



# The Artificial Intelligence Application Model In Higher Education Towards World-Class University

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**Abstract.** This study aims to determine how self-adjustment is described by overseas students from outside Malang City in dealing with problems and challenges of cultural, linguistic, and environmental differences in the area where they live to pursue education with stress-coping strategies. This research uses qualitative research methods with a phenomenological approach. Data acquisition in this study used semi-structured interviews and observations. The number of participants in this study amounted to three people. All participants were overseas students from outside Malang City in the 2021-2023 batch, rented and lived in a boarding house, and studied in Malang City. The data obtained will be processed using theory-driven analysis techniques where themes are developed with indicators supporting the theory. The results showed that an excellent ability to self-adjust and apply both coping strategies is needed so that participants can live overseas life without being full of burdens and pressures that affect social and academic life.

**Keywords:** overseas students, adjustments, coping with stress.

## Abstract

Artificial Intelligence (AI) as a global societal trend is showing rapid and increasing penetration of universities in the world. The benefits of AI are said to be able to accelerate improvements in the quality of education in higher education. The aim of this research is to look for evidence that is relevant to this global academic issue, and then use it as material for a recommended policy formula for 21 policymakers at Indonesian State Universities with Legal Entities (PTN-BH) who are prepared to increase the World-Class University (WCU) ranking in 2024. This research uses the Systematic Literature Review (SLR) method with the PRISMA model data filtering protocol. Discussing an overview of 31 internationally indexed scientific articles that met the inclusion criteria, we found that 147 models of AI-powered technology items, systems, and applications were discussed and used for 132 functions in supporting the provision of higher education in the world. This application is most related to the domain of teaching and learning, followed by assessment and research, and the least is in the domain of higher education management. By paying attention to the promising but proven benefits obtained by universities that implement AI early, we recommend 37 AI implementation approaches for 21 Indonesian PTN-BH to accelerate the increase in WCU rankings in 2024 based on the 9 QS WUR version of WCU assessment indicators that need to start now.

## Keywords

Artificial Intelligence, Higher Education, Policy Change, World-Class University

## Introduction

Internationalization and World Class University (WCU) ranking have become significant forces that moderate the development of higher education (Manning, 2021). Several universities have improved their ranking on the WCU list. One important aspect of it is ensuring that the higher education provided also responds to international interests (Zare, 2021).

problems and demands and global societal trends. One of the global trends and demands is the use of Artificial Intelligence (Abonamah et al., 2021) or AI. How could it not be, AI as a technology model in the 21st century is considered to be changing world civilization (Trolice et al., 2021) because it continues to develop until it is present in almost all aspects of human life (Ågerfalk, 2020) marking the era of computing and the digitalization transition entering an advanced stage.

AI has been widely debated over concerns that the intelligence systems in it have the potential to be misused (Zuboff, 2019). AI is believed to provide benefits and pitfalls at the same time in overcoming social challenges (Sipior, 2020), but because of the belief in its great benefits, the application of AI continues to be developed to advance various sectors of life (Tan et al., 2022; Kaplan & Haenlein, 2019), the world educational professionals (Laupichler et al., 2022a) learning (Darayseh, 2023) and universities. In the beginning, AI only developed in the realm of pure scientific research. The application of AI in higher education is relatively new. Due to this element of novelty, we as academics in the field of educational administration are interested in conducting research on it.

There are a number of benefits that can be obtained when universities decide to utilize AI. In research activities, for example, the ChatGPT application developed by openAI has been proven to be able to help researchers organize material, formulate initial drafts, and proofread (Salvagno et al., 2023). Furthermore, in innovative research, in various fields of study, AI truly contributes as a reliable instrument (Jiang et al., 2022). Remembering the indicators in ranking World Class Universities is an aspect of research that covers volume, income, and reputation (Koivo, 2018), so the use of AI can certainly provide great benefits for universities in increasing the research index. Because AI can accelerate research productivity.

Currently, research on the application of AI in higher education is being intensively carried out throughout the world. Not without reason, because the application of AI can provide benefits including intelligent tutoring systems, adaptive learning or teaching, research design, and learning analysis (Salas-Pilco & Yang, 2022a). World-class universities need to continue and consider technology that is developing globally. Because they need to provide education to respond to global challenges as well.

In line with this perspective, (Ashour et al., 2021) emphasize that the administration of higher education will certainly change in 2030. The changes in question will occur due to the pressing need for knowledge and demand for graduate competencies for the labor market and increasingly digital social changes (Ashour et al., 2021). For universities that strive to continuously improve their rankings on the World Class University entry list, a review of changes in higher education that will inevitably occur due to labor market demand is closely related to aspects of industry *income* which needs to continue to be developed.

This analysis indicates that if universities ignore the opportunity to utilize AI, the index will suffer research and industry *income*; those or other aspects, have the potential to be left behind by competitors in a tight competitive entry. The next potential problem is a decline in ranking in the world-class university ranking itself. Because other universities utilize AI whereas certain colleges do not. This link shows that the use of AI, both in global societal trends and in its application in higher education, correlates with the challenges faced by world-class higher education providers.

This new challenge applies to universities that specialize in pure science or not. This is demonstrated by world-class universities that provide medical sciences; To produce medical leaders who are able to use AI-based medical devices, a number of universities in the world have started creating new curricula with the Engineering Doctor study program (Briganti & Le Moine, 2020). Even though they are not in the computer, mathematician, or AI engineer group, they need to be able to use AI at any time in the medical discipline.

In Indonesia, the title of a world-class university is filled by a number of PTN-BH. In 2020, the PTN-BH entity was the largest contributor to the presentation of international scientific publications from Indonesia indexed by Scopus. Spread across the accumulated quartile 1, quartile 2, quartile 3, and quartile 4 accreditations, PTN-BH was recorded as having succeeded in publishing 21.109 international scientific papers in 2020 (Kemdikbud, 2022). However, even though there are 21 Indonesian PTN-BH that are being prepared to become world-class universities in 2024<sup>1</sup>, then in the same time - International scientific publications regarding the application of AI have increased rapidly in 2019-2023 (Sayekti, 2023). In fact, it is alleged that there is not yet a comprehensive formula regarding the application of AI that can be recommended to leaders of Indonesian universities who are prepared to increase their ranking in the WCU. Thus, an analytical review is needed to design a policy recommendation formula for leaders of Indonesian universities as an acceleration strategy in improving WCU's ranking.

### Methodology

This research uses a descriptive type qualitative approach. A review of previous research was carried out using techniques of *Systematic Literature Review* (SLR), namely the exploration of previous research to answer specific research questions through an explicit, systematic, and replicable search strategy by paying attention to inclusion and exclusion criteria (Xiao & Watson, 2019).

SLR is used to identify, review, and evaluate previous relevant research so that it can describe the concept being sought, namely what and how AI-based applications are used by universities from various countries in the world through analysis of internationally accredited journal articles. Then the information resulting from the process will be formulated as Recommendation material for universities in Indonesia to encourage accelerated ranking increases in world-class university rankings.

