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Recombinants for Learning Innovation in Higher Education: Blended Learning Plus AI – *Semi Systematic Literature Review*

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ABSTRACT- Society 5.0 with an approach of being human-centric, has pushed a change on the learning system in Indonesia's education. Education plays a crucial role in developing a country, where the level of education in one country shows the quality of its people. Blended learning acts as a recombinant of innovations in learning that are aligned with impactful curriculum, in which blended learning is a form of learning that blends e-learning and traditional class learning into one framework. This study intends to introduce blended learning as a recombinant of innovations in learning with the help of artificial intelligence (AI) to improve the quality of education and to solve problems in Indonesia's education. This study uses a semi-systematic literature review (SSLR) to identify scientific journals that contain blended learning in college as their topic from 2017 to 2025. This study reveals that blended learning is the most suitable way to teach students in the 5.0 industry era as it accommodates students with the skills to continue their study, to determine their own education needs, and to find the most suitable source of education. Other additional benefits are educational experiences that are adjusted and flexible. This study gives a literature contribution to the topic of blended learning with an emphasis on recombinant innovation education towards society 5.0, where the implication of this study is for colleges to take a pro-change approach about blended learning with the support of artificial intelligence. The support of artificial intelligence includes creating a supportive education environment, including blended learning plus AI in the learning curriculum, and preparing the infrastructure gradually so that the process of blended learning can be implemented smoothly and therefore increases the quality of learning activities for both lecturers and students.

KEYWORDS- Blended learning, Artificial intelligence, Higher Education, Learning Innovation, Recombinant.

I. INTRODUCTION

Covid-19 Pandemic and industrial revolution 5.0 (IR5.0) has made technology disruption into a double technology disruption, where it leads us to a super clever society made by the transformation that is led by science innovations and technology called "society 5.0" [1]. Amid the ongoing national Indonesia's economic recovery, Society 5.0 can't be ignored because the implementation of 5G technologies developed by the Indonesian government and the continuous use of internet by Indonesian people which number increases from time to time will develop into the era of Society 5.0. People in Society 5.0 with the approach of human centric are expected to be able to solve various challenges and problems they face by leveraging the innovations emerged in the era of IR5.0. IR5.0 and Society 5.0 has changed the structure of everyday life, which includes affecting the society's working habits, thinking skills, culture, politics, economy, and education world [2]. At the time of the Covid 19 pandemic, fundamentally the education world immediately transforms into a comprehensive online learning system. [3], [4], [5]. After the Covid 19, pandemic began to return to the offline learning system, the face-to-face system. The world has entered the life of metaverse driven by the internet, digital, computer and others into a world of unlimited virtual communication, so online learning cannot be avoided in developing learning strategies especially in college [6].

According to Worldtop20.org, Indonesia's education is ranked number 67 among 203 countries. Education is very crucial to improve and guarantee one country's sustainability; therefore, the excellent quality of education will greatly influence the quality of one's developed country. The poor quality of education in Indonesia is shown in societal trends, where many college students and lecturers remain exposed to radicalism, and where universities are increasingly viewed as a means to obtain a degree rather than as a place to develop one's potential [7], In other words the distribution of education particularly higher education in Indonesia remains uneven, both geographically and across social strata. In 2025, Minister of Higher Education, Science and Technology of Indonesia pushed digitalization, hybrid working system, and flexibility learning in colleges. Impactful curriculum is a continuation of the independent curriculum, it's also a digital transformation in the world of education with the availability of many kinds of learning platforms [8]. Impactful curriculum aligns with blended learning that once has become a reliable learning tool while in the Covid_19 era [8].

Technological advancements have fundamentally transformed the paradigm of education, creating a more dynamic, interactive, and responsive learning ecosystem [9]. Advances in information technology (IT) have given

rise to blended learning (the use of IT in the learning process), introducing a new approach to instruction that differs from the conventional format of in-person classes. In blended learning, lecture is not limited in offline meeting, but the communication between lecturers and students still can be established outside offline classes [10]. Through blended learning, students can discuss with their friends and their lecturers online or in person [8]. Blended learning is a hybrid approach to higher education that offers student centred learning solutions by (1) prioritizing discussion and collaboration, (2) facilitating self-directed learning, (3) providing access to a wide range of learning resources, (4) fostering critical, analytical, and innovative thinking, and (5) encouraging engagement in a social environment [7], [11].

In addition, the advancement in artificial intelligence (AI) technology in the digital age is creating new opportunities to support more adaptive and personalized blended learning models [12]. AI has the ability to analyze learning patterns in real time and tailor learning content to students' individual abilities [9], [13].

