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Framework of smart learning technology in supporting quality of higher education in Indonesia

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Abstract
The rapid advancement of technology and information results in educational service innovations at various levels. Innovation through smart learning positively impacts the quality of university services in Indonesia. Therefore, this quantitative study aimed to explore the readiness of smart learning implementation in Indonesian universities to realize international reputation. A descriptive method was used, while data were collected using a questionnaire distributed to 608 university students. The data were analyzed through descriptive statistical tests using SPSS, and their validity was tested through discussions with experts. The results showed that the use of smart learning in Indonesian universities is on an average of 48.61%. The use is spread across management systems with 8.5%, Assessment with 10.5%, Smart classrooms with 8.3%, and use of library management systems with 10%. This implies proper implementation of smart learning in universities in Indonesia. This means that the use of smart learning based on a sample that represents some universities in Indonesia has been implemented well.

Keywords: Education Technology, HOTS, Smart Learning

Introduction

The challenges faced worldwide in the globalization era of the information industry are increasingly complex. They cover economic competition, trade, tourism, education, defense, security, and other aspects [1]. State stability could be maintained by increasing human resource competence through education [2]. This would harmonize community competencies to become globally competitive. Therefore, such development goals could be achieved by establishing an economic sector with quality human resources [3].

Reform of educational services in universities is unavoidable because technology is increasingly popular among students as a learning tool. In Indonesia, students must adapt to innovative educational services to develop the smart learning concept [4]. This technology-based concept detects learning needs and style, context, and the process is conducted dynamically according to the students' wishes [5].

Smart learning innovation in higher education is the latest pedagogic tool [4], whose application improves learning [6]. It changes the teaching and learning process from a content-based to a competency-based curriculum [4]. This is followed by a change from teacher-centered to student-centered learning [7, 8]. Smart learning is more absorbing, interactive, and collaborative than existing learning in universities [9].

Current digital technology trends include massive open online courses (MOOC), Open Education Resource (OER), and Mobile Learning (M-Learning) [4]. Another trend is the use of smart learning in universities by utilizing the Learning Management System (LMS) [5, 10]. Examples of LMS applications are Moodle, Blackboard, and Schoology [6], all consistent with the smart learning criteria. Therefore, this concept could be developed in higher education by assessing the LMS criteria.

Studies on smart learning have been conducted by academics, scholars, and scientists in educational technology. However, they need development to explore important issues not publicly disclosed.

First, Bdiwi *et al*. (2019) showed that smart learning requires teacher involvement in guiding students to participate in learning, which increases motivation and enthusiasm [8]. Second, Han & Xu (2021) stated that this concept must be integrated into learning ecology, educational environment, innovative applications, and the latest teaching methods to coordinate formal and informal learning [11]. Third, Paunović *et al*. (2020) found that the success of universities in utilizing smart learning as the main capital for implementing learning and academic services has competitive value in the global development era [12]. Fourth, Sułkowski *et al*. (2021a) explained that smart learning as part of society's 5.0 era would imply the need to integrate real and virtual worlds to prepare competitive human resources in various fields [13]. Fifth, Novaliendry *et al*. (2020) stated that the concept is the main foundation for developing human resources with creative ideas to make major national and international changes [14].

The rapid development of technology forces universities to adapt quickly to provide services to students effectively and efficiently. Many universities prepare smart learning as a tool to be applied in their environment to support better learning. Therefore, this study aimed to highlight the readiness of universities in Indonesia to apply this concept to improve education quality. It is expected to develop a positive frame as a reference by universities in forming quality smart learning.

Method

This quantitative descriptive study elaborated statistical figures to determine the independent variable from one or more variables without comparing or connecting them [15]. The use of smart learning in universities in Indonesia was described factually, systematically, and accurately using quantitative measuring tools and describing the whole sample. The population comprised 608 students of universities from Ten provinces of Indonesia. These 10 provinces include East Java, West Java, Jakarta, North Sumatra, Central Java, West Sumatra, South Sumatra, West Nusa Tenggara, Jambi, and Riau. And the number of Islamic universities themselves consists of 40 Islamic-based universities in Indonesia. The instrument used is a questionnaire with several questions about smart learning in various Indonesian universities. The questionnaire was tested for expert validation in learning technology using SPPS (Version, 26.00). The instrument for using Smart learning was classified into five parts that adopt Muhammad *et al*., (2017). The first part adopted a Smart learning management system. The third part adopted. The fourth part adopted a Smart classroom. The fifth part adopted a Library management system. All the question items are declared valid, with rCount greater than rTable. The r Table determined by 608 respondents at 5% significance is 0.080. This indicates that all question items show more than 0.080, meaning the instrument is valid. Furthermore, the reliability of an instrument using the Cronbach Alpha Questionnaire is declared reliable when the Cronbach Alpha is>0.6. The table shows that the value of the overall question item >0.6, insicating the instrument is reliable.

