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Analysis of Industrial Revolution 4.0 Technology-Based Learning in Higher Education

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ABSTRACT

This study aimed to obtain an overview of the implementation of industrial revolution 4.0 technology-based learning management to improve university learning management, particularly in Bengkulu. The research method used was descriptive qualitative. According to the study's findings, Dehasen University of Bengkulu, Muhammadiyah University of Bengkulu, and Hazairin University of Bengkulu all have access to ICT network infrastructure. As a result, 84% of students and members of the academic community can easily find ICT tools for learning, 83% can easily learn how to use ICT tools for learning on campus, 87% can understand when and how to use ICT tools to achieve specific learning objectives, and 73% have s. This ease of using and accessing SIAKAD, e-learning, and an electronic library.

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1. INTRODUCTION

An educational institution, especially a university, needs good management because it can directly or indirectly support all parties' operations. Everything will be chaotic and not proceed as planned if there is no management, according to Saefullah (2012) and Shadily in Zaini (2015), the word management derives from the verb manage, which implies to manage. Learning management refers to the actions taken to control the teaching and learning process and increase its effectiveness and efficiency. Curriculum and learning management are terms used to describe the administration of learning programs (Bafadal, 2005).

Learning management, in its most basic form, controls all elements of learning activities at tertiary institutions, including learning activities classified as core and supporting curriculum, based on the curriculum established by the government (Azmi, 2022). In higher education, learning management is a sort of activity that starts with planning the teaching and learning process and ends with effective and efficient teaching and learning. Services are more effective and efficient when such management is used as a learning management strategy.

Cyber technology and automation technology are combined in the "Industrial Revolution 4.0" phenomenon (Indriani, 2021). Its application is intended to replace manual work with technology-based automation (Leong & Surya, 2022). Industrial revolution 4.0 is the age requiring numerous changes in all areas. Colleges must improve their lecture methods to help students prepare themselves and highlight their uniqueness and additional value (Romansyah, Rahayu, Suhendra, & Sulastri, 2022).

Reflecting on the stages of how individuals master information and communication technology (ICT) which are grouped into 4 stages, namely a) Discovering information and communication technology (ICT) tools, This stage studies ICT in its general functions and benefits, such as an early introduction to ICT and basic skills in its use; b) Learning how to use ICT tools, this stage learns how to use ICT in various disciplines including general use or parts of various ICT tools; c) Understanding how and when to utilize ICT technologies to attain specific goals, this stage understands the timing and reasons for using ICT tools to achieve learning objectives. This has implications for the ability to choose the most useful tools to complete tasks and use them to solve various problems; and d) Specializing in the use of ICT tools, This stage uses ICT tools more deeply in the formation of knowledge and developing it. Students are directed to become professionals in various ICT fields (UNESCO, 2002).

Learning management based on industrial revolution 4.0 may boost the effectiveness and efficiency of higher education management in a dynamic environment, helping to establish an organization that can satiate students, society, and educational objects (parents and students) in particular. They could also compete in regional, international, and local contests. Universities must apply ICT-based learning management in order to increase the efficiency and productivity of higher education management for students, faculty, and stakeholders. To establish and sustain a competitive position that will allow it to later produce excellent human resources in response to the times, businesses frequently use this strategy and operation..

The government's social distancing strategy has an impact on all aspects of life, including higher education, which is also affected. Due to institutions' lack of readiness to undertake online learning, several parties have been confused by the government's surprise decision to discontinue or move the learning process from campuses to homes (Iwani, 2021).

But some academics in higher education—lecturers, managers, and students—have attained levels of mastery C and D, which call for knowing when and how to utilize ICT tools to carry out a particular work (skill C) and having mastered the particular use of ICT tools. According to conclusions of observations, universities in the province of Bengkulu are distributed among the four stages (skill D). The government's strategy of social distance influences all aspects of human existence, including higher education. Due to the unreadiness of colleges to implement online learning, several parties are perplexed by the government's unexpected decision to terminate or relocate the learning process from campus to home.

Romansyah (2022) in his research, stated that higher education curriculum management in the Industry 4.0 era. This organization is integrated with the world in an automated and data-driven manner. So universities design competency-based curricula so that graduates can compete and be relevant to the needs of the industrial world. The industrial era 4.0, provides many challenges and needs to be faced, so it requires basic skills for each individual/student to have qualified skills and competencies to keep up with changing times, improve technology mastery skills, and analyze and evaluate information quickly and accurately. These skills and competencies students must have been called industrial era skills 4.0 (Kan & Murat, 2018).