Although there is a phenomenon that happened especially post Covid-19 pandemic, the existence of blended learning is no longer readily accepted among students and lecturers [2]. In fact, blended learning is used merely as a marketing ploy to make Indonesian universities appear up-to-date. Furthermore, there is significant skepticism regarding the use of AI in the educational system revolution. Particularly following the release of ChatGPT in November 2022, educators have expressed concerns about the reliability, the overreliance on new tools, the threats and challenges to academic integrity, and the potential for these new tools to be used for various forms of academic dishonesty. [14].

The emergence of blended learning combined with AI has sparked polarized reactions among two distinct groups: those who support blended learning (pro-change) and those who wish to abandon blended learning in favour of a return to the conventional system (pro-status quo) [10]. The pro-status quo group argues that the adoption of the blended learning system leads to instability [10], where the quality of learning outcomes is questionable and there is a decline in genuine learning motivation. Blended learning plus AI is viewed merely as a tool for online student learning, where blended learning cannot fully grasp reality from various perspectives, particularly cultural perspectives [2]. In addition, educators have raised concerns about the integrity of academic and the high incidence of plagiarism in blended learning combined with AI [14].

The premise of an educator's responsibility is to only transfer knowledge, so the educator will be obsolete once new technologies and learning strategies are introduced [15]. This trend has become apparent with the emergence of the Ruang Guru app. As educators, lecturers must be flexible, innovative, and creative in contributing to the improvement of educational quality without neglecting cultural values [16], [17], [18], [19]. Thus, blended learning as a learning system leading toward Society 5.0 is now inevitable [20].

Research on the transformation of learning from Industry 5.0 to Society 5.0 is not linear, but it rather occurs rapidly, thereby disrupting existing structures and creating new ones [2], [3], [21]. Research findings [7], [17], [18], [21] have identified ways for educational institutions to maintain educational standards without sacrificing cultural values—an issue that has long been a major concern in the era of Industry 5.0. Research findings [22] indicate that educational challenges—ranging from issues related to teachers, students, infrastructure, curriculum, and cultural systems have not yet been adequately addressed. Some existing studies focus on the perceptions and experiences of blended learning among students and teachers in elementary schools [17], [21], [23], [24], [25], [26], [27] and middle schools [2], [16], [19], [26], [28], [29], [30], [31], [32], [33], [34], [35], [36], while at the university level, studies are scattered across different faculties with student respondents; there are still very few studies involving lecturers as respondents [7], [10], [26], [37], [38], [39], [40], [41], [42], [43], [44], [45], [46], [47], [48], [49], [50], [51], [52]. The findings of the study [51] indicate that students hold negative perceptions regarding the usefulness of digital classes for learning English, which has important implications for instructors who must work harder during the COVID-19 pandemic to capture student's attention. The results of a study [36] show that in blended learning, cognitive load does not have a significant effect on learning engagement and has a negative impact on the improvement of academic self-confidence. Some other studies show negative impacts from blended learning, like the increase of workload for lecturers [25], [44], [46], [53], and the discomfort of students on sending their answers for their online assignments [53]. This has become the reason why the group of pro-status quo appeared Furthermore, although there is a relatively extensive body of literature on the effectiveness of fully online learning delivery, fewer studies have examined blended learning approaches. The case for blended learning has centred on the fact that different learning tasks are naturally suited to specific delivery modalities, with a mix of modalities allowing for a "match" between learning tasks and learning delivery modes.

It is therefore important to investigate various aspects of blended learning implementation, such as its characteristics, benefits, and challenges, particularly its effectiveness. This study aims to examine blended learning in Indonesian higher education institutions in the IR5.0 era, focusing on its characteristics, types, and implementation. Blended learning represents a recombinant form of educational innovation designed to address challenges in the future of Indonesian education. This study contributes to improving the quality of Indonesian education through blended learning combined with AI, while taking into account the diversity of learning models in higher education institutions in alignment with an impactful curriculum.

II. METHODOLOGY

This study uses a semi-systematic literature review (SSLR), which is a literature review guided by systematic review principles in terms of survey and literature selection, combined with "framing discourse on literature that may be established as a component of a thesis or other research [54]. This SSLR focuses on the topic of blended learning as a recombinant innovation in learning by identifying scientific journals covering the topic of blended learning in higher education published between 2017 and 2025. The researcher chose 2017 as the starting year for the data because technological development is so rapid that 2017 is still considered relevant to current technological conditions. The SSLR is a method that emphasizes features such as the

transparency in the search process and the potential for comprehensiveness, where the "systematic" protocol—namely CASP (The Critical Appraisal Skills Program)—for this review has been validated through the use of explicit search questions and a replicable research search procedure [54]. The following are the stages of the semi-systematic literature review in this study.