The research was carried out in the stages of formulating research questions, exploring literature, determining inclusion and exclusion criteria, selecting literature, processing selected literature data, and then discussing to draw conclusions. To describe the quality and reliability of data, qualitative research needs to include an explanation of the role of the presence of researchers, subjects, informants, and data collection methods. Besides that, considering the use of tools, it is also important to provide an overview of the specifications and sophistication of the tools. See the Search Process section.

### Research Question

1. How is AI used by universities in the world?
2. What are the Recommendations for Using AI to Accelerate Increasing WCU

#### Rankings in Indonesian Higher Education?

Exploration of literature sources focuses on scientific publications in internationally accredited peer-reviewed journals that meet the inclusion criteria in Table 1. The selected list of articles becomes the primary source. At the recommendation formulation stage, namely to answer the second research question, a search for reliable supporting information is carried out which becomes a secondary data source.

### Search Process

The collection of journal articles is compiled from the Google Scholar and Crossref databases with the help of Harzing's Publish or Perish application. The article search keyword used is 'AI in Higher Education' with a publication time limit of 2019 to 2023 as an effort to focus on reference sources in the last 5 years only. From various accredited publishers, researchers collected 232 journal articles with international languages and accreditations related to the search keywords. Then the researchers produced 101 article files which were not peer-reviewed journal articles, but rather journal

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<sup>1</sup> <https://ppid.uny.ac.id/content/sosialisasi-universitas-berkelas-dunia-%E2%80%93-world-class-university>

proceedings and book chapters. Then record data for 51 articles without URL and DOI links and 9 articles detected as duplicates were removed.

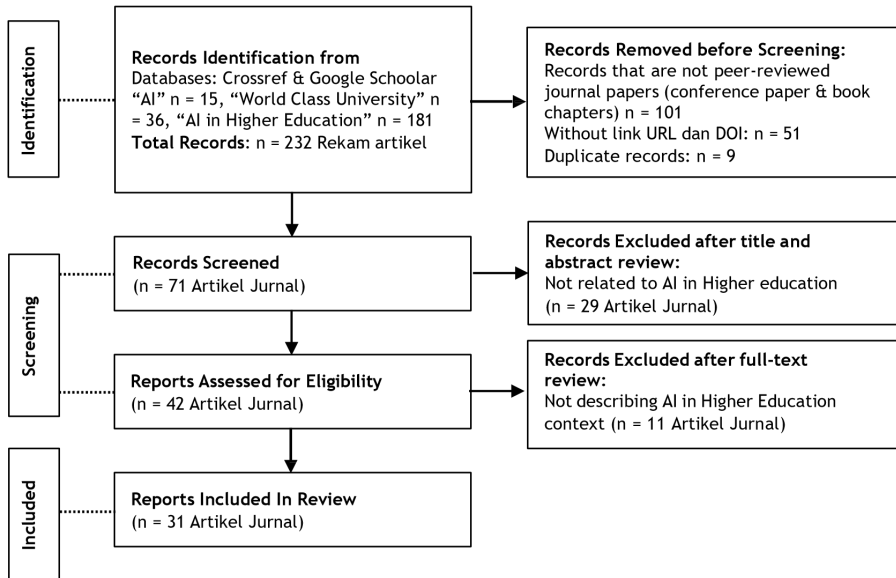
At the first screening stage, reviewing through the title and abstract text, 29 journal articles were excluded because they were not relevant to AI in higher education. Then in the second screening stage to test eligibility, 11 articles were again excluded because after reading them thoroughly the content of the articles did not match the topic focus and context of AI application in higher education.

After the selection process in several stages, the researcher sorted and determined 31 articles that were directly related to the topic and research objectives. These 31 scientific articles were then studied intensely and in-depth. The stages of data collection and filtering are illustrated visually based on the PRISMA technique which can be seen in Figure 1.

**Table 1 Inclusion and Exclusion Criteria in Research Data Collection**

| Aspects     | Inclusion                                      | Exclusion                                                                            |
|-------------|------------------------------------------------|--------------------------------------------------------------------------------------|
| Source Type | Article peer-reviewed journal indexed document | publications, books, conference proceedings, missing Links URLs, Duplicate articles. |
| Year        | Journal articles were                          | Journal articles                                                                     |
| Publishing  | published from January 2019                    | –published before January 2019October 2023                                           |
| Language    | English                                        | Other Languages (e.g. Chinese, Indian, Spain)                                        |
| Context     | Application of AI in Education                 | Non-educational contexts (e.g. company)                                              |
| Theme       | Using AI in Higher Education                   | Use of AI in Primary Education and Secondary                                         |

Source: Adapted from (Tan et al., 2022b)

**Figure 1 Overview of the PRISMA Technique Data Search Protocol**

Source: Adapted from (Tan et al., 2022)

### Data Extraction Strategy

The determination and use of inclusion and exclusion criteria is aimed at compiling literature that is appropriate to the focus (Chichekian & Benteux, 2022) of this review. Metadata from the articles is tabulated into a table with a mapping of the author's name, title, year of publication, type of research, research results, related domain or aspect of higher education, and AI-based technology and applications used or discussed therein.

Concept descriptions, metadata, and (Tan et al., 2022b) formation resulting from the mapping table as well as the in-depth literature review process carried out at the same time, are then used as references to develop a comprehensive formula regarding the application of AI that can be recommended for Indonesian higher education leaders who are prepared to improve their rankings in a world-class university in 2024. The idea of these recommendations is based on the belief that external observers (including researchers), can advise organizations in their approach to AI utilization (Stahl et al., 2023).

### Results

In this section, we will show the results of an in-depth review of selected articles with the aim of focusing on answering the problem formulation.

#### Research Question 1. How is AI used by universities in the world?

The idea of AI is 68 years old if you count from its first inception, namely by McCarty in 1955. But in the last 3 decades (Salas-Pilco & Yang, 2022b), AI has continued to expand into various sectors, including higher education. The utilization and use of AI in higher education are relatively new, starting with AI applications used by students, educators, and administrators, and various tools, algorithms, and a number of

applications developed with the capacity to transform the field of education (Swiecki et al., 2022a). Even though it is new, the increasingly widespread use of AI shows surprising resonance.

The process of expanding AI in higher education is characterized by heated debates between brilliant innovators and staunch critical resisters. Uniquely, research regarding the application of AI in higher education increased sharply throughout 2019-2023. When exploration was carried out with the keyword "AI in higher education" in the Crossref database in the period 2019 to October 2023, the publication experienced a significant increase. The inclusion criteria in Table 1 in this study sort out many related publications, leaving only journal articles published from 2022 to 2023. Interestingly, in these two years, there was still a spike in the number of publications. See Figure 2.

