiences. Graduates' talent achievement students in AI-based learning cover four domains: knowledge mastery, attitudes and values, responsibility, and job capacity. Based on the research's results, this reserach developed AI-based learning model for use in higher education consists of four dimension, which are input, process, output, and outcome. The input dimension includes components such as students, lecturers, organizations, and infrastructure that are ready to adopt AI-based learning models. The process dimension includes the elements that influence the operation of the AI-based learning model system as well as the functionality provided by the learning model. The output dimension includes characteristics that may be directly measured as well as process feedback. Finally, there is the outcome, which comprises of the predicted outputs from the AI-based learning model.

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