Data were analyzed descriptively quantitatively and displayed using central tendencies and percentages [17]. The data from each question were obtained directly after distributing the questionnaire via google forms. The overall data were analyzed through tabulation by changing the respondent's answer choices into scores of 1, 2, and 3 according to the instrument score table. The total score was then determined, followed by calculating the percentage. All data were processed and analyzed using Microsoft Excel and SPSS Version 26.00.

Results and Discussion

The renewal of smart learning adopts opinions and studies stating that international or smart universities should fulfill one of several categories [16]. Smart learning is categorized into the following four parts.

Smart learning management system

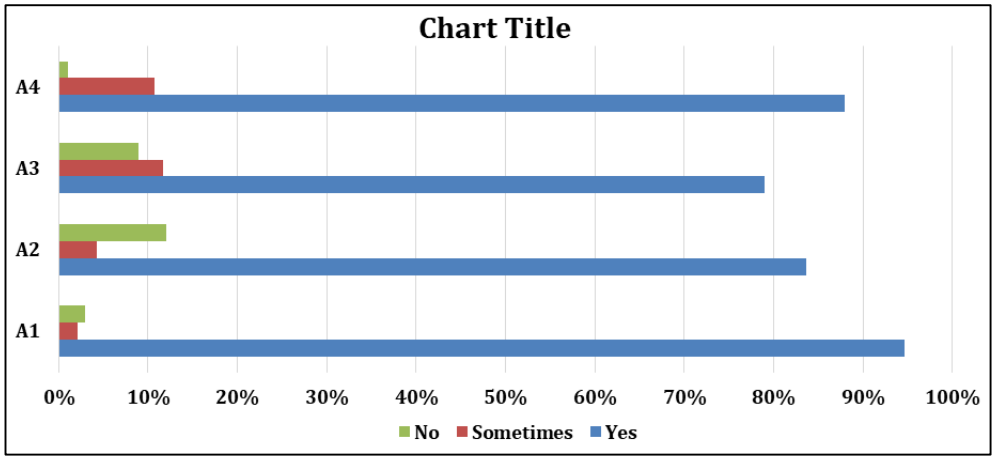

Fig 1: Smart learning management system for universities in Indonesia

Description

A1: Learning on campus has used E-Learning

A2: Apart from E-Learning, the campus also uses similar applications or technology

A3: E-Learning on campus is used effectively.

A4: The campus environment is connected to the internet network

The Figures shows that the first category to fulfill smart learning needs is a management system in each university [6]. Several universities in Indonesia have used E-learning as a

renewal of technological developments. As many as 94.7% of the respondents stated that their universities had used web-based learning. Another 2.1% of students stated that their university was designing the system to be applied in learning. Additionally, 3.1% of respondents stated that there was no E-Learning at their university.

The use of E-Learning was also considered very good by 83.7% of the students, while 4.3% stated that it was still improving. Another 12% stated that E-Learning was not used properly, while 83.7% of universities in Indonesia use applications and technology as learning tools. Moreover, 4.3% of universities design other technologies, while 12% have not used other assistance to support learning.

The use of E-Learning and other technologies in learning should be supported by an internet network [18]. Without a good network and internet connection in universities, some systems cannot be used properly [19]. However, 88.5% of respondents stated that their campus was connected to the internet. Another 10.7% stated that their university was designing and working on connecting to the internet network for use by all parties. Furthermore, 0.8% stated that the internet network on their campus could not support learning. The overall analysis shows that the internet network has been well implemented in universities in Indonesia.

The relevant universities should support the smart learning management system by socializing E-learning to lecturers, students, and related employees. According to Fayez *et al*. (2021), a properly used learning management system is beneficial for students [20]. A system focusing on the benefits of use, presentation, and content quality through the integration of resources and videos makes the students successful [21]. Additionally, students prefer learning through a smart learning management system.