**Figure 2 Publication of AI in Higher Education In the literature that meets the inclusion criteria**

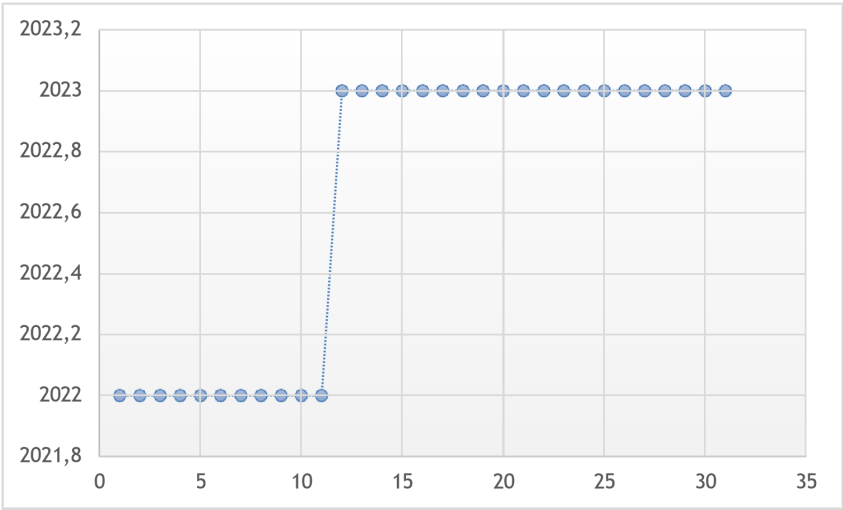
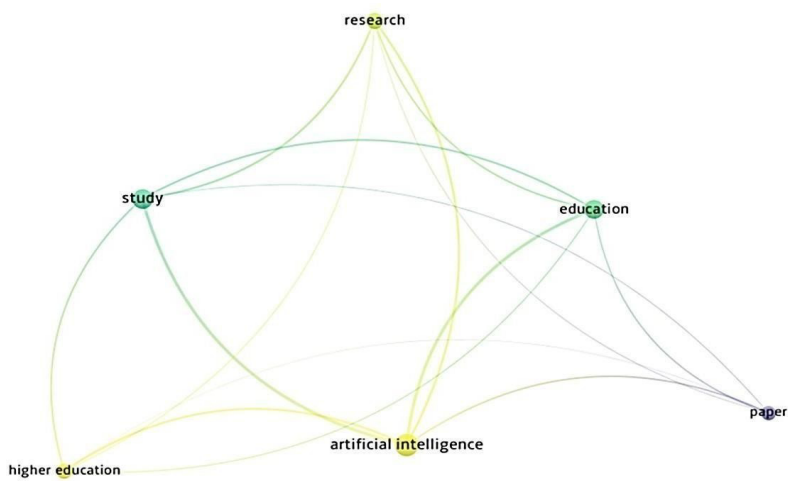


Figure 2 shows that for 12 months in 2022, there were only 11 articles. Meanwhile, in just 10 months in 2023, as many as 20 journal articles have been published rise. This proves that the penetration of AI into higher education in the world is increasing sharply. In the landscape of accredited research that we reviewed, the use of AI in higher education shows integration with the domains of teaching (Tan et al., 2022a), learning (Carolus et al., 2023; Dai & Ke, 2022; Darayseh, 2023; Fan & Li, 2023) and assessment (Sein Minn, 2022; Swiecki et al., 2022b), as well as the curriculum (Pisica et al., 2023) as a whole (Southworth et al., 2023a). Apart from that, penetration has been found into the research domain (Laupichler et al., 2022b), and the most recent, and also the smallest, is in the administrative - Managerial domain area in higher education (George & Wooden, 2023; Mallik & Gangopadhyay, 2023). With this distribution, AI shows network correlation with universities, research, study activities, research, education, and publication of scientific articles. See figure 3 and table 2.

Figure 3 Network Visualization Between AI and Higher Education



Source: Results of bibliometric analysis with VOS viewer

Table 2 Use of AI by Universities in the world in the literature reviewed

| No | Author, Year, and Publisher                                                                                 | AI-Based Aspects, Technologies dan Applications                                                                                        | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | (Laupichler et al., 2022a) Elsevier- Computers and Education; AI                                            | AI literacy                                                                                                                            | Introduction to the concept of AI literacy for an open,AI- literate, and adaptive attitude toward AI in research activities                                                                                                                                                                                                                                                                                                                                 |
| 2  | (Chu et al., 2022a) Elsevier- Computers and Education; AI                                                   | AIrobots in computers and programming, engineering, languages, and Science                                                             | 1) Tutor and teaching assistant<br>2) Assistants and research support devices in thefields of computers and programming, engineering, languages and science                                                                                                                                                                                                                                                                                                 |
| 3  | (Salas-Pilco & Yang, 2022b) Springer Open- International Journal Educational Technology In Higher Education | 1) Predictive models, 2) Intelligent Analytics, 3) Chatbot assistive technology, 4) ComputerAI, 5) Image Analysis orfacial recognition | Helping to address important educational issues;<br>1) Detecting students at risk of dropping out of school,<br>2) Automatic content analysis of posts<br>3) Multi-functional Chatbot technology<br>4) Computer; AI-based data processing and management devices with high sophistication<br>5) Gathering information according to context Andfacial recognition for accessibility instruments, preferences, and correlation with learning performance data |
| 4  | (Tan et al., 2022b) Elsevier- Computers and Education; AI                                                   | The majority use Natural Language Processing (NLP)                                                                                     | Improving the quality of collaborative learning                                                                                                                                                                                                                                                                                                                                                                                                             |

