

# **Improve E-Learning Ecosystem with Big Data in Higher Education**

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## **Abstract**

E-learning as the main system that supports the learning process in higher education turns out to have several problems such as inadequate compatibility between service technology design and the psychological components of the learning process, shallowness in learning caused by various methodologies, certain types of reduction of the relationship between learners, between themselves and the lecturer, the possibility of a loss of direct communication and direct collaboration. On the other hand, big data can determine and analyze the causes of a problem that occurs in the system, including the e-learning system. The purpose of this research is to help higher education optimize e-learning by using big data. The research method uses a qualitative approach through literature review to find e-learning problems in universities. While the qualitative approach is through observation to analyze alternative solutions with a big data approach.

## **Keywords**

E-Learning, Big Data, Ecosystem Higher Education.

## **1. Introduction**

E-Learning has an important role to support the learning process in many institutions including universities. E-learning has several advantages such as: Flexibility; meaning that students are free to choose the time and place to access lessons so that E-learning enables students to individually control the achievement of their learning (Regmi and Jones 2020). E-learning also improves cost effectiveness. E-learning reduces the cost of management for planners, the cost of providing physical infrastructure and learning facilities, and the transport expenses and lodging for classmates [ (Alenzi 2020). Some e-learning is built with high customization, Customization of learning related to the needs of the learner (Shi et al. 2020). [3] (Shi et al. 2020). However, some research shows problems related to the implementation of e- Difficulties with various learning styles, for example (Khamparia and Pandey 2020) (Rasheed et al.2020). There

is a concern with e-learning. Inadequate suitability between the service's system solutions and the psychological aspect of the education process (Dhawan 2020) (Cojocariu et al. 2021). Learning levels of flexibility are both comparative and ephemeral concepts is other problem with e-learning (Delaunay 2020) (Rajabale and Santally 2021). Until know few research have goals to solve e-learning problem.

On the other hand, big data has several benefits, such as: Enhancing competitiveness are those that can change the way businesses compete or the essence of their brands. Bigdata's information - based advantages are those that offer information and knowledge that can be used to 's recommendations decision making (del et al. 2018) (Vassakis et al.2018). Big data has other advantages. The term "transaction processing benefits" refers to an investment that endorse functional areas and have the potential to reduce company costs (Raut et al. 2019) (Popovic et al. 2018) (Gupta et al. 2018).

The purpose of this research is to help higher education implement e-learning with an ecosystem approach that will result in a better learning process. The result of this research is an e-learning ecosystem model with a big data approach in higher education. The research method uses a qualitative approach through literature review and observation to identify e-learning problems. Literature reviews and interviews with higher education academics are also used to analyze alternative solutions using a big data approach

## 2. Literature Review

### E-Learning

E-learning seems to have become a requirement in universities and is being implemented in academic institutions across the world. Internationalization can be driven by the rise of e-learning innovation used by universities (Waller et al. 2019). This refers to politically and economically occurrences, as well as an internationalization of ideas, heritage, and goods. The increased use of e-learning undoubtedly contributes to globalization in educational institutions, which are struggling to break down geographic and cultural limitations to provide online educational education, resulting in the interconnection of academic standards and perspectives (Elumalai et al. 2021) (Inayatulloh 2021).

E-learning and the incorporation of Information and Communication Technology (ICT) into conventional teaching have lagged well behind many industrialized countries. However, most states have successfully implemented E-learning, and consequently, the student information population is growing at a relatively rapid rate. As a result, the adoption of this new structure has become almost unavoidable, as the conventional approach has established to be quite inadequate in preparing learners for the difficulties that they are likely to encounter in a quickly evolving society. Figure 1 show strategy and technology of e-learning (Geetha 2015)

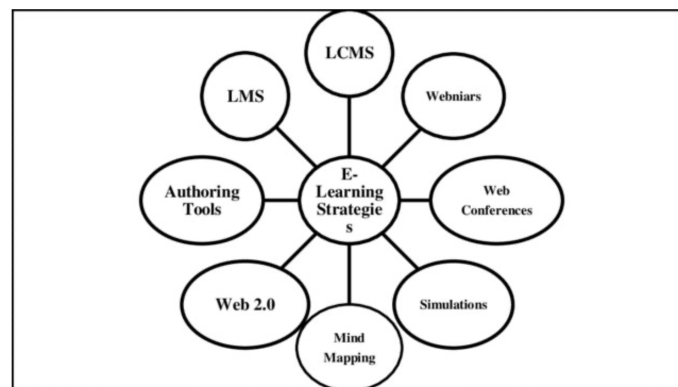


Figure 1. E-Learning strategy and technology (Geetha 2015)