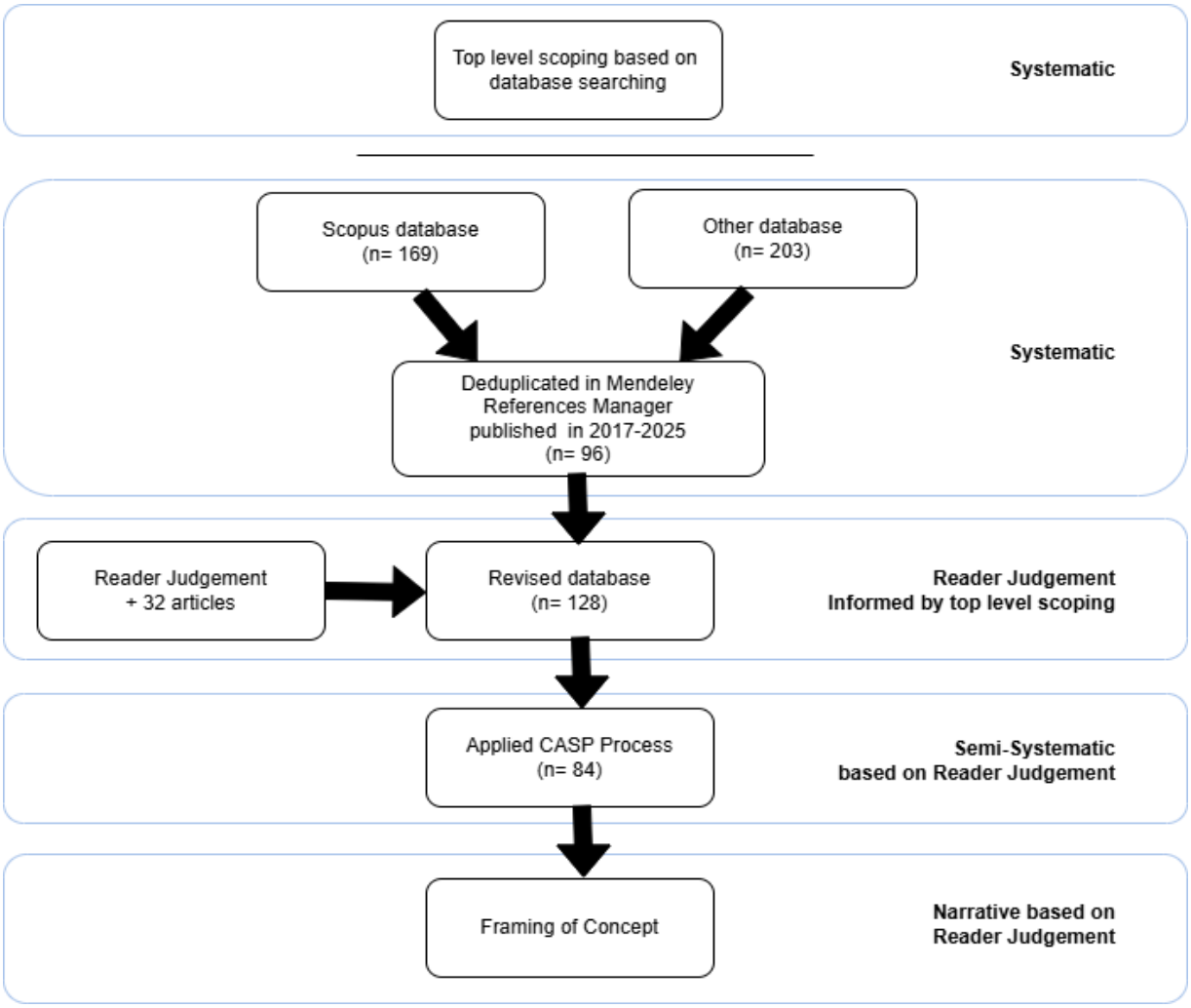

Figure 1: Semi systematic literature review process

Figure 1 illustrates the stages of a semi-systematic literature review, beginning with a systematic literature search across various databases such as Scopus and others (top-level scoping), followed by the consolidation and removal of duplicates using tools like Mendeley, resulting in a result of 96 relevant articles within a specific timeframe. The next stage involves reader judgment, where the researcher adds and selects additional articles to refine the reviewed dataset. Subsequently, the selected articles are analysed using the Critical Appraisal Skills Programme framework to assess the quality and validity of the studies, thereby narrowing the focus to 84 articles. In the final stage, the researcher conducted a narrative framing of concepts, reflecting a conceptual synthesis based on the researcher's interpretation, thereby integrating systematic and subjective approaches in a structured manner to produce a comprehensive literature review.