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|----|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5  | (Al Darayseh, 2023)<br>Elsevier-Computers and Education; AI                                              | 1) Intelligent private AI applications<br>2) Fuzzy logic, Bayesian networks, hidden Markov models, and genetic algorithms.<br>3) AI-based scoring.<br>4) AI educational robot.<br>5) AI-based virtual reality (VR) applications<br>6) PhET Simulation, Labster Virtual Lab, and Third Space.<br>7) AI application Auto-correction | 1) Intelligent private teaching simulation mimics humans providing adaptive learning activities with environmental construction that suit students' knowledge needs<br>3) Quick constructive feedback with performance task assessment test corrections.<br>4) Develop digital content and help digitize textbooks or create a worthy digital learning interface.<br>5) Integrated into teaching, provides multisensory stimulation, leads to previously unimaginable depths of knowledge, provides interactive learning to students,<br>6) Supports scoring with autocorrect applications |
| 6  | (Sein Minn, 2022)<br>Elsevier-Computers and Education; AI                                                | AI for Knowledge Assessment                                                                                                                                                                                                                                                                                                       | Integrated and sustainable assessment innovation for fair and adaptive learning and education in the future                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 7  | (Crompton & Burke, 2023)<br>Springer-International Journal of Educational Technology In Higher Education | Intended AI users: 72% students, 17% instructors, and 11% managers                                                                                                                                                                                                                                                                | Helping students, instructors, and managers with tasks include activities:<br>1) Assessment<br>2) Predict a situation to prevent problems<br>3) Assistance, tutoring, and/or mentoring for students & teaching staff<br>4) Improving student learning management                                                                                                                                                                                                                                                                                                                           |
| 8  | (Gašević et al., 2023)<br>Elsevier-Computers and Education; AI                                           | 1) Educational assessment,<br>2) Ability to explain,<br>3) Concept & learning design,<br>4) Prediction, and application                                                                                                                                                                                                           | 1) Support assessment activities,<br>2) Supports explanation activities,<br>3) Supports learning concepts and designs,<br>4) present predictive data                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 9  | (Luckin et al., 2022)<br>Elsevier-Computers and Education; AI                                            | Readiness of teaching staff in the AI era                                                                                                                                                                                                                                                                                         | Personalization in the use of AI according to the task context and work environment of teaching staff                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 10 | (Rangel-de Lázaro et al., 2023)<br>Elsevier-Computers and Education; AI                                  | 1) Machine learning algorithms or ensemble methods,<br>2) Module-based modeling,<br>3) Scripted AI,<br>4) NLP or TTS conversion technology,<br>5) Rule-based AI,<br>6) Markup language AI,<br>7) Affective computing                                                                                                              | 1) Supports machine-based learning<br>2) Module-based modeling<br>3) Security and order support through AI-based regulations<br>4) Driving computing behavior                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 11 | (Carolus et al., 2023)<br>Elsevier-Computers and                                                         | Intelligent Voice Assistant (IVA)                                                                                                                                                                                                                                                                                                 | Improving the quality of science learning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| Education; AI |                                                                           |                                                                                                                                                                                                                                                                                                                                                              |
|---------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12            | (Southworth et al., 2023a) Elsevier-Computers and Education; AI           | The entire (interdisciplinary) curriculum is AI-based, study programs & elective courses are                                                                                                                                                                                                                                                                 |
|               |                                                                           | Supporting all learning and educational activities held by universities                                                                                                                                                                                                                                                                                      |
| 13            | (Batarseh et al., 2021) Springer-International Journal of AI in Education | AI-based<br>The game-based learning environment we designed is AI-based (ARIN-561)                                                                                                                                                                                                                                                                           |
|               |                                                                           | Help students in:<br>1) Learn AI concepts<br>2) Sharpening mathematical competence<br>3) Build computational thinking skills                                                                                                                                                                                                                                 |
| 14            | (Swiecki et al., 2022a) Elsevier-Computers and Education; AI              | 1) RiiPLE,<br>2) MI Write,<br>3) LambdaMART,<br>4) Aca Writer,<br>5) Turnitin,<br>6) Electronic Assessment Platforms atau EAP,<br>7) Stealth Assessment,<br>8) Latent knowledge estimation,<br>9) Bayesian knowledge tracing atau BKT,<br>10) Clickstream,<br>11) Computerised adaptive testing systems (CATs),<br>12) Data storytelling,<br>13) Grammarly   |
|               |                                                                           | Supported automated scoring includes:<br>1) Facilitate peer assessment<br>2) Assessment of essays, articles, plagiarism tests<br>3) learning with AI techniques that use multichannel data<br>4) Automatic adaptive assignment recommendation application according to heterogeneous student ability data<br>5) Authentic assessment<br>6) Modern assessment |
| 15            | (Fan & Li, 2023) Taylor & Francis-Applied AI                              | Back Propagation Neural Networks (BPNN)                                                                                                                                                                                                                                                                                                                      |
|               |                                                                           | 1) AI-based assessment technology that is believed to be objective, efficient and measurable<br>2) Provide valuable feedback to students and Instructors                                                                                                                                                                                                     |
| 16            | (Adams et al., 2023) Elsevier-Computers and Education; AI                 | Not specific                                                                                                                                                                                                                                                                                                                                                 |
|               |                                                                           | Not specific                                                                                                                                                                                                                                                                                                                                                 |
| 17            | (Memarian & Doleck, 2023) Elsevier-Computers and Education; AI            | General Data Protection Regulation (GDPR)                                                                                                                                                                                                                                                                                                                    |
|               |                                                                           | Recommendations for preparing AI-based data security as carried out by Europe                                                                                                                                                                                                                                                                                |
| 18            | (Rangel-de Lázaro et al., 2023) Taylor & Francis- Applied AI              | 1) Teacherbots, 2) Superkomputer IBM, 3) Recommendation System, 4) Collaborative Filter, 5) Content Based, 6) Hybrid (Campuran CF & CB)                                                                                                                                                                                                                      |
|               |                                                                           | 1) Teaching assistance<br>2) Advanced computers to support learning management<br>3) Giver of recommendations for action in the assessment<br>4) Filter and modify learning content                                                                                                                                                                          |
| 19            | (Chaka, 2023) Research and Practice in Technology Enhanced Learning       | 1) OOPL Chatbot,<br>2) Eliza & Erasmus                                                                                                                                                                                                                                                                                                                       |
|               |                                                                           | 1) Automatic scoring<br>2) Supports wound suturing training, by connecting a recording-based analysis system and instructor commands with suture and artificial skin tools in medical disciplines                                                                                                                                                            |

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|----|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20 | (Pisica et al., 2023)<br>MDPI-Societies                 | 1) Virtual & augmented reality, 2) Voice assistant. 3) AI Curriculum, 4) Chatbot, 5) Virtual Reality and gamification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1) Supports translation for students<br>2) Voice command-based assistance<br>3) Supports personalized learning guidance, instant assessments, and feedback                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 21 | (George & Wooden, 2023)<br>MDPI-Administrative Sciences | 1) Automatic evaluation and scoring<br>2) Calendar synchronization and activity schedule reminders<br>3) Evaluate financial aid applications<br>4) Personalized learning paths<br>5) AI chatbot in virtual mentoring classes<br>6) Support collaboration between peer students<br>7) AI-based collaborative research<br>8) Automatic Literature Review<br>9) AI-assisted data analysis<br>10) AI-based virtual reality simulation<br>11) AI-based learning content filter<br>12) AI-based virtual learning analytics<br>13) Automatic course and exam scheduling 14) AI-based chatbot<br>15) Automatic document processing<br>16) Recommended AI-assisted internship and job opportunities<br>17) AI-based virtual interview simulation<br>18) AI-based networking platform<br>19) AI-based monitoring<br>20) AI-assisted crisis situation prediction and response<br>21) AI-driven energy optimization<br>22) AI-based room usage data tracking<br>23) AI-based curriculum Design | Office service management domain:<br>1) AI-based application filtering<br>2) AI-based interview scheduling<br>3) Assessment of financial aid applications receivedSmart tutoring & learning domains:<br>4) Adaptive course recommendations<br>5) Virtual teaching assistant 6) AI-facilitated study groups<br>Research & development domain:<br>7) AI matching with research interests<br>8) AI-based article summarization and citation Supportdata visualization Virtual learning domains:<br>9) Supports immersive virtual learning Experiences<br>10) Automatic learning content curation and recommendations<br>11) Predict outcomes and improve subsequent virtual learning<br>Auto service office domain:<br>12) AI-powered scheduling<br>13) Supports automatic answer service for student questions<br>14) Formula validation and document simplification fordata management<br>Career counseling office domain:<br>15) Data-driven student job matching<br>16) Support virtual interview readiness<br>17) Gather event information and wider professional connections<br>Campus service domain with AI-based security andmonitoring protection:<br>18) Increasing campus security includes threat detection monitoring<br>19) Support response management to emergency conditions<br>Facility services office domain:<br>20) Supports intelligent energy management in sustainable energy consumption<br>21) Supports scheduling in the use of room facilities<br>Data-driven curriculum and assessment design domains:<br>22) Support evaluation and innovation of course curriculum to make it dynamic, relevant, and interesting<br>23) Support accurate assessments in timely evaluation activities<br>Collaboration and innovation domain:<br>24) Facilitate brainstorming and mediation towards creativity and collaboration<br>25) Supports efficient coordination and project management |