The fourth phase of the industrial revolution is now underway. Rapid advancements in science and technology have a significant influence on human existence. With digital technology, several luxuries and advancements may be attained. With the internet system, services grow quicker and more efficient and have a more significant number of connections (Ghufron, 2018). With these advancements, some tasks must be completed, including 1) the suitability of educational policies and curricula, 2) the readiness of human resources to use ICT, maximize student potential, and develop students' values

(character), and 3) the readiness of educational infrastructure and facilities (Syamsuar & Reflianto, 2019).

Competencies available during the Industrial Revolution 4.0, there are a lot of innovations and breakthroughs generated by lecturers in increasing the quality of learning via curriculum creation and the use of ICT in various methods and learning techniques. All innovative and breakthrough learning procedures are supported by lecturers' ability to use sound learning management principles (Widyanto, Merliana, & Pranata, 2020). The curriculum designed must be capable of shaping pupils with a concentration on Science, Technology, Engineering, and Mathematics (STEM), including information and communication technology-based learning, the internet of things, big data, and computers, as well as entrepreneurship and internships (Lase, 2019).

Indonesia must develop trustworthy operators and analysts in education management to strengthen the talents and skills of its human resources to be ready for the educational challenges of Industry 4.0, which are continuing to move swiftly. This will fuel the growth of information technology-based education in Indonesia. Indonesian education management policies encourage digital technology and instructional computing in the 4IR at all educational levels, especially in higher education. Optimum student skill development and character development, ready digital-based learning infrastructure, ready human resources in ICT, and appropriate curriculum and policies in education are some solutions (Purba & Yando, 2020).

This research examines the adoption of the industrial revolution 4.0-based learning management to improve universities in Bengkulu Province. Leadership initiatives to promote higher education management seek to boost institutions' competitiveness. This project will explore the management variables of increasing higher education quality using ICT-based information systems to boost competitiveness.

2. METHODS

The method used in this research is descriptive qualitative. This research was conducted at three universities in Bengkulu: Dehasen University of Bengkulu, Muhammadiyah University of Bengkulu, and Hazairin University of Bengkulu. These informants amounted to 150 students from the three universities. The availability of ICT networks (X1), finding ICT tools on campus (X2), how and when to use ICT tools (X3), and using e-learning or the like (X4) were the four main questions that were used to collect the data. Academic rules, organizational behavior, student intelligence, higher education's ICT culture, the length of study completion, high-quality documents, and specialized information or phenomena are also documented. Data collecting techniques are the most strategically important step in the research process because gathering data is the main objective. Data for this study were acquired by triangulation, testing, observation, and interviews (Sugiyono, 2011:224).

This investigation is divided into the following phases: 1) The following are the preparation, action, and consideration phases: A study design should be created, a field should be selected, permissions should be obtained, the field should be evaluated, informants should be identified and used, equipment should be prepared, and research ethics issues should be addressed. 2) There are three stages to the work stage at school: Knowing the context of the research and self-preparation, going into the field, and collecting data are the first two steps. The third step is data analysis, which includes data processing, classification, and interpretation.

3. FINDINGS AND DISCUSSION

Based on research conducted on three coded subjects, PT XYZ 1 (Dehasen University of Bengkulu), PT XYZ 2 (Muhammadiyah University of Bengkulu), and PT XYZ 3 (Hazairin University of Bengkulu), the findings of the analysis of learning management research in higher education will be presented using an approach to technology known as "Industrial Revolution 4.0.":

3.1. Findings from Learning System (LS) exams and observations on each step of ICT mastery at Dehasen University of Bengkulu