III. RESULTS AND DISCUSSION

A. Innovation Recombinant

Blended learning is a recombinant innovation in higher education that combines the learning process with information and communication technology, alongside the expertise and skills of lecturers and students [11]. "Recombination" refers to scholarly works on the characteristics of knowledge and the mechanisms of recombination, which seek to explain the formal and informal mechanisms through which effective knowledge integration can occur [55]. Since 1934, economic development, innovation, and entrepreneurship are based on "new combinations" that can lead to new products, services, methods/processes, and markets [55]. The role of recombination in the creative process, which involves placing new elements into old combinations and old elements into new combinations [55]. Recombination is the process by which new knowledge constructs itself by combining existing knowledge in new, useful ways that were not previously understood [56].

The benefits of recombination lie in a company's ability to recognize the value of new external information, to assimilate it, and to apply it for commercial purposes—viewing this as largely a function of the level of prior relevant knowledge [57]. Recombination is an open innovation that provides benefits: (1) lowering barriers to entry (widespread, inexpensive communication enables the "democratization" of innovation, bringing more players into the innovation game), (2) increasing reach (open innovation gives more people a voice, granting them access to the innovation process and the tools to activate it), (3) increasing participation (rapidly building communities around key themes, and if this reaches critical mass, there is a level of long-term sustainability), (4) expanding the range of ideas (open innovation casts a wider net and offers greater flexibility in developing ideas, insights, and diverse new inspirations), fostering co-creation that generates cost savings by bringing many users into the process, (5) accelerating diffusion (innovation markets, communities, and clusters are easily formed and quickly achieve a scale of connectivity with significant effects in terms of idea generation and development), (6) enhancing rapid diffusion acceleration across the entire community and (7) expanding reach to previously uneconomical solutions (open innovation facilitates the management of protracted problems [57]. One example of recombinant innovation that is effective and useful for improving public welfare is the development of cash assistance programs for humanitarian crises on mobile platforms. There are two distinct types of recombinant capabilities, which are: (1) recombinant creation, where universities can innovate through recombinant creation by creating new combinations of technologies for learning such as virtual classrooms; (2) recombinant reuse, where universities can innovate through the reuse of recombinant elements by reconfiguring combinations of established learning methods such as interactive discussions using student-centered learning methods [58].

B. Blended Learning

Blended learning is a combination of technology based instructions, which means a technology-based learning system to control the learning experience's path, location, pace, as well as to give more personalized learning experience [7], [59], [60]. Blended learning is a combination of traditional learning and e-learning/cyberlearning, in which technological support in e-learning plays a specific role in facilitating the learning process, such as Computer-Based Training, Computer-Based Instruction, Cybernetic Learning Environment, Desktop Video Conferencing Integrated Learning System, and Web-Based Training [7], [10], [50]. Blended learning is a form of formal education that emphasizes efforts to foster students' interest in learning (student-centered learning) by introducing integrated learning modalities—specifically, multimodal learning—presented through multiple sensory modes (visual, auditory, and written) and various presentation formats to enhance learning interest, with the expectation that blended learning will lead to improved academic performance [7]. Thus, blended learning differs from hybrid learning, where hybrid learning involves conducting both in-person and online classes simultaneously in a single session and a single physical space connected to online facilities [61], [62], [63], [64]. The following is a summary of the differences between blended learning and hybrid learning.