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|----|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                                                       | 27) Supports interdisciplinary network connections forexpanded collaboration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|    |                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|    |                                                       | 24) AI-based automated assessment and feedback                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|    |                                                       | 25) AI-based idea generation application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|    |                                                       | 26) AI-based project allocation and tracking                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|    |                                                       | 27) Recommendations across the network Disciplines                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|    |                                                       | 1) AI-based student data processing, 2) Intelligent Machines, 3) Gamified, 4) AI-based computers, 5) Chatbot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 22 | (Bhutoria, 2022) Elsevier-Computers and Education; AI | <p>1) Supports combining study groups based on study habits for personalized group learning</p> <p>2) Distinguish behavior patterns among individuals, identify each learning experience factor and learning outcome, as well as predict future movements and outcomes of a learner based on such analysis to recommend appropriate learning options according to a particular learner's abilities by predicting their movements</p> <p>3) Incorporation of learning to develop noncognitive-based skills.</p> <p>4) Supports some of the teacher's routine tasks (giving quizzes, assessing answer sheets, filling in and processing attendance</p>                                                                                                                                                                                                                                     |
|    |                                                       | 5) Facilitate personal assistance for students                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 23 | (Mallik & Gangopadhyay, 2023) Frontiers in AI         | <p>1) Using logistic regression on previous admissions records, can predict a new applicant's likelihood of being accepted into their graduate program.</p> <p>2) Helping evaluate learning to avoid plagiarism and designing a series of assignments with increasing levels of difficulty</p> <p>3) Automatically generate questions based on narrative or informational text, or automatically generate problems for conceptual analysis</p> <p>4) Assist students in Connecting past discussions to current discussion threads</p> <p>5) Facilitate customized student collaboration based on current student needs</p> <p>6) Evaluates task compositions produced by learners in response to specific prompts, and is usually trained on a large set of written samples that have been pregraded by expert raters</p> <p>7) Supports automatic scoring for math question answers</p> |
|    |                                                       | 1) Graduate Admissions Evaluator (GRADE) 2) Question Difficulty Prediction atau QDP, 3) Automatic question generation atau AQG, 4) Natural Language Processing atau NLP, 5) Automatic Question Answering (AQA) systems, 6) Machine Reading Comprehension (MRC) systems, 7) automatic quantitative reasoning problem solvers, 8) Virtual Reality, 9) Chatbot, 10) PedaBot, 11) Mentor Match, 12) Deep Learning Based Course Recommender System (DECOR), 13) Automatic Essay Scoring (AES) and Automatic Short Answer Grading (ASAG), 14) Mathematical language processing atau MLP                                                                                                                                                                                                                                                                                                        |

|                                            |                                                                                 |                                                                                                            |                                                                                                                                                                                                       |
|--------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 24                                         | (Alotaibi & Alshehri, 2023) MDPI-                                               | Machine Learning (ML)                                                                                      | Optimizing quality in machine-based learning                                                                                                                                                          |
| Sustainability                             |                                                                                 |                                                                                                            |                                                                                                                                                                                                       |
| 25                                         | (Jin et al., 2023) Springer-International Journal of                            | 1) Plan Organizer, 2) AI Companion, 3) Pre-question generator, 4) Intelligent suggestions, 5) AI Analytics | 1) Facilitating study planning<br>2) Providing support to establish learning strategies, identify task values, and stimulate interests                                                                |
| Educational Technology in Higher Education | 6) Virtual Human, 7) AI Agent, 8) Notelink, 9) Adaptive Quiz, 10) AI Reflection |                                                                                                            | 3) Assisting in researching and acquiring previous knowledge, as well as preparing for the next lessons                                                                                               |
|                                            |                                                                                 |                                                                                                            | 4) Useful data-based smart counselors for improving understanding of learning content and preventing job delays                                                                                       |
|                                            |                                                                                 |                                                                                                            | 5) Supporting self-monitoring, establishing learning strategy, and enhancing motivation                                                                                                               |
|                                            |                                                                                 |                                                                                                            | 6) Virtual humans for stimulating attention & focus in virtual learning                                                                                                                               |
|                                            |                                                                                 |                                                                                                            | 7) AI agents for obtaining assistance in learning activities                                                                                                                                          |
|                                            |                                                                                 |                                                                                                            | 8) A useful note link to support review activities                                                                                                                                                    |
|                                            |                                                                                 |                                                                                                            | 9) Adaptive quizzes are useful for 5 things; support self-evaluation, enhance understanding of content, establish strategies for learning, help high-value acquisition, and support Self-satisfaction |
|                                            |                                                                                 |                                                                                                            | 10) AI-based reflection applications to support positive learning attitudes & enhance student self-understanding                                                                                      |
|                                            |                                                                                 |                                                                                                            |                                                                                                                                                                                                       |
|                                            |                                                                                 |                                                                                                            |                                                                                                                                                                                                       |

|    |                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 26 | (Chiu et al., 2023)<br>Elsevier-<br>Computers and<br>Education; AI | 1) fuzzy analytic hierarchy process, 2) Random Forest algorithm, 3) J48 algorithm, 4) Bayesian network, 5) Sound Recognition NLP, 6) audio analysis algorithms, 7) Speech recognition, 8) learning web based-AI, 9) Chatbot, 10) Robotic arms; speech recognition and machine vision, 11) AI language Prolog, 12) Recurrent Neural Networks (RNN), Artificial Neural Networks (ANN), Naive Bayes, k-Nearest Neighbors (k-NN), Support Vector Machines, and Decision Trees Dalam Prediction System 13) Face recognition dalam User Authentication System, 14) Ant Colony Optimization (ACO), 15) knowledge representation, algorithmic methods, 16) NLP, 17) Manajemen platform, 18) case-based reasoning (CBR) algorithm dalam AI-based mobile application, 19) Intelligent tutoring system, 20) convolutional neural networks, 21) convolutional neural network (CNN) dalam motor-controlled car kit, 22) Multi-layer Perceptron (MLP), 23) Alat Intelligent managementcloud platform, 24) artificial skin that was connected to an AI recording & analysis system, 25) random forest (RF); decision tree, dan 26) Machine Learning Framework Intelligent Tutoring System (ITS) | 1) Supports the assessment system<br>2) Supports prediction models<br>3) Supports SmartPathK teaching system<br>4) Optimizing pedagogical learning agents<br>5) Operating a Chinese language tutor robot<br>6) supports the role of expert tutors<br>7) Providing empowered digital automated assessmentsas learning tools,<br>8) Supports AI-based higher education management activities<br>9) Support teaching system<br>10) Prediction system<br>11) System user authentication in commercial AI platforms<br>12) Supports serious game-based learning<br>13) Presenting AI-based Books<br>14) Refining the operation of the simulator's virtual patient role to support medical conversations that canenhance the acquisition of specific medical service skills<br>15) Supporting the fulfillment of higher education administrative affairs with AI-based tools<br>16) Smart Virtual Assistance that supports the introductionof college for new students<br>17) Supports predictive modeling for management<br>18) Supporting convolutional neural network models in learning<br>19) Supports semantic analysis<br>20) Supports Image recognition<br>21) Predict character<br>22) Supports big data analysis<br>23) Facilitates data mining<br>24) Support human skin sewing training<br>25) Supports the assessment of machine-based learning |
| 27 | (Chichekian & Benteux, 2022)<br>Frontiers in AI                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Attempts to model human tutor interaction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 28 | (Humble & Mozeliuss, 2022)<br>Springer-Discover<br>AI              | Not specific                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Not specific                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|    |                                                                       |                                                         |                                                                                                               |
|----|-----------------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| 29 | (McGrath et al., 2023)<br>Elsevier-<br>Computers and<br>Education; AI | 1) Intelligent Tutoring<br>System (ITS) and<br>2) MOOCs | 1) Robots as an alternative learning tutor<br>2) Online Education Platform that supports didactic<br>learning |
| 30 | (Nasution, 2023)<br>Agricultural and<br>Environmental<br>Education    | Chat GPT AI                                             | Assistance for students                                                                                       |
| 31 | (Rangel-de Lázaro<br>& Duarte, 2023)<br>MDPI-<br>Sustainability       | Extended Reality                                        | Optimizing virtual learning                                                                                   |