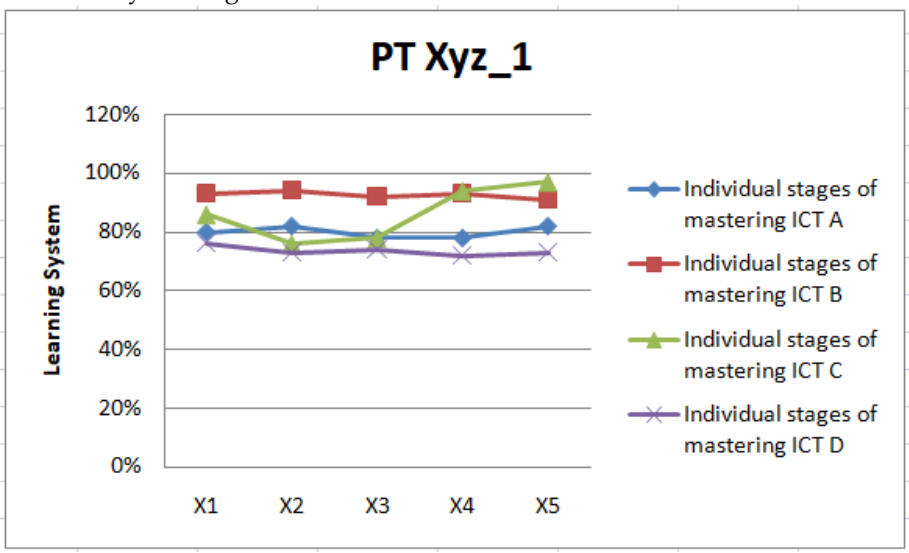


Figure 1. Findings from ISM Dehasen University of Bengkulu's Learning System (LS)

Dehasen University of Bengkulu discovered that students need x1 in LS (x1-x4) because they obtain well-accessible ICT networks with an INCREASING trend at ISM (A) but need administrative apps in LS (x2) instead. Because students in ISM (C) understand when and how to use ICT tools to achieve learning objectives, there has been an INCREASING trend in using e-learning applications in LS (x3). Due to ISM (D) students' specialization in ICT-based learning, LS (x4) students accessed e-libraries.

3.2. Findings from Learning System (LS) exams and observations on each step of ICT mastery at Muhammadiyah University of Bengkulu

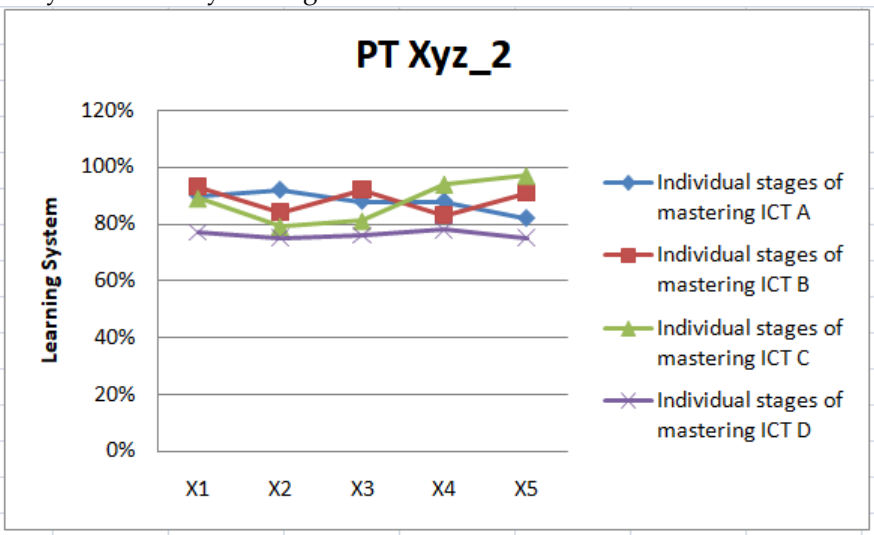
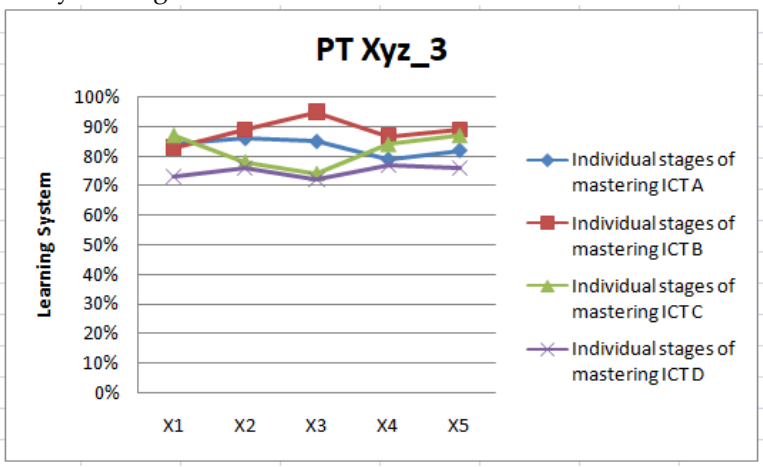


Figure 2. Findings from ISM Muhammadiyah University of Bengkulu's Learning System (LS)

In contrast to ISM (A) students, who have well-accessible ICT networks with a DOWN trend, LS (x2) students at Muhammadiyah University of Bengkulu require administrative apps. Students at LS (x3) have used e-learning programs because they learned at ISM (C) when and how to use ICT resources to accomplish learning goals in an increasing trend. Because ISM (D) students typically focus in ICT-based learning, LS (x4) students have used e-libraries.

