Work system method as an e-learning design framework in private universities

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Abstract - The development of information and communication technology, especially the internet provides opportunities to improve the ability of lecturers to deliver courses to students without being limited by distance and time. This can be done by utilizing e-learning which will accelerate the transfer of knowledge and skills. E-learning is distance education that utilizes various digital tools and platforms. These tools and platform are used to support interaction, lectures and delivery of instructions between lecturers and students. This study will discuss the use of work system methods and the use of e-learning technology in a business entity. The work system methods are used to design information systems. Meanwhile e-learning technology in a business entity serves lecturers and students, conduct lectures at private universities in increasing knowledge dissemination, educational affordability and the use of technology and information as its support. The result of this research is the works system method model which refers to the analysis of data from the internet accessibility survey of students, analysis of its components, the system development cycle, the revision of the vision, mission and resources in private universities and recommendations of opportunities for the development of higher quality e-learning implementation.

1. Introduction
The development of information and communication technology provides opportunities for the ability and competitiveness of private universities. This includes increasing the implementation of lecture activities using e-learning which will facilitate access and dissemination of knowledge to improve the quality of students. The condition of private universities that tend to have students with various abilities, skills and access to technology is a factor that must be taken into account in the implementation of e-learning. The level of understanding and application of information and communication technology in private universities has not been fully utilized in teaching by lecturers. Private tertiary institutions are obliged to serve and improve the abilities and skills of students. Private universities do not only provide the means and information technology to do this but understand and support the components in the use of e-learning that are involved in achieving these goals. This study will answer the question of how to use the work system method in analyzing information systems and information technology to help taking a more active and knowledgeable role in e-learning for the implementation of a quality, easy, affordable, comfortable and efficient education process.

2. Research Methodology
The methodology used in this research is framework work system method for designing a system run by private universities. The research that will produce a work system life cycle e-learning with case studies was conducted at the Faculty of Engineering, Pasundan University. The research stages will be
carried out as follows: (1) doing exploration of the concept of e-learning, work system framework and work system life cycle, (2) using previous research, survey data and case studies regarding work system frameworks and work system life cycles and the implementation of e-learning at the Faculty of Engineering, Pasundan University, (3) analyzing work system components in e-learning and (4) building e-learning work system life cycle models. The results of this study will contribute in identifying the components that make up the work system life cycle e-learning at the Faculty of Engineering, Pasundan University. Components that will enrich and improve a significant work system in the lecture process, effectively use information technology and support the achievement of learning targets are identified. This e-learning design is about the development, operation, and maintenance of systems and their components.

3. E-learning Study in Higher Education
The learning has various forms, which does not only support individual learning but also support collaborative learning. Individual learning helps students to train themselves to solve problems on their own, and collaborative learning helps students to train their teamwork spirit. The most common way of learning is to work individually. Students have to work on their own to solve problems and reach the learning outcomes. Collaborative learning is a type of learning in which two or more people learn something together, where students can make use of peer’s learning resources and skills [14] [18] [19]. Traditional e-learning separates teachers from students and also separates students from students; the teaching and learning carry out over the internet or through computer-based technologies. E-learning techniques provide various forms of electronic tools and platforms, teaching and learning approaches, learning environments, etc. [9] [14] [17] [19]. In examining the success factors of workplace e-learning, studies have taken into account in a variety of issues, such as learners’ motivation and attitudes, associated costs, technical and administrative support, and cultural shift strategies. The use of social media and networking tools have significantly improved knowledge creation and sharing in the workplace by engaging and empowering people in social interaction [17]. E-learning represents a unique opportunity to attenuate the inequalities in access to higher education and improve access across socio-economic groups. One of the main differentiating factors in getting access to higher education is income and socio-economic background. New ICTs facilitate more democratic participation in higher education as long as a large part of the population has guaranteed access to them, thus reducing the importance of income or the background. New technologies also enable people from rural and isolated areas, as well as disadvantaged and targeted groups, to enrol and participate in higher education. Finally, e-learning introduces more flexibility in teaching and learning practices, thus facilitating participation by different segments of the population [12]. The forms of e-learning are: using instructional methods such as examples, practice, and feedback to promote learning, in the form of instructor-led (synchronous e-learning) or designed for self-paced individual study (asynchronous e-learning). Strategies for instructional activities in e-learning must support the objectives of the course being taught [1]. E-learning activities are carried out by lecturers by fulfilling teaching ethics and professionalism in addition to the lessons delivered to students. [7] The Promises of e-Learning is customized training, engagement in learning, multimedia, acceleration of expertise through scenarios and learning through digital games or gamification [6] [9]. To control the e-learning activities of students, an independent and cross (mutual) evaluating students work with each other are used. Only the final control measure takes full-time teacher in a case where it is necessary to issue a certificate. For humanities organized online discussion forums as one of the options for students can ask questions and help each other, receive support and encouragement, additional information related to the course and so on [11]. In 2000 the Institute for Higher Education Policy (IHEP) in the United States developed Benchmarks for Success in Internet-Based distance learning. The IHEP research is a comprehensive study of guidelines for success in e-learning environments and blended learning that includes seven categories: (1) institutional support; (2) course development; (3) teaching/learning; (4) course structure; (5) student support; (6) faculty support; and (7) evaluation and assessment. [14] E-learning activities must also take into account of digital divide among participants, the ability of each student to use information technology and computers and access learning materials via the internet [13].
4. Work System