E-learning systems, on the other hand, present as many obstacles as they do advantages, which must be recognized prior to making any significant funding in the E-learning higher education system (Bubou et al. 2021). This knowledge is likely to aid in the efficient development of a new higher education, making the disseminating knowledge simpler,

efficient, and less expensive for many students in other countries around the world. Recognizing the obstacles and other factors involved will also assist experts in addressing such issues in advance, increasing the likelihood of attaining the much-needed advantages of e-learning (Ruggeri et al.2013). Figure 2 show technology to support e-learning activities by synchronous and unsynchronous approach (Chikurteva et al. 2020)

E-learning technologies	
Synchronous communication	Asynchronous communication
✓ Chat	✓ Virtual libraries
✓ VoIP	✓ E-mail
✓ Web conference	✓ Forum
✓ Audio podcasts	✓ Social networks
✓ Virtual worlds	✓ Electronic portfolio

Figure 2. Synchronous And Asynchronous Technologies (Chikurteva et al. 2020)

### **Big Data**

The way institutions capture, create, and use information is affecting the way they operate. Top management, intellectuals, and industry experts must be aware of this shift, which will modify how institutions are managed as well as the societies in which they operate. Companies have gone through many changes because of this revolution. For instance, they now have greater access to information than ever before. This information could be internal or external, semi - structured and unstructured. Businesses are beginning to realize patterns of consumer activity that were previously unavailable to perceive or act on by utilizing internal and external data.

Companies are also utilizing innovative solutions to gain a much more detailed understanding of their own processes and behavior. Big data is the solution.: “Big data is high-volume, high- velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making” (Less et al. 2021). Quantity, in this description, refers to the creation and gathering of massive amounts of data, where the information scale becomes increasingly significant (Raguseo 2018). The timing with which big data is generated, gathered, and analyzed is referred to as velocity (Zhu et al.2018). Variety refers to the different types of information that can be generated in a structured and unstructured manner, such as audios, video files, internet sites, and texts (Taleb et al. 2018).

Big data can also be categorized as machine-generated (data generated by a machine without human involvement) or human-generated (data supplied by individuals in interaction with computers) (Rageso 2018)

### **3. Methods**

The role of e-learning to support the learning process in higher education has been proven in many studies, but several studies have also found problems with e-learning. This problem became the initiation of the research. After finding the problem, the research continued by identifying the causes of e-learning problems through observing the implementation and use of e-learning in several universities. After determining the problem and its causes, the research was continued by conducting a literature review to find a solution using an information technology approach and finding the best solution with big data. The final step is to build an e-learning ecosystem model in higher education with big data. Fig. 3 show the research method.

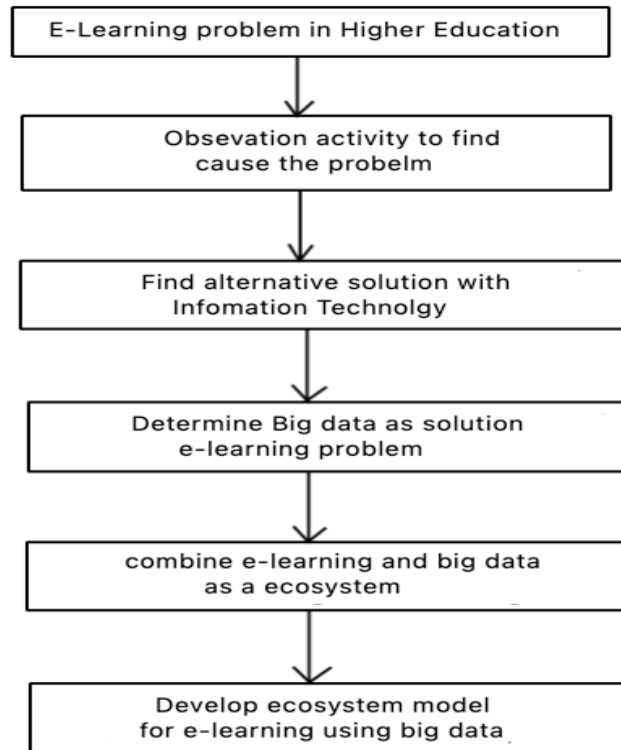


Figure 3. Research method.

#### 4. Results and Discussion

Figure 4 show the proposes model. The proposed model consists of 2 main parts, namely e-learning and big data. The ecosystem concept in this model is an iterative cycle from e-learning to big data and back to e-learning. The problem of e-learning becomes the initiation of the process in big data and the results of the process will be implemented in e-learning. Fig.2 describes the model with detailed explanations as follows:

The e-learning system in this model explains all the parts that support the learning process from e-learning technology, e-learning models, and e-learning strategies.

- a. E-learning technology is a combination of all hardware, software and communication technology that supports the implementation of e-learning in universities. In general, Learning Management System and Content Management are 2 software models that are widely used in higher education institutions (Abazi et al. 2018) (Kanadhasan et al. 2020) (Inayatulloh 2021).
- b. E-learning model is a model that is widely used in higher education such as blended learning (castro 2019) (Muller and Midenberger 2021), Hybrid learning (Kastornova and Gerova 2021) (Norgaard and Hilli 2022) (Raes et al. 2020).
- c. Some of the learning strategies used in higher education are discovery learning (Rudibyani 2018) (Healey and Jenkins 2018) (Galvao et al. 2020), Inquiry learning (Weiser 2020) (Bijsmas and Schakel 2018) (Guo et al.2020), problem-based learning (Kassmova et al. 2020) (Ulger 2018), project based (Alves et al. 2019) (Torio 2019).