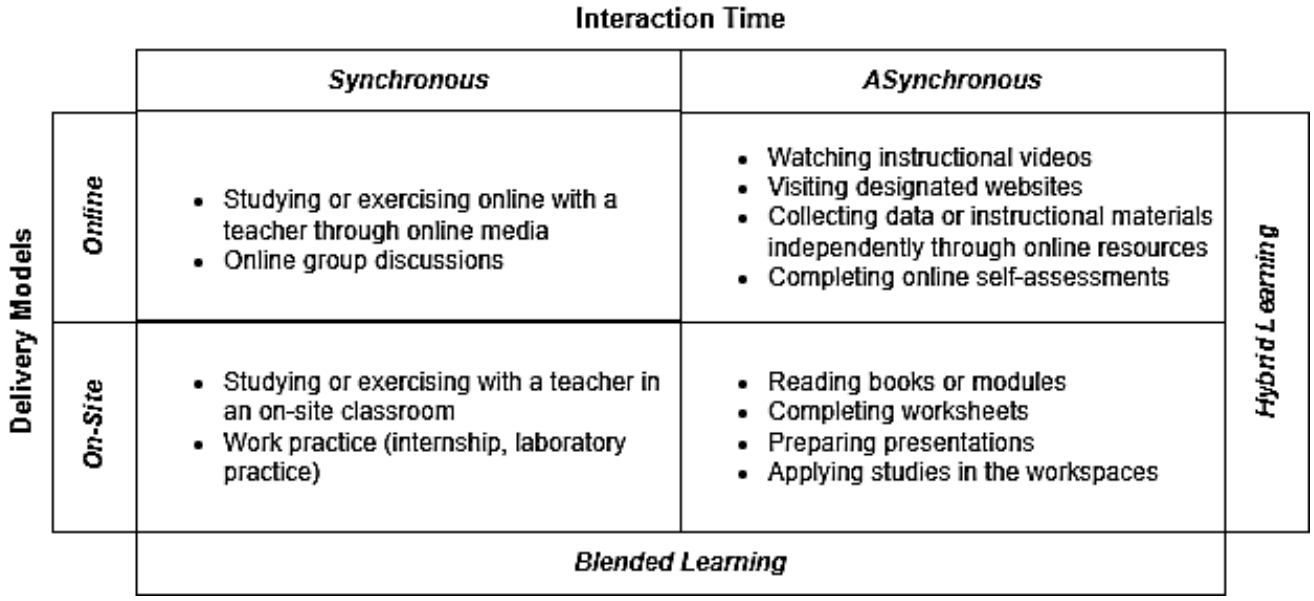

Figure 2: Differences between blended learning and hybrid learning [61]

Figure 2 represents blended learning as a learning model which integrates four main combinations of learning, which are *synchronous–asynchronous* and *online–on-site* so the students do not only learn face-to-face, but also learn through online activities both in real-time and independent learning. To compare, this model of learning is different from hybrid learning, which emphasizes on synchronous learning, which is done at the same time by the students in the offline class (on-site learning) and the online class (online learning) at the same time. Therefore, it does not emphasize on the flexible combination of various methods like blended learning. To conclude, the picture above shows that blended learning is a comprehensive and flexible learning method, and that hybrid learning is a specific

example of synchronous interaction, which covers both physical and virtual attendance of the students simultaneously.

Blended learning is an educational approach that combines online and in-person classroom components with online sessions outside the classroom [50]. Blended learning techniques can take the form of self-directed learning, in which individuals learn using web-based learning modules, links to online resources, simulations, online self-assessments, workbooks, or CDs/DVDs [10], [50]. Although there are many definitions related to blended learning, most research agrees that blended learning is achieved by integrating several modes of delivery, namely traditional face-to-face, e-learning, and self-access materials, while others view it as a transition of the traditional teacher's role into that of a virtual teacher and "e-teacher."

Blended learning consists of five components, two of which are in-person and three are online [65], including: (1) Instructor-led in-person sessions, where students participate in classes in which the instructor presents the learning content, and there is little interaction, learning experience, or practice; (2) In-person collaboration, where students are encouraged to participate in collaborative learning activities in the classroom; (3) Instructor-guided online, where the teaching process is conducted online with the instructor assessing learning progress and interactions during the learning process; (4) Online collaboration, where students are encouraged to participate in online learning activities; (5) Online self-paced, where students learn at their own pace, with flexible time and space.

Five blended learning models are classified based on where content is delivered and where practical activities take place (in-person or online) as follows: (1) Flipped model: students are guided to access prepared materials before class begins; this preparation takes place outside of class hours via online formats and is then utilized to maximize opportunities for student-instructor interaction, collaboration, problem-solving, and hands-on activities during in-person learning [32], [65]; (2) Mixed model: the delivery of learning content and practice assignments is conducted both in-person and online [65]. (3) Flex model: learning content and practical assignments are delivered through online instruction; however, students participate in in-person sessions to review progress and receive feedback on the learning process [65]. This model can be implemented by conducting online instruction that includes various tasks such as watching videos, researching books, participating in online discussions, or problem-solving exercises. Instructors allow students to learn at their own pace, and students meet with one another regularly and individually for class instruction [66]. This model can be applied to thesis writing; (4) Supplemental model: knowledge and practical learning are enhanced through face-to-face instruction; however, online activities are added to increase student engagement [65]; (5) Online-practicing model: this model is similar to e-learning, allowing students to practice, solve problems online, and receive instant feedback through an online learning platform [65].

C. Implementation of Blended Learning as a Recombinant Learning Innovation

The discussion of the implementation of blended learning as a recombinant learning innovation is divided into two parts: the implementation process and the self-assessment process. The following diagram illustrates the implementation of blended learning as a recombinant learning innovation, which combines traditional learning and e-learning as recombinant creation and recombinant reuse.