The results of our exploration and metadata analysis of publication scientific work between January 2022 and October 2023 show that AI is driving transformation and developing the world's higher education landscape. This finding is relevant to research (George & Wooden, 2023). Through Table 2 above, we reveal how 147 advanced and sophisticated AI-based technology and application models are used in 132 functions, most in the teaching and learning domains, learning, followed by assessment, and research, and the smallest is the management domain in higher education. This emphasizes the significance of AI for universities in the world in a presentation that has never been imagined before.

## Research Question 2. What are the Recommendations for Using AI to Accelerate Increasing WCU Rankings in Indonesian Higher Education?

World Class University (WCU) is an academic institution dedicated to creating and disseminating knowledge across disciplines and contexts, providing quality higher education, as well as responding to national demands, and helping answer international interests (Zare, 2021). In a more specific sense, WCU is a university with an international reputation that obtains a license through ranking the best campuses from around the world.

Many institutions measure higher education performance globally by reviewing various aspects of standardization. One of them is the Quacquarelli Symonds World University Rankings (QS WUR), which is an annual publication ranking world-class universities that is most widely read in the world. This institution applies several indicators in measuring rankings, namely academic peer review, the ratio of faculty and student, citation per faculty, employer reputation, international student ratio, international staff ratio, and international publication (Ibrahim & Fadhli, 2021).

Salmi and Atbach reported in 2020 that world-class universities at the top of the ranking are universities that contribute to the advancement of science through significant research, teaching with the most innovative curriculum and pedagogical methods, and producing graduates who stand out in their success in intensive fields (Muslimah & Kusumaputri, 2020). This means that the competitive aspects include highlighting the period when education took place for students, as well as when they graduated. In 2023, QS WUR will improve its ranking methodology through 3 metrics, namely sustainability, Employment Outcomes, and international research network combined with 6 other indicators<sup>2</sup>.

Increasing the ranking of Indonesian universities in the list of world-class universities is one of the plans set by the Ministry of Education, Culture, Research and

<sup>2</sup> <https://www.topuniversities.com/qs-world-university-rankings/methodology>

Technology (Kemendikbudristek) through the strategic plan of the Directorate General (Ditjen) of Higher Education, Research and Technology (Diktiristek) for 2020-2024 as contribution to the national development agenda of the Republic of Indonesia, the thirdpoint, namely increasing quality and competitive human resources (Kemdikbud, 2022). The Ministry of Education and Culture formed a special team for World Class Universities (UBD) to accelerate the increase in WCU rankings, especially at 21 PTNBH. These 21 universities are ranked in the range of 100-200, up to 1,200-1,500 in the 2023 QS WUR<sup>3</sup>.

Many universities receive different rankings from ranking providers. This is caused by differences in aspects and varying presentation of aspect weights in the assessments carried out by raters. For example, Webometrics highlights the visibility or impact of website content by paying attention to external networks connected to the institution's website with a weight of 50%, the number of researchers most cited with a weight of 10%, and the most cited scientific publications with a weight of 40%<sup>4</sup>. The Times Higher Education World University Ranking (THE WUR) examines the learning environment with a 30% weighting, volume, revenue, and reputation research by 30%, Quotes as research impact by 30%, International Outlooks at 7.5% and Industry Income with a weight of 2.5%.

Meanwhile, the QS WUR version of the assessment index for the 2024 WCU ranking includes 9 indicators, namely Academic reputation with a weight of 30%, Employer Reputation 15%, Faculty Student Ratio 10%, Citations per Faculty 20%, International Faculty Ratio 5%, International Student Ratio 5%, International Research Network 5%, Employment Outcomes 5%, and Sustainability with a weight of 5%. Because the Ministry of Education and Culture is reviewing the QS WUR in the established strategic plan, in the next section we will recommend the application of AI to Indonesian universities based on each assessment index according to the QS WUR indicators applied for the 2024 WCU ranking. See Table 3.

**Table 3 AI Implementation Policy Recommendations To Accelerate WCURanking Improvement For Indonesian Universities Based on 9 QS WUR Indicators**

| QS WUR Indicators | Policy Recommendations                                    |
|-------------------|-----------------------------------------------------------|
|                   | Utilization of AI-Based Technology/ Systems/ Applications |

<sup>3</sup> <https://www.kompas.com/edu/read/2023/03/16/165715471/21-ptn-bh-siap-jadi-universitas-kelas-dunia-ini-upayanva?page=all>