Assessment

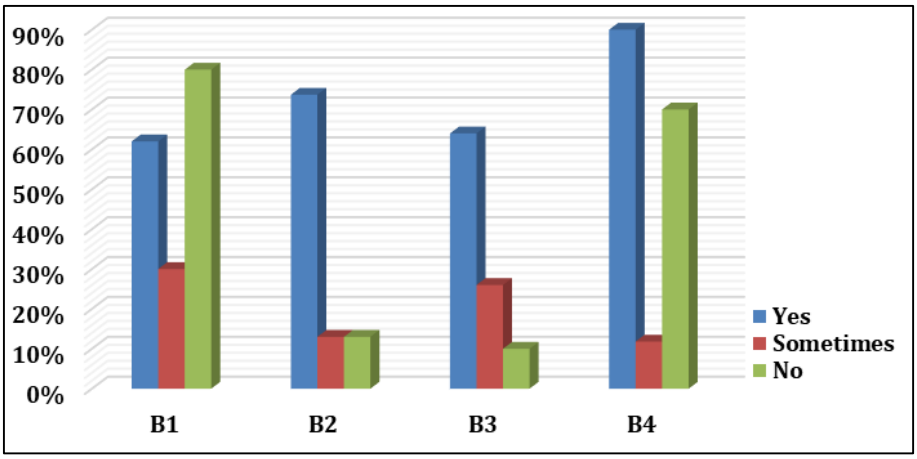

Fig 2: Assessment for universities in Indonesia

Description

B1: Are the learning outcomes assessed using e-learning.

B2: Are the learning outcomes assessed using other applications or technologies besides e-learning.

B3: The assessment is based on High Order Thinking Skills (HOTS)

B4: Do lecturers assess the learning process besides outcomes?

Assessment is an important part of the education system [22] that evaluates and compares students performance and progress [23]. This study found that 62% of universities in Indonesia use e-learning to assess learning outcomes. Furthermore, 73.7% of respondents stated that universities have used other applications or supporting technologies in learning. This utilization expedites the face-to-face learning system that has shifted to online learning due to the Covid-19 pandemic.

The learning process is also assessed [24] to provide feedback to lecturers and related universities as a basis for improvement [25]. As many as 84.9% of respondents stated that lecturers at their respective campuses had assessed the learning process for quality and effectiveness. The other 11.8% stated that lecturers were not consistently assessing the learning process.

The assessment should measure students' abilities to improve the quality of learning. In this regard, HOTS-based assessment should be considered and implemented in universities [26]. Referring to the Newcomb-Trefz model, Edwards & Briers (2000) stated that HOTS is based on Bloom's taxonomy, while Thomas & Litowitz (1986) stated that it shows a complex intellectual function. In Indonesia, 64.3% of lecturers have conducted HOTS assessments, 26.2% are inconsistent in their implementation, while 9.5% have not. The development of science and technology requires students to master higher-order thinking skills to answer the challenges of the 21st century.

Smart Classroom

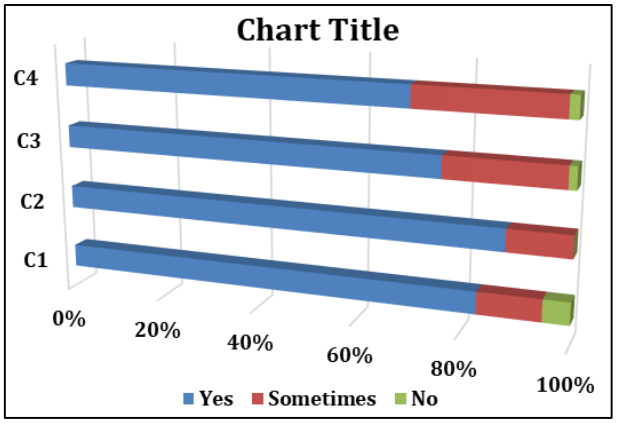

Fig 3: Smart classroom for universities in Indonesia

Description
C1: Using hardware and software
C2: Lecturer as Facilitator, Motivator, and Inspirator
C3: The teaching materials used are independent in digital form
C4: Learning displays Interactive Content.