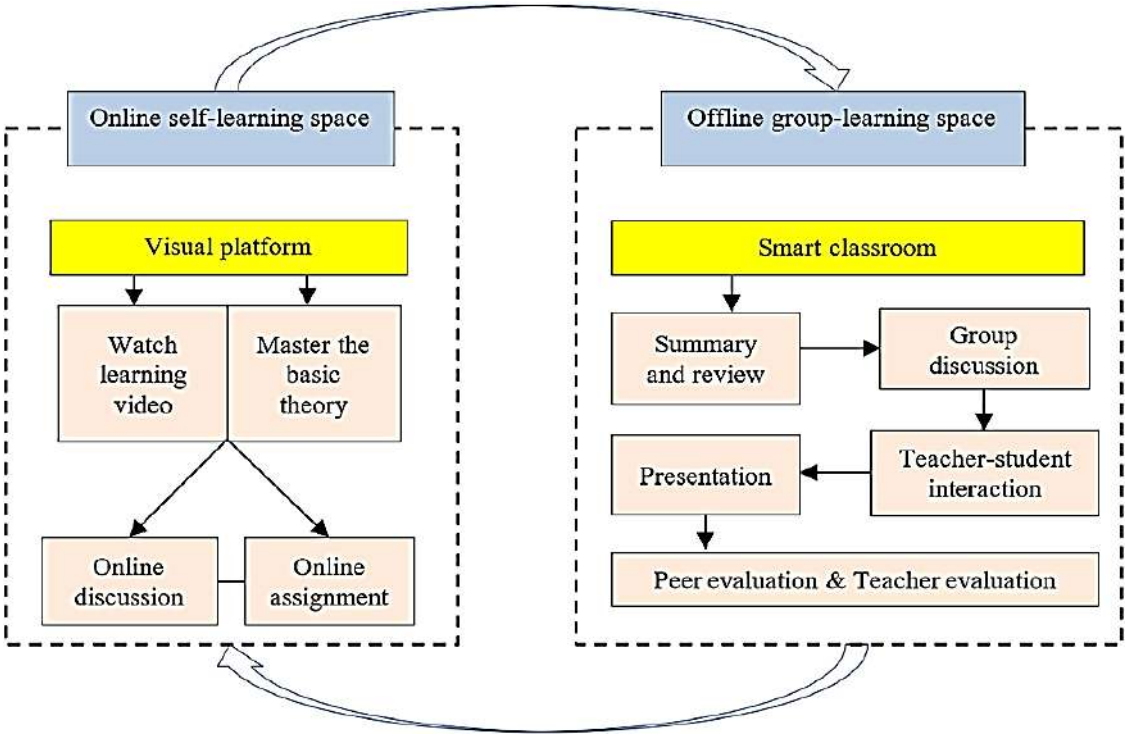

Figure 3: The Implementation Process of Blended Learning [49]

Figure 3 describes the implementation of blended learning through integrating two learning environments, *online self-learning space* and *offline group-learning space*, which are connected through simultaneous cycles. In the online learning, students independently access digital platforms to watch educational videos, understand basic theories, and do online discussion and tasks (asynchronous learning). Then, the process continues to face-to-face learning in the *smart classroom* (synchronous learning), which focuses on strengthening the students' understanding through summarizing activities, group discussion, presentation, teacher-student interaction, and peers and teachers' evaluation. This pattern shows describes that blended learning does not only combine online and offline learning, but also creates learning practice which combines students' independent individual learning and onsite interaction to enhance the students' understanding and increase their participation.

Effective implementation of blended learning involves complex teaching methods that support face-to-face instruction while also facilitating students' work on projects, contributing to the learning process, and engaging in other activities. Students require constant supervision in online classes [43]. In the implementation of blended learning, roles can be divided into three groups [43], namely: (1) Student factors, including available information, technological knowledge/experience [33], self-confidence, self-discipline [33], learning styles [67], and responsibility for learning progress [65], [68]; (2) Instructor factors, including personality, information and communication technology (ICT) competencies, teaching style, knowledge, facilities, feedback and course structure, online teaching, information quality, and communication quality [65], [68]; (3) Technology adoption and technical support, including ease of use, access, user-friendly interfaces, and technical support [65].

Next, the second component is self-assessment, where evaluating the concepts and content of online learning materials is crucial as instructors provide students with feedback on project-based assignments and ask students to evaluate the quality of their own work. The instructors' feedback will inform students about how well they have learned [31], [43]. Additionally, instructors can assess the extent to which the material is understood, and students' learning requirements must be interpreted and monitored to track their learning progress [30], [31], [43], [46]. Three blended learning self-assessment methods utilize various types of questions: quick warm-up questions, summary exercises, and diagnostic and summative assessments, where these diverse question types provide personalized feedback while reinforcing critical knowledge during the learning process [30], [69].