<sup>4</sup> <https://www.webometrics.info/en/Methodology>

|                                                                  |  |                                                                                                                                                                                                                        |
|------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Academic Reputation</b>                                       |  |                                                                                                                                                                                                                        |
| Seeks to explore answersto the question 'Which                   |  | 1)Strengthening AI literacy through intensive training and mentoring so that teaching and research staff increase teaching effectiveness and the volume of international research publications based on big data.      |
| university has the                                               |  | 2)Use of AI robots or Teacher bots as language, science, and computer science teaching assistants and acceleration of interdisciplinary research                                                                       |
| most superior academic aspects                                   |  | Use of computers and AI-based applications for predictive systems for students who have the potential to drop out of schoolto support preventive measures                                                              |
| in the world? This index <sup>3)</sup> is                        |  | 4) Smart Analysis applications such as supporting automatic contentanalysis of research article manuscripts or data on graduates' contributions to society                                                             |
| translated into                                                  |  | Use of AI-based image analysis or facial recognition applications                                                                                                                                                      |
| aspects of research                                              |  | 5)for attendance and accessibility management systems that are integrated with student learning performance data, teaching staff, and academic staff performance                                                       |
| quality institutions,                                            |  | AI-based inter-university research project tracking to supportresearch collaboration management                                                                                                                        |
| methodology in                                                   |  | 6) education Use of an AI-powered Intelligent Management Cloud Platformthat can make big data mining activities easier for students,                                                                                   |
| managing academic                                                |  | 7)teaching staff, researchers, or higher education policymakers                                                                                                                                                        |
| partnerships, impact strategy,                                   |  | 8) Utilization of the Ant Colony Optimization (ACO) applicationwhich can support the fulfillment of higher education administrative affairs                                                                            |
| innovation education,                                            |  | 9) use of the Intelligent Tutoring System (ITS) as an assistant orrepresentative for teaching staff in certain roles                                                                                                   |
| and                                                              |  | 10) To encourage learning innovation, use AI Companion which can provide assistance in determining learning strategies and stimulating student interest                                                                |
| the impact of                                                    |  | 11) Use the Pre-question Generator application to support students in checking or obtaining previous knowledge and preparing for subsequent learning                                                                   |
| on global                                                        |  | 12) Recommends that teaching staff and students use the intelligent suggestions application which can provide intelligent, data-based suggestions to improve understanding of learning content and prevent work delays |
| society.                                                         |  | 13) Use of the AI-powered Adaptive Quiz application which is useful for supporting self-evaluation, facilitating the determination of learning strategies, and supporting the achievement of high grades               |
|                                                                  |  | 14) Use of the fuzzy analytic hierarchy process system to support an automated and integrated assessment system                                                                                                        |
| <b>Employer Reputation</b>                                       |  |                                                                                                                                                                                                                        |
| Pay attention to the reputation institutionthe employer          |  | 15)Use of an AI-based network platform to obtain job opportunity recommendations based on large data on students in higher education, and collect event information and a wider professionalreach of employers         |
| evaluates the employability of college graduates <sup>10</sup> . |  | 16)Utilization of an AI-based virtual interview simulation application to train students' skills in facing competition in employmentselection                                                                          |
| <b>Faculty-Student Ratio</b>                                     |  |                                                                                                                                                                                                                        |
| More and more resources and staff                                |  | 17)AI-based curriculum design to support curriculum evaluation and innovation so that it is always dynamic, innovative and                                                                                             |
| academics available                                              |  | 18)interesting Providing student pastoral services based on student data records supported by AI                                                                                                                       |

<sup>9</sup> <https://support.qs.com/hc/en-gb/articles/4405952675346>

<sup>10</sup> <https://support.qs.com/hc/en-gb/articles/4407794203410>

|                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| for Students for teaching, supervision, curriculum development, and pastoral support, the better the learning experience will be obtained by students <sup>5</sup> .                                                                                                            | 19) Use of RiPLE, MI Write, Lambda MART, Aca Writer, or Turnitin applications to support automation of peer assessment, assessment of article writing, and monitoring of potential plagiarism<br>20) Use of the AI-based generate application to facilitate brainstorming and mediation of collaborative creative ideas between students<br>21) Use of virtual reality (VR) and Virtual Human (VH) technology to optimize experiences in virtual learning<br>22) Providing virtual and augmented reality applications to facilitate translation activities of cross-language learning resources for students<br>23) Use of AI-based assessment systems such as OOPL Chatbot or Back Propagation Neural Networks (BPNN) which can provide automatic feedback to students<br>24) Automatic scheduling of research projects according to the academic calendar with citation mitigation to increase the research intensity of teaching staff and students |
| <b>Citations per Faculty</b><br>Score quote per faculty is a measure of research intensity and volume carried out by an institution taking into account the size of the institution. This pays attention to strong research that is widely understood and accepted <sup>6</sup> | 25) Use of Clickstream applications and Computerized adaptive testing systems (CATs) to provide automatic research assignment recommendations with adaptive levels of difficulty to students according to heterogeneous student ability data<br>26) Use of AI-based Bayesian Knowledge Tracing (BKT) technology for learning using multi-channel data, thereby increasing citations<br>27) Use of the Plan Organizer application and AI-based network platform to support international teaching staff recruitment management by expanding effective recruitment information to world professionals                                                                                                                                                                                                                                                                                                                                                    |
| <b>International Faculty Ratio</b><br>Looking at the ratio of international teaching staff to all staff taking into account the benefit of diversity and collaboration study <sup>7</sup> .                                                                                     | 28) Adapt the Graduate Admissions Evaluator (GRADE) system which uses logistic regression on previous teaching staff admissions records, to predict the number of international teaching staff applicants that will be accepted                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>International Student Ratio</b><br>This Indicator Notice international student-to-student ratio overall taking into account the potential expansion of benefits and networks, diversity, and exchange culture <sup>8</sup>                                                   | 29) Develop higher education promotion instruments based on AI technology such as VR and ER to stimulate the interest of prospective international students<br>30) Using an AI-based networking platform for international student recruitment<br>31) To support environmental adaptation and learning processes in international student exchanges, whether Indonesian students are sent to foreign universities or vice versa - to be facilitated with an Intelligent Tutoring System (ITS) as an alternative study tutor or Chat GPT as a study assistant                                                                                                                                                                                                                                                                                                                                                                                           |

<sup>5</sup> <https://support.qs.com/hc/en-gb/articles/360019108240>

<https://support.qs.com/hc/en-gb/articles/360019107580>

<sup>7</sup> <https://support.qs.com/hc/en-gb/articles/4403961809554>

<sup>8</sup> <https://support.qs.com/hc/en-gb/articles/4403961727506>

|                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>International Research Network</b><br>IRN is an engagement measure for global universities in                                                                                                                                                                                                       | 32) Global problems that need to be addressed by international publications are the impact of previous domestic or international phenomena. So international research produced by collaboration between universities needs to use the Note link application with                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| creating and maintaining partnerships research with other universities around the world to produce international publications to solve world challenges <sup>9</sup>                                                                                                                                   | Natural Language Processing (NLP) technology to connect problems related to the past with current research topics.<br>33) Use of the Automatic Quantitative Reasoning Problem Solvers system powered by AI to evaluate the number of international publications that have successfully responded to global problems through collaboration between universities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Employment Outcomes</b><br>Measuring institutional capabilities in ensuring high employment rates among college graduates height <sup>10</sup>                                                                                                                                                      | 34) Improving AI-based learning assessment for effectiveness and accelerating student competency achievement to answer competency challenges in global workforce competition<br>35) Using the Multi-Layer Perceptron (MLP) application to support big data analysis about employment levels of college graduates                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Sustainability</b> Pay attention to commitment to college for life more sustainable, thereby evaluating impacts social as well as the environmental impact of higher education. this is This indicator is being used for the first time in the QS WUR 2024 edition, no Once previously implemented. | 36) Use of an AI-powered energy optimization system that can support intelligent management of energy in sustainable energy consumption in higher education<br>37) Preparation of an AI-based General Data Protection Regulation (GDPR) as carried out in Europe for the protection and orderly use of university community data. This can minimize the potential for data misuse and prevent social losses.<br><br>Specifically within the scope of this indicator, recommendations for implementing AI can be used and the benefits can be felt gradually. To be able to obtain an assessment in sustainability indicators, universities need to be included in the previous year's QS WUR provided that the university has a commitment to mitigating the climate crisis and reaches the minimum number of research articles that are aligned with the UN SDGs <sup>11</sup> |

In Table 3, we show 37 recommendations for Indonesian higher education which are based on an explanation of 9 WCU indicators. Even though we studied 31 related scientific articles, the recommendations for AI systems, technology, and applications offered in Table 3 are the result of extraction from only 29 articles. Because the other 2 articles do not describe AI-powered systems or applications with specific names.