A smart classroom is equipped with digital technology to create a modern teaching and learning process [29]. This concept is integrated with educational technology that utilizes smart audio and visual devices [30] to make the class interactive and more interesting [31]. In Indonesia, smart classrooms have been used effectively in universities. According to 83% of respondents, hardware and software technology has been used in various universities in Indonesia. However, some colleges do not consistently utilize 12.4% of the smart technology usage. Several universities have not implemented classroom learning by utilizing existing technology [32].

The use of technology or smart classrooms changes [33] from conventional to modern learning [34]. For instance, teaching materials such as heavy books are packaged digitally, enabling students to carry and access them anywhere [35]. The digital teaching materials have been used by 76% of respondents in various universities in Indonesia, while 1.5% use conventional options. Teaching materials could also be made interactive because science and technology development requires teachers and lecturers to innovate in learning. Interactive teaching materials attract interest and reach their highest potential. In the classroom and out-of-class learning, 70.4% of university students used interactive and interesting teaching materials, while 1.8% did not. Subsequently, 27% need to utilize existing technology and create interesting teaching materials consistently.

Library Management System

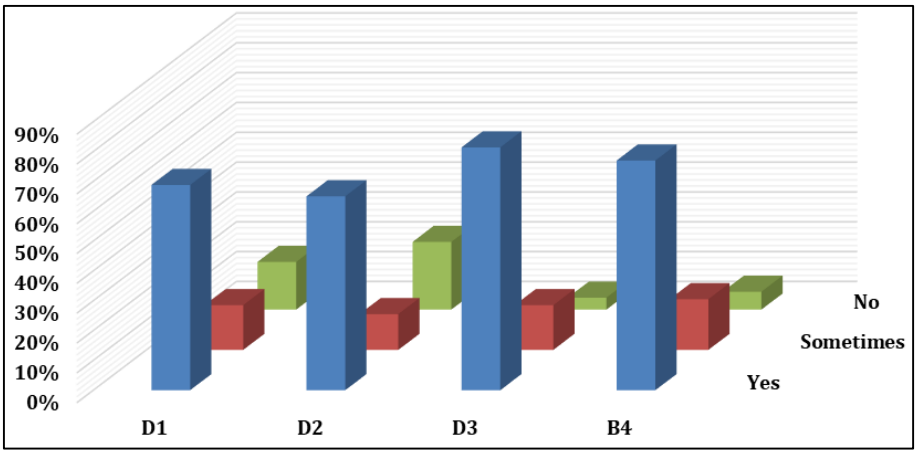

Fig 4: Library management system for universities in Indonesia

Description
D1: Is an open-source library automation system web-based
D2: Does it use the library card
D3: There is a comfortable place to read and discuss.
D4: Are lighting, internet connection, and other supporting facilities available in the library

The library management system is software designed to manage all functions [36] and automate all activities. The system facilitates easy access to and publishing or republishing books quickly and managing data efficiently and regularly [37]. Furthermore, it tracks records of the published or returned books and the updated or late fees. In Indonesia, 68.8% of students stated that their library had used a web-based system. Furthermore, 16.3% of respondents revealed that many universities had not implemented the web-based system.

The development of manual recording transfer technology uses library cards [38]. This helps the librarian record borrowing data automatically using a barcode or QR code that enhances data copying to a computer [39]. The library card has been used on several campuses in Indonesia, as expressed by 63.3% of students. However, 22.7% of students used the student's identity card connected to the library system.

The library room has furniture, space conditioning, ventilation, lighting, attractive character, and comfortable wall paint colors [40]. This layout design increases interest in a digital culture [41] that allows people to read in any place and time. Although this makes the library a comfortable place to read, it has its challenges [41]. For instance, the challenge to ensure the library has visitors requires universities to innovate and provide comfortable facilities to guarantee comfort for students to read, study and discuss [42]. In this regard, the survey respondents stated that 81.4% of their campuses conduct library renovations to make them more attractive and comfortable. However, 15.3% have not provided full facilities for students and other visitors.

This study aimed to examine the role of technology in supporting intelligent learning in Indonesian universities [43]. Smart learning should focus on how devices are used and educational models of universal and social learning. Intelligent learning features formal, informal, personalized, positioned, application, content, social, collective learning. The world is changing university education from traditional models to smart learning. In this case, smart learning is a new educational context using innovative technologies by students and teachers [44]. This depends on the software and hardware and their synergistic use in the classroom or online training. According to the Korean Ministry of Education, Science, and Technology, intelligent learning is a self-directed, motivated, adaptive, resource-enriched, technology-embedded concept. It extends the methods, competencies, content, and learning spaces of students and teachers [45].