Big data is the second part of the built model consisting of:

- a. Big data acquisition and discovery is a part of big data that takes structured and unstructured data about all e-learning system information in higher education. where all data and information about structured and unstructured e-learning systems will be processed in the next process. Data acquisition has traditionally been explained as the method of collecting, filtration, and retrieving information prior to

storing it in a data warehouse or other storage server (Logica et al. 2015). Big data acquisition is frequently constrained by four Vs: volume, velocity, variety, and value. Often these data acquisition circumstances assume high-volume, high-velocity, high-variety, but low-value data, so able to adapt and time-efficient collecting, sorting, and cleaning algorithms are required to maintain that only the high-value fractions of the data are produced by the data-warehouse analysis (Austin 2018).

- b. Big data preparation encompasses all the stages required to obtain, begin preparing, collate, and handle the company's data resources. The foundation for actionable information supplied by sophisticated analytics applications is solid data. If the data is corrupted, conclusions drawn from it become dubious, if not arguable, and big data, if not supported by precise intelligence, can contribute to ambiguity and organizational chaos (Saggi et l. 2018).
- c. Big design is the method of analyzing "things" of involvement to your institution and how they relate to one another. The data modeling procedure resulted in the discovering and recordkeeping of your company's data resources. You are working to develop the vocabulary of your organization's business as you create logical and physical data models. A data model is composed of elements that serve as abstract ideas of real-world objects. Entities and relationships are the most basic types of data models (Jyothi et al 2015).
- d. Big data processing is a collection of practices or data structures for accessing large amounts of data to extract information for effective decision support and provision. In this section, we will look at some of the tools and methodologies for big data analysis in data centers (Ning and Fengqi 2019).
- e. Big Data visualization techniques — charts, locations, interactive elements, graphs, computer animation, scatter plots, regression lines, timelines, for instance, enable companies' judgment get results by better understanding their processes and interested parties. Software can handle large amounts of raw data as well as provide instant analysis of information, trends, and trends (Bikakis 2018).

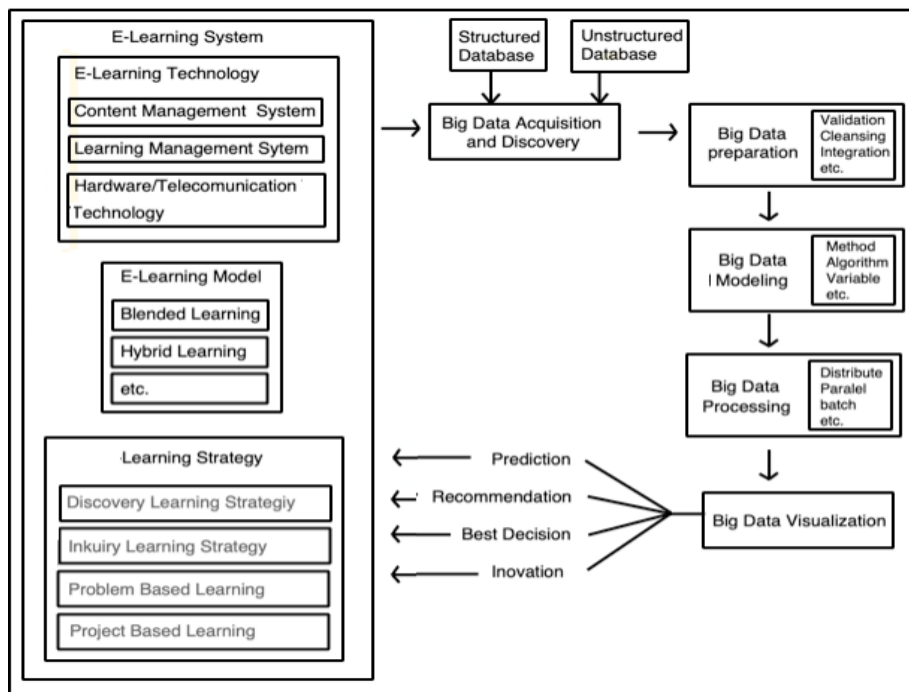


Figure 4. Ecosystem Model of E-Learning with Big Data (Source by Author)

## 5. Conclusion

Based on observations of the implementation of e-learning in several universities and literature reviews, e-learning provides a lot of convenience in the learning process, especially in universities, but the existing problems cannot be solved comprehensively. The use of big in e-learning not only solves e-learning problems but can increase the competitive advantage of higher education from the output of big data because it will have an impact on many aspects such as student satisfaction, lecturers, staff, and all other stakeholders

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