D. Blended Learning Plus AI

Artificial intelligence (AI) plays a crucial role in the digital transformation of education, particularly through the implementation Artificial Intelligence in Education (AIEd) [70]. AIEd can provide real-time feedback and assist educators in designing more adaptive approaches to meet student's learning needs. AIEd also helps students enhance their technical skills through more adaptive and targeted approaches [70], [71]. AIEd in learning does not only increase the students' engagement, but also provides more accurate and effective feedback. AIEd, such as web-based educational systems, chatbots, and humanoid robots, is used to optimize administrative tasks and personalize curricula for students [14], [72]. Along with technological changes and the digital era, AIEd aims to develop flexible learning systems that can easily adapt to the dynamic needs of the job market [70], [73].

The integration of AI technology into blended learning models (blended learning plus AI) creates opportunities for the development of more personalized and interactive learning resources [74]. With AI, students are encouraged to think critically and creatively and to actively engage in learning activities. In addition to increasing student engagement [14], [70], [71], AI can also promote more sustainable and inclusive learning through the automation of administrative tasks and the delivery of more structured learning materials.

The implementation of blended learning combined with AI requires careful and precise redesign, as exemplified by Indonesia's geographical conditions, where remote or high-altitude areas face difficulties in accessing the internet [70]. This necessitates alternative solutions to address the digital access gap. Additionally, it is necessary to consider students' readiness to adopt digital transformation in learning. Although AI offers many benefits, its implementation must also address ethical challenges such as issues of fairness, privacy, transparency, and human-AI cooperation [14], [70] . A blended learning plus AI model requires a comprehensive approach that considers technological, pedagogical, and ethical aspects to significantly enhance student performance and prepare them for an increasingly advanced digital world [14]. In efforts to redesign learning models in the era of artificial intelligence (AI), it is important to consider not only technological and cognitive learning aspects but also emotional intelligence (EQ) and spiritual intelligence (SQ) [70]. The EQ aspect enables students to have a better control on themselves, enhance empathy, and develop social skills in collaboration and interaction in the workplace and social life [70]. Meanwhile, the SQ aspect provides a spiritual foundation that supports wise and meaningful decision-making in life, particularly when facing the complexities and moral challenges of the digital era [70].

The contributions of AI to Blended Learning [14], [70], [71], [74] are:

- Learning effectiveness, meaning that learning can take place anywhere and anytime, integrate motivational strategies with a real-time and accurate assessment system, and support the development of competencies, independence, and peer relationships.
- Control students' flexibility and autonomy, meaning providing easy access to information and quick support tailored to students' needs, delivering customized instructions and support, and facilitating class administration and management through student monitoring and classroom dynamics.
- Facilitate interactions between instructors and students, and/or among students (pedagogical agent), which helps instructors adapt course materials and monitor students' learning progress, reduces instructors' workload, and saves time.
- Transforming learning and improving performance, which involves helping "beginner" students enhance

their knowledge and skills in specific areas, such as programming languages or foreign language speaking skills; conducting individual vocabulary assessments to improve reading and listening comprehension; and enhancing students' performance and critical thinking through peer assessment and feedback.

- Supports communication between instructors and students by helping instructors organize student groups and select appropriate materials for various teaching strategies, supporting a variety of methods in collaborative learning, and helping instructors interact with students and notify them when intervention is needed.

E. Benefits Blended Learning as a recombinant innovation for learning

Numerous studies have demonstrated that blended learning has yielded positive results for the learning process of both students and instructors. A key characteristic of blended learning is that this teaching approach optimizes the strengths of both face-to-face and online instruction as a recombinant of learning innovations [30], [33], [43], [48]. Face-to-face instruction occurs only during in-class meetings, yet direct face-to-face interaction has a positive impact on learning because students can interact directly with instructors. The shortcomings of face-to-face instruction are addressed through online instruction, which maximizes the functions of the Learning Management System (LMS)—a comprehensive online learning platform. The benefits of the LMS include efficient goal-setting, better organization of documents compared to offline learning, facilitation of participation in learning at any time, and standardized assessment of academic achievement [46]. The benefits of blended learning combined with AI, as identified in existing research, are as follows: (1) facilitating interactions between instructors and students, among students, among instructors, and between instructors, students, and families [9], [14], [25], [33], [44], [62], [65], [67], [70]; (2) giving more personalized learning and assessment [24], [75]; (3) having no barriers of time and space [68]; (4) creating a flexible learning environment that allows students to review lessons at the right time and place [68]; (5) accessing and selecting learning content easily [9], [14], [40], [44], [70]. Furthermore, numerous studies indicate that blended learning can positively influence students' learning attitudes [24], [29], [33], [38], [68]; such as fostering learning motivation, enhancing flexibility, and boosting self-confidence [25], [28], [40], [65], [76]; and increasing the ability to work in groups [30], [33], [40].