The work system method is a unit of analysis for designing systems in organizations. In an organizational setting, work is the application of human resources, information, physical activities, and other resources to produce a product or service. A work system is a system in which humans as participants and or machines perform work (processes and activities) using information, technology and other resources to produce certain products or services for certain internal and or external customers [3]. The work system method is a set of ideas that can be applied to understand, analyze, and improve systems in an organization, regardless of whether information technology is involved or not [2]. Work system framework at the beginning of the analysis, creating and discussing work system snapshots that can be useful in clarifying and reaching agreement on the scope and objectives of the work system being analyzed [2] [3] [4] [5]. A snapshot of the work system framework is (1) Processes and activities: includes everything that happens in the work system, (2) Participants: people who do the work, (3) Information: includes codified and non-codified information that is used and created when participants do the work, (4) Technologies: includes tools and techniques used by work system participants, (5) Products & Services: a combination of physical things, information, and services produced by work systems, (6) Customers: people who benefit directly from products and services produced by the work system, (7) Environment: includes the organizational, cultural, competitive, technical and regulatory environment in which the work system operates, (8) Infrastructures: includes human resources, information, and technical aspects that depend on work systems, (9) Strategies: includes the work system strategy, departments and companies where the work system exists. [8]

![Diagram of Work System Method and Work System Life Cycle](image)

**Figure 1.** Work System Method and Work System Life Cycle [2] [3] [4] [5].

The Work System Life Cycle model shows how a work system can develop through several iterations in four phases, namely (1) operation and maintenance, (2) initiation, (3) development, and (4) implementation. Phase names were chosen to describe computerized and non-computer systems, and to implement them regardless of whether the application software was acquired, built from scratch, or not used at all. Operation and maintenance refer to operating a work system and monitoring its performance. Maintenance of work systems by identifying minor deficiencies and eliminating or minimizing them through repair, adaptation, or problem solving. Initiation is the process of determining the need for significant changes in the work system and describing in general how changes in the work system will meet the needs. Development of a vision is for a new or revised work system. Development of operational objectives including allocating resources and clarifying time frames, evaluating the economic, organizational, and technical feasibility of planned changes. Development is the process of determining and creating or obtaining the tools, documentation, procedures, facilities, and sources of physical and other information necessary before the desired changes can be implemented successfully in the organization. Implementation is the process of creating a new system or operational modification in an organization, including planning for launch, training work system participants, and conversion of the old way of doing things to a new way [8][15][16].
5. Work System Analysis in E-learning Design

The implementation of online learning activities using e-learning at the Faculty of Engineering, Pasundan University is to answer challenges in carrying out distance lecturing activities. However, it is still prioritizing learning activities that are comfortable and affordable, increasing and developing scientific insights for students and all parties involved, including lecturers. The Work Systems Method will be an analysis tool to help determine students and lecturers as participants and customers in the process and activities of online learning activities using e-learning to produce services or products. Here is an analysis that is a 'snapshot' of the Work Systems Method:

1. Participants: participants in lecture activities using e-learning are lecturers and students from the Faculty of Engineering, Pasundan University who support, provides and uses class schedules, provides and studies lecture materials, teaching/learning, gives and does assignments and ultimately conducts and accepts lecture results assessments. Other participants are faculty and study programs as parties with an interest and support in improving student knowledge, providing e-learning facilities, organizing distance education activities and providing assessments of teaching activities by lecturers.