3.3. Findings from Learning System (LS) exams and observations on each step of ICT mastery at Hazairin University of Bengkulu



Gambar 3. Findings from ISM Hazairin University of Bengkulu's Learning System (LS)

The Hazairin University of Bengkulu found that LS (x1..x5), where students desperately need x1 due to ISM (A) students learning about the availability of easily accessible ICT networks with a DOWN trend, LS (x2) students need administrative applications that can be accessed via the web due to ISM (B) students learning how to find ICT tools with a DOWN trend, and LS (x3) students taking advantage of available, ISM (D) students used e-libraries while in LS since they had a persistent tendency of specializing in ICT-based learning (x4).

The Industrial Revolution 4.0 has the potential to increase global income and people's quality of life, including increasing efficiency and productivity, increasing the effectiveness of global supply chains and encouraging economic growth. This era is also called the digital era where everything is turned on by technology. Starting from television, computers, and smartphones to the internet. The internet makes all information accessible easily and quickly. Indonesia needs to immediately prepare and improve the capacity of its human resources through education and training that can encourage competitive and productive industries. If you do this, Indonesia will become a developed country by utilizing digital technology into industry. These uses include digital computers, transmission technology, the internet, and digital broadcasting (Syamsuar & Reflianto, 2019).

The industrial revolution 4.0 also impacts the world of education by giving birth to various innovations in learning. According to Freud Pervical and Henry Ellington (1988), the learning innovation carried out in the development of digital information technology is to utilize information technology facilities that are developing rapidly in this era of the industrial revolution 4.0 to improve the quality of learning. Next, Reigeluth's (2011) educational innovations in learning methods include formulations on the organization of teaching materials, delivery strategies and management of activities by taking into account the objectives, barriers, and characteristics of students so as to obtain effective, efficient results, and create learning attractiveness. Reigeluth's opinion is supported by Jerome Brunner (Semiawan, 1997) by calling the inductive learning method or inductive thinking. Then Mauch J.E. (2014) use it to classify teaching and learning patterns, namely classical, independent, and teacher-student interaction or group teaching.

One of the learning innovations with the presence of the industrial revolution 4.0 is the use of the Learning Management System (LMS) by universities by developing various service applications for all campus academics. The use of this technology is often referred to as online learning. Electronic learning (online instruction, e-learning, or web-based learning) has three main functions: supplementary functions that are optional, complementary functions, and substitution functions in classroom learning activities (classroom instructions). Judging from the characteristics of online learning above, learning using e-learning is a substitute category. In this situation, e-learning needs to be built that is more all-

encompassing in character and that can accommodate a learning system that governs the responsibilities of instructors and students, as well as the use of learning resources, learning management, assessment systems, and learning to monitor. In this instance, mandatory online learning comprises a learning management system that is integrated online (Munir, 2010; Siahaan, 2003).

This LMS offers pedagogic and professional competency resources in multimedia packaging (text, animation, video, sound, FX), as a complement and enrichment for learner competency development. LMS provides learning innovations such as ICT advances, particularly virtual ones such as online web learning, multimedia, and video conferencing. The web-based learning LMS is dynamically created (dinamic e-learning). LMS is the website-based administration of the interaction of the ICT-based learning process. Munir (2008) mentions that the elements that are included in the development of the LMS must involve the psychological development of students. Among these elements are dealing with real life, 'Hands-on', indirect-theme ICT approach, fun, positive affirmation and seeking.

Learning Management System (LMS) is a platform or software application for online learning activities, or commonly referred to as virtual classroom learning. Some of the platforms are by design and some are by utilization. Some popular LMS in education include Quipper School, Edmodo, Schoology, GeSchool, Moodle, and others (Subiyantoro & Ismail, 2017; H. Zaini, Hadi, Sofyan, & Hamzah, 2021). Utilization of LMS for universities will improve academic performance for institutions, students and lecturers.

Student academic performance in higher education is influenced by various aspects such as socio-economic, psychological, and environmental factors (Dhaqane & Afrah, 2016; Hijazi & Naqvi, 2006). Students' performance or academic performance is one of the metrics for learning success for lecturers. This enables them to assess student knowledge and the effectiveness of their learning, including student satisfaction.