Considering that the 21 PTN-BH which are prepared to improve the WCU ranking in 2024 have the authority from the Ministry of Education and Culture to manage and develop themselves autonomously - this is regulated in Permendikbudristek number 53 of 2023, the recommendation for implementing AI in higher education is an option that can be taken because is not outside the scope of the university's authority. This means

<sup>9</sup> <https://support.qs.com/hc/en-gb/articles/360021865579> <sup>10</sup> <https://support.qs.com/hc/en-gb/articles/4744563188508> <sup>11</sup> <https://support.qs.com/hc/en-gb/articles/8322582098460>

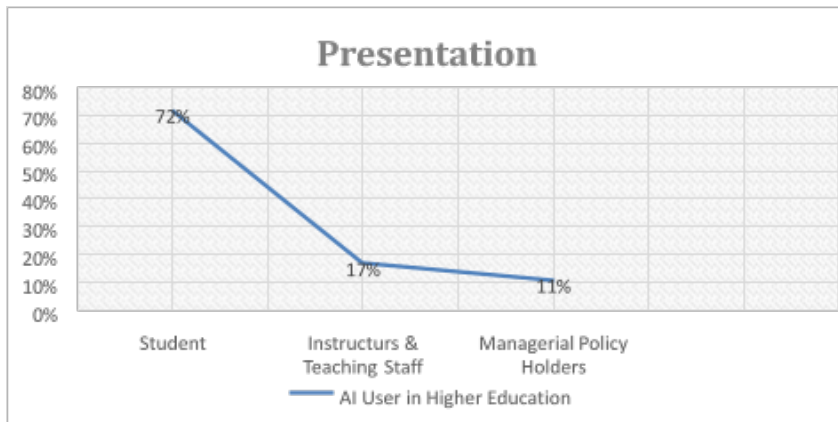
that the authority to implement, postpone, or even reject the recommendations resulting from this research review depends entirely on the decision of the relevant higher education policy authority.

During the consideration process, it is important to remember the benefits that can be obtained if Indonesian universities implement AI. At independent higher education institutions equipped with AI-based data management systems, extensive data regarding students, staff, lecturers, and other relevant stakeholders can be accumulated and assessed. This encourages the effectiveness of recommendations for improving performance as well as facilitating data-based decision-making (George & Wooden, 2023), thus enabling higher education policymakers to continue to improve student study outcomes, improve teaching quality, and optimize resource management (Sein Minn, 2022).

AI can power intelligent reporting systems for individualized guidance and long-term educational planning with the utilization of algorithms, resource-intensive databases, and queries that are often complained of being complex (Assiri et al., 2020) when performed manually, supporting predictive and descriptive analysis to gain insights important regarding educational elements, combines data collection methods for decision making (Alotaibi & Alshehri, 2023) for higher education policymakers as well as teaching staff and students, helps provide automatic assessment and feedback to students and tests theories theory effectively (Khairy et al., 2020), and most importantly, encourage the quality of students' final educational outcomes (Hooda et al., 2022) to increase the academic reputation of universities globally.

Apart from considering the benefits that can be obtained, we believe that it is also important to pay attention to the time aspect. Whether universities choose to immediately implement or postpone the recommendation for implementing AI, this aspect will certainly have implications for the size or small of the opportunity to increase WCU's ranking. Currently, AI users in world universities still show gaps. See the research results of (Crompton & Burke, 2023) which we visualize in figure 4

**Figure 4 AI User Trends in Higher Education On 6 of the 7 Continents in the World**



Source: Adapted from (Crompton & Burke, 2023)

Figure 4 shows that AI in higher education is most widely used by students, followed by instructors including teaching staff and academic staff who are far below,

then the fewest AI users are higher education managerial policy makers. In our synthesis, this gap arises due to the transition to AI use which is relatively easier for young humans to follow. But if you look at it strategically, this is actually the right time to accelerate the quality of higher education through the application of AI in Indonesian higher education, namely when the majority of higher education policy makers in the world have not yet done so. One of the world's top-ranking universities in the 2023 QS WUR version of the WCU list with an overall score of 97.6 is Harvard University<sup>12</sup>, adapting and using AI Generate as a teaching resource for their students<sup>19</sup> to simulate a 1:1 student to lecturer ratio to encourage unique and varied learning styles among students.

The University of Florida (UF), which integrated AI into its curriculum to produce a competent workforce for the 21st century in response to workforce needs throughout the world (Southworth et al., 2023b) succeeded in improving its WCU ranking 3 times. In 2022, UF will be ranked 154th, and in 2023, it will rise to 151st<sup>13</sup>. Research findings (Chu et al., 2022b) reveal that not only Canada and Chile but also one Asian country, namely South Korea, has long been investing in research of AI Robotic Education (AIRE) so that one of their universities, such as Seoul National University (SNU), saw a jump in the WCU ranking. In THE WUR database in 2011, SNU was ranked 109th while in 2023 it suddenly skyrocketed to the ranking 56<sup>21</sup>. These three examples perfect the argument for the recommendation that Indonesian higher education leaders immediately increase the use of AI to improve WCU rankings, which must start now.

## Conclusion

Artificial Intelligence as a global societal trend is showing rapid and ever-increasing penetration of universities in the world. Through intensely and deeply researched metadata, we discovered how 147 models of cutting-edge AI-powered technology items, systems, and applications are discussed and used in 132 functions of higher education administration. The application of AI in higher education is most closely related to the domain of teaching and learning, followed by assessment and research, and the least is in the domain of higher education management.

Considering the promising benefits in presentations that could never have been imagined before but have been proven to be obtained by universities that apply AI thereby accelerating their ranking increase in WCU, we recommend 37 approaches in implementing AI for 21 Indonesian PTN-BH who are persistently looking for ways to accelerate increase the ranking in the 2024 WCU list based on 9 WCU assessment indicators by QS WUR. Apart from that, research findings which show that AI is still minimally used by higher education policymakers in 6 out of 7 continents, is an opportunity to get ahead of current 'competitors' so the implementation of AI in Indonesian higher education needs to start now.

## Acknowledgments

Not Applicable

<sup>12</sup> <https://www.topuniversities.com/university-rankings/world-university-rankings/2023>  
<https://www.liputan6.com/tekno/read/5328794/universitas-harvard-rilis-ai-generatif-untuk-mahasiswa-di-kelas-ilmu-komputer>

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<sup>13</sup> [https://www.timeshighereducation.com/world-university-rankings/2023/world-ranking#!/length/25/name/university%20of%20florida/sort\\_by/rank/sort\\_order/asc/cols/stat](https://www.timeshighereducation.com/world-university-rankings/2023/world-ranking#!/length/25/name/university%20of%20florida/sort_by/rank/sort_order/asc/cols/stat)  
<https://www.timeshighereducation.com/world-university-rankings/seoul-national-university>

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### Author Contributions

MDCR initiated the topic, performed data analysis, and led the research process. NA provided an overview of the methodology and assisted with language translation in preparing the article. AD begins the initial data search process. RS supports searching for additional data sources and help with typing. The final version of this article was based on the agreement of all four authors.

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### Availability of Data and Materials

The data and information sources used in this article document are available based on citations that meet scientific principles.

### Declarations Competing Interests

The authors declare that there are no objectives or potential conflicts of interest or competition related to the research, writing, and/or publication of this article.

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