2. Information: information needed and managed in lecture activities using e-learning, in carrying out education for students and the course structure used by lecturers. Information will include course development, students participating in certain lecture classes, teaching lecturers, number of teaching lecturers, class schedules, procedures for conducting online lectures which are part of the teaching strategy of a lecturer or a group of lecturers in a particular lecture. Further information is the coordination of course materials in parallel classes and the determination of the course load according to limitations in the use of e-learning.

3. Technologies: the technology used in this distance learning activity is the e-learning website belonging to the Faculty of Engineering, Pasundan University which is supported by the Moodle application and computer server, a database related to contract taking for student courses and social media applications such as remote conferences. Technology is managed by the information technology department which is part of the Engineering Faculty organization.

4. Processes & Activities: The main process and activities are lectures followed by students and taught by lecturers. The stages of the process include identifying students who are attending lectures, sharing teaching schedules, e-learning login, distributing course materials into lecture meetings in accordance with the lecture syllabus, determining the teaching strategy for each lecture in the form of material delivery (synchronous or asynchronous), giving assignments (individual or group), assignment assessments, discussions and questions and answers (using chat or web conferencing), conducting exams and examinations that end up with determining student graduation from the lecture. The process of delivering lectures can be done outside of the class schedule by providing asynchronous lecture materials, for example with teaching videos on social media. The communication process between students and lecturers can also be done outside of class hours, especially to anticipate individual lecture problems through communication outside of e-learning using social media.

5. Products & Services: products and services from e-learning lectures are services for student lectures, teaching lecturers, storage, delivery of teaching materials, evaluation and assessment. Services that are carried out to support these products and also facilitate communication between students and lecturers with various options that can be tailored to the needs or limitations of internet capabilities possessed by students or lecturers from their respective homes. The resulting information product must be easily accessible to users who have access rights, easy to manage, can be supervised by e-learning administrators and can ensure the continuity of lectures.

6. Costumers: the parties who receive services and products are (1) students as the main subject in lectures, delivery of knowledge, enhancement of skills and ease of utilizing lecture information, (2) lecturers as providers of course information, as presenters of knowledge, supervisors of lecture implementation and assessors from student study results, (3) study programs at the Faculty of Engineering that require e-learning for the implementation of lectures per semester and student management and (4) the Faculty of Engineering which provides e-learning facilities
while receiving benefits in implementing education with the help of information technology and computers.

7. Environment: an environment in the Faculty of Engineering, Pasundan University that has policies, rules and means to carry out distance education with the help of e-learning. An educational environment that ensures that every student gets taught in an online classroom equivalent to face-to-face classes with lecturers.

8. Infrastructures: infrastructure provided by the Faculty of Engineering, Pasundan University to support e-learning activities ranging from software, hardware, internet, e-learning managers, lecturers providing teaching materials, lecture documentation and support staff.

9. Strategies: strategies in using e-learning in lectures are supported by the strategy of the Faculty of Engineering which is part of Pasundan University to provide internet-based education services to facilitate student learning and educational equality.

6. E-learning Design Using Work System Life Cycle

The next stage in designing e-learning is implementing the four stages of the work system life cycle in translating the results of the work system analysis into the adopted process, from initiation to operation and maintenance. The survey conducted by the Faculty of Engineering on around 300 students, showed that 70.8% of students doing online lectures were conducted from outside the city, although from 94.8% of students with internet access but only 17.3% had very stable internet access, 56.4% was quite stable and the rest are unstable. The implementation of synchronous lectures using video chat communication applications by students and lecturers was carried out well by 78% of the participants, while the rest had difficulty accessing this activity [10]. The survey shows that the digital divide in internet access is still quite significant. Seen in Figure 2, each stage pays attention to unanticipated opportunities related to the implementation of e-learning courses at the Faculty of Engineering. Each stage can produce feedback in the previous stage regarding the inappropriate results of the previous stage process which turned out to be difficult to carry out at that stage. The following are the processes in the work system life cycle stages:

The initiation stage, identification of students who will attend lectures, course materials that must be prepared according to the education syllabus, appointment of lecturers and preparing the e-learning system to be used are carried out. Lecturers must be able to find out all the supporting components of the e-learning application through socialization or workshops to be able to adjust course materials and how they are delivered to students. The initiation was started because not all e-learning services could be understood and used in online lectures. The existing syllabus did not show how to deliver online lectures specifically on how lecturers and students can use chat, download and upload files, video conferencing, hyperlinks and others to facilitate access to knowledge has not been utilized. Likewise, the initiation is to support individual lectures or collaboration between students, especially in monitoring the results of lecture activities, for example avoiding plagiarism in making assignments. There are no rules for the use of social media, for example in teaching videos, will greatly help students learn according to their respective abilities and can be repeated as needed to support asynchronous lectures. The snapshot work system method looks at the environment, infrastructure and strategies to support participants and technologies. Opportunities that have not been anticipated in the initiation stage referring to the case study at the Faculty of Engineering are specific data collection regarding students’ ability to take online lectures, disseminating the data to teaching lecturers to help determining teaching strategies, readiness in the availability of the internet, information technology and computers and other supporting factors to ensure college strategies. The next opportunity is collaboration with third parties in providing supporting technology infrastructure for e-learning, both for the Faculty of Engineering or students.