Flexible learning, with the notion of learning anytime, anywhere, and through any device, is one of the efforts that may be made to improve student academic performance. This can be accomplished by using a learning support platform or application, such as Learning Management Systems (LMS). The LMS chosen must be easy to use and facilitate student learning. In this regard, Sukarno (2015) have conducted research, measuring whether or not it is easy to use LMS applications to support blended learning. This research was conducted on lecturers and students in independent lectures with online tutorials. Indicators related to the ease of use of the LMS application for students are measured by counting the number of students who can independently operate the LMS application to (1) download lecture materials, (2) send assignment results, and (3) take quizzes. Lectures with blended learning model with face-to-face 9 times, independent learning with online tutorials 4 times, and independent learning without tutorial once. The result is that after simplifying the operating procedures for the LMS application and optimizing the collaboration between lecturers and the ICT team, lecturers' performance in the implementation of learning increases, namely by easily sending materials, giving online assignments, and holding quizzes. Second, providing information in Indonesian on English terms found on the LMS application panels and detailed explanations of icons can improve student performance in operating the LMS application in downloading materials, downloading/uploading assignments online, and taking quizzes (Subiyantoro & Ismail, 2017).

Utilization of LMS is carried out in 4 stages, namely: 1) discovering ICT tools; 2) learning how to use ICT tools; 3) understanding how and when to use ICT tools and to achieve particular purposes; and 4) specializing in the use of ICT tools (UNESCO, 2002).

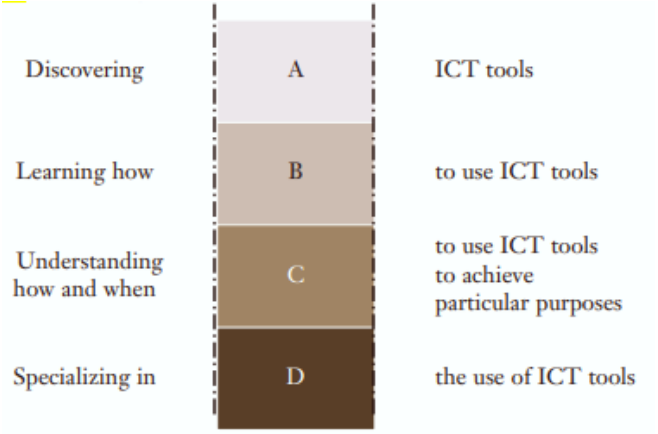


Figure 4. Model of stages of teaching and learning with and through ICT

Teaching and learning are best viewed as two sides of the same coin, intertwined and interrelated, rather than as separate and independent activities. Global studies of teaching and learning in schools have identified four major stages in how teachers and students learn about and build confidence in utilizing ICT. These four steps result in the model shown in Figure 1, which depicts the stages in discovering, learning how, knowing how and when, and specializing in using an ICT tool.

Learning about ICT tools. The first step in ICT development that teachers and learners go through is discovering ICT tools and their broad functions and uses (Stage A in Figure 4). During the exploration stage, a focus is placed on ICT literacy and basic skills. This stage of ICT tool discovery is tied to the evolving approach to ICT development.

Understanding how to use ICT tools. Following the discovery of ICT tools, comes the stage of learning how to utilize them and applying them in various disciplines (Stage B in Figure 1). This level involves the usage of generic or specific ICT applications and is tied to the strategy to ICT development.

Knowing when and how to use ICT tools. The following level (Stage C in Figure 4) is learning how and when to employ ICT tools to accomplish a specific goal, such as completing a project. This stage requires the capacity to identify circumstances when ICT will be useful, select the best relevant tools for a certain activity, and use these tools in combination to address real-world problems. This stage is associated with ways to infusing and altering ICT development.

Specializing in the application of ICT tools. The fourth and final step (Figure 4) is specializing in the use of ICT tools, such as when one delves deeper into the science that develops and supports ICT. Students at this stage study ICT as a topic in order to become specialists. This type of research focuses on vocational or professional education rather than general education and differs significantly from previous stages, including using ICT resources.

4. CONCLUSION

The availability of ICT network infrastructure at Dehasen University of Bengkulu, Muhammadiyah University of Bengkulu, and Hazairin University of Bengkulu yielded 84% of students and the academic community being able to find ICT tools for learning easily, 83% being able to easily learn how to use ICT tools for learning on campus, 87% being able to understand when and how to use ICT tools to achieve specific learning goals, and 73% of students being able to learn how This simplicity of use and accessibility extends to some services, such as the Academic Information System (SIAKAD), online education, and the electronic library. Therefore, the fourth industrial revolution, which includes technological advancements for universities, has the power to change universities from a knowledge monopoly to a limitless organization that can be easily and quickly accessed.

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