As such, blended learning combined with AI can enhance students' engagement [9], [14], [31], [33], [70], [71], [77], [78] and improve the students' learning experience [24], [25], [31], [41], [76]. Furthermore, several studies indicate that the implementation of blended learning combined with AI in teaching improves students' academic performance [27], [28], [29], [33], [38], [65], [68], [78], [79], [80], [81]. Several studies have confirmed that blended learning plus AI empowers students by building their capacity to communicate [25], [30], [41], improving students' critical thinking skills [25], [35], problem-solving abilities [81], and enhancing students' technology application skills [30], [81].

Blended learning is a teaching approach that has a positive impact on student learning and faculty instruction. Through individual interactions with students, lecturers can identify students' learning needs, thereby enabling them to adapt or design lesson plans that align with the students' learning progress, [25], [31], [43]. At the same time, blended learning enhances instructors' ability to integrate information and digital technologies into teaching [25], [30] while also implementing alternative teaching methods through innovations in learning spaces and instructional contexts [25].

F. The Challenges of Blended Learning Combined with AI as a New Approach to Educational Innovation in Indonesia

During the COVID-19 pandemic, where it forced the education system to adapt immediately, lecturers and students experienced many benefits of online learning. However, there are challenges that must be addressed in the implementation of blended learning, including: flexibility of integration (in terms of time, place, and learning progress), interaction (face-to-face and online interaction), student learning support (student monitoring and assessment), and creating an effective learning environment (fostering motivation and encouraging learning) [42], [82]. Consequently, the implementation of blended learning often imposes a significant workload on lecturers [25], [44], [46], [53], and even impacts work-life balance. This is what drives many lecturers' members to join the pro-status-quo group, which does not support blended learning.

On the other hand, the lack of professional development to equip lecturers with the communication techniques, teaching strategies, and information technology skills necessary for blended learning was also noted in studies [25], [44]. The lack of training is particularly felt by senior lecturers, who generally lack technological proficiency. In Indonesia, the proportion of senior lecturers is quite large compared to that of junior lecturers. Some students also face difficulties when using blended learning, particularly those with limited resources for online learning. Students also experience significant discomfort when using online learning systems to submit assignment answers on time, due to internet connectivity issues or slow webpage loading [53]. Students in the pro-status-quo group do not feel motivated by blended learning programs due to a sense of inauthenticity and alienation resulting from fewer in-person campus meetings and a lack of opportunities to develop leadership skills. Students in the pro-status-quo group feel the need for more authentic interpersonal connections in the classroom and social interaction during face-to-face learning.

IV. CONCLUSION

Blended learning combines e-learning with traditional education (a fusion of learning innovations), offering flexibility in education and thereby streamlining the educational process for students, as they can maintain contact with fellow students and instructors anytime and anywhere. This blended learning plus AI model can serve as an alternative solution to improve the quality of learning in Indonesia regarding impactful curricula. With blended learning plus AI, education becomes a more effective interactive process than traditional classrooms; students can

learn in an environment tailored to their own needs. "Gifted" students can match their intellectual abilities and fulfil their needs and aspirations without disadvantaging their peers [83].

Finally, in addition to the flexibility blended learning plus AI offers in maintaining faculty contact—which is crucial for student success and satisfaction with their education—technological advancements using blended learning plus AI provide additional opportunities for varied learning experiences. Students can even listen to and benefit from lectures delivered by top professors located in other cities or countries. There are many other ideas that instructors can use in their courses to integrate technology with face-to-face instruction. The choice of ideas will vary depending on student needs and learning objectives [37]

There are costs in terms of time and effort involved in teacher training and infrastructure improvements for blended learning combined with AI. Several challenges have emerged that could hinder implementation or effectiveness, including a reduction in direct social interaction among faculty, students, and university administration, which may negatively impact students' social communication skills. Additionally, the freedom afforded by this learning approach may have negative consequences for the balance between students, faculty, and non-academic staff. Overall, investments in time, effort, and resources are beneficial for enhancing the effectiveness and efficiency of the educational process [50], [84]. To maximize the benefits of blended learning plus AI, higher education institutions must integrate digital literacy throughout the curriculum, invest in faculty training, and prioritize the equitable expansion of infrastructure [4]. Higher education institutions in Indonesia must design blended learning plus models that offer increased flexibility, enhanced student engagement, and the potential for improved learning outcomes while still paying attention to technological, pedagogical, and ethical aspects [14], [70], [84].

To successfully implement blended learning with AI in higher education, it is important to understand how well blended learning with AI supports in-person classes, whether the quality of digital content is adequate, or whether online courses have been designed with their own specific objectives in mind. Furthermore, the learning environment and social interactions are crucial in blended learning with AI, particularly interactions between students and instructors. Education in Indonesia should begin to embrace blended learning (pro-change) and to start developing curricula that optimize the use of blended learning plus AI to advance toward Society 5.0.

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