Kuffman mentioned that technology or digital devices connect distant people and enrich the learning environment

[46]. According to Brian Arthur [47], technology orchestrates phenomena for some users to adapt and evolve. The future of education facilitates collaboration between humans and machines in designing and integrating technology with students, teachers, intelligent machines, and ideas as the main interacting elements. A smart learning environment provides support based on students' online and real-world status [48]. Applications of smart learning offer instant and adaptive support to students to analyze their needs from different perspectives. The last decade has seen an increase in the popularity of smartphones, tablet computers, wireless communication networks, and sensing technologies such as RFID, GPS, and QR codes. These devices have fulfilled the basic requirements for developing intelligent learning environments. Consequently, the learning system detects and collects students' real-world contexts and interactions with the online environment [49].

Smart learning is a core indicator of the education existence in universities. It is the integrity of institutions that provide professional education services to produce tough, intellectual, and competent graduates ready for globalization [50]. This emphasizes the direct pattern through the teacher's efforts in stimulating students through learning materials. The concept applies a pattern to increase students' thinking power to digest abstract into concrete things through their learning experiences and knowledge [51]. Furthermore, it builds students' awareness of the increasingly complex challenges of global development [52] because awareness is the core of imagination. Implementing smart learning must be integrated into skills in using technology as an inseparable tool in modern education [10].

The key to realizing smart learning is through smart students and teachers that want education to encompass knowledge transfer and form individual students in an interactive environment [4]. The students participate in multidisciplinary skills improvement training programs and demonstrate a personality commitment with a great orientation in life. This concept is a dimension of today's educational innovation to realize smart learning [53]. It could be realized by adopting diversified and personalized educational technology using the latest digital services [54].

Higher education in Indonesia is strongly influenced by technological developments that require universities to direct digital-based learning models. E-learning is a technology used in educational institutions in recent years [55]. In universities, it is equipped with features that support the learning process, including management, teacher and students' assessment, completeness reporting, content presentation, material delivery, and assignments. Additionally, this could find facilities to manage device development suggestions and confirm learning materials that require deeper explanations. The discussion feature is equipped with facilities for teacher and students' involvement in the experience [21].

The advantages of e-learning are the reasons for its use as a smart learning media. It offers flexibility and could be adopted using a computer or mobile device. Also, it facilitates presenting various learning materials and is freely visited by users without space-time limitation [56]. Although it is practical and flexible, some users must discuss with tutors the material contained in e-learning. Moreover, it creates pedagogical disorders, where students have difficulty learning through online media. There is limited time for a direct question-answer session, leaving some important questions unanswered. Therefore, some users feel they lack support when learning to use e-learning media.

The strategies used to utilize educational technology are quite difficult in universities because planning and needs analysis must be thorough. Therefore, many of them fail to utilize technology in learning [57]. This could be caused by raw planning and the unpreparedness of teachers and students as academic stakeholders to use technology in learning. Other possible causes are inadequate educational facilities an

Conclusion

The results of the study are as follows: 1) the overall smart learning management system has been used by Islamic universities in Indonesia which became the object of this research. The results show that 94% of respondents said their campus had implemented LMS-based learning. In addition, to use this LMS, it is supported to connect to the internet; 2) The assessment used is technology-based. And the assessment has been based on HOTS and has shown good results, namely 64.3%; 3) For information-based classroom learning, we have used a smart classroom, namely hardware and software devices have been installed so that they can facilitate the learning process and provide interactive learning content. This can be seen from the percentage of respondents, which is 83%; 4) And finally, there is a smart library management system. Overall, the implementation of the library management system has been implemented well, it is just that it still requires innovation and further development of the library management system to create a smart library management system.

This study recommends determining the overall application of smart learning in universities in all provinces in Indonesia. There is a need for an in-depth study of how effective smart learning is used in every university. Moreover, further studies should focus on an intense, sustainable, and effective application of smart learning in universities. Technology should be used for learning and educational facilities by considering the readiness of human resources using smart learning. This would ensure effective and efficient implementation and use of smart learning.

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