In the development stage, a standard operational procedure is designed for the implementation of online lectures using the e-learning system. This standard is in line with the vision and mission of the study program, Faculty of Engineering and higher education institutions in general, containing procedures for conducting online lectures, supervision, assessment for the quality and quantity of lectures, feedback for system managers, implementation documentation for students and lecturers. This standard will be reviewed during the course of the lecture based on feedback for changes or
improvements as needed. The standards will be socialized in the form of written instructions and workshops for lecturers and students. The next process is to identify students’ needs in conducting lectures, this identification is needed to facilitate the delivery of knowledge, lighten the work of lecturers and improve the quality of lectures. Each lecture material that is delivered must be able to design its delivery in online lectures, identify which course materials require face-to-face, which must use asynchronous lectures because they have to be repeated, sufficient with text and others, both for individual learning or collaboration. This process will be closely related to the next process, such as the design of synchronous and asynchronous lectures to support collaboration between students. Collaboration between students is needed, especially in the implementation of lectures at the Faculty of Engineering to complete complex tasks that require cooperation in its completion. The snapshot work system method will pay attention to participants, information and technologies to support it and get feedback on the processes and activities of e-learning activities. This stage will also provide input and improvement for infrastructures and strategies. An opportunity that has not been anticipated in the development stage is to conduct a comparative study between the quality of e-learning system services owned by the Faculty of Engineering and providers of other communication support applications that are cheaper, more reliable and more stable as another option or backup in case of obstacles in e-learning, for example due to decreased internet bandwidth or the large number of e-learning users that slowed down server access.

Figure 2. Work System Life cycle of e-learning design in Engineering Faculty, Private University.

The implementation stage such as carrying out socialization and workshops in using e-learning and social media. This activity also received feedback from lecturers, students and system managers regarding real conditions in lectures, difficulties that may arise, procedures for monitoring the e-learning process and improving documentation of socialization or workshops that are easier to use as user guides. Implementation in the organizational structure of managers and supervisors who are specifically responsible for e-learning activities starting from planning, implementation to evaluation and assessment. Implementation of the use of a complete e-learning system with supporting
components tailored to the needs of college and students’ internet access abilities. This implementation is also balanced with the use of other applications outside of e-learning such as video conferencing or social media as supporting and alternative technologies for the delivery and dissemination of knowledge. The processes mentioned above are implemented properly and will support the readiness to operate the e-learning system. The snapshot work system method will pay attention to participants, information and technologies in carrying out processes and activities and support the delivery of products and services for e-learning activities. An opportunity that has not been anticipated is the further design of the dissemination of lectures which is not only useful in e-learning activities but also as knowledge possessed by universities and can be used by other parties who need it.

The operation and maintenance stages, such as monitoring online lecture activities and e-learning, can take actions that can improve the quality of online lectures and anticipate problems that may arise. Evaluating and improving online lectures and e-learning activities, carried out by the information technology department which is responsible for managing e-learning, study programs and the Faculty of Engineering. Identification of new needs to support the implementation of e-learning during the course of activities, paying attention to aspects of the ease and comfort of e-learning users ranging from student attendance, delivery of lecture materials, discussion and question and answer, giving and receiving assignments, sharing files, communication outside of class hours and others. To evaluate the benefits of e-learning and social media on the learning progress of students and lecturers, evaluation is carried out during lecture activities and after lecture activities refer to the lecture syllabus, lecture planning and strategy as well as agreed standard operational procedures. The snapshot work system method will focus to the implementation of processes and activities in support of the delivery of e-learning products and services to customers, especially students. An opportunity that has not been anticipated is the preparation of documentation and reporting in the operation and maintenance stages, which will become a reference in improving standard operational procedures. The implementation of operations and maintenance always receives feedback from executors and e-learning users so that this stage can be repeated and continued or requires significant repairs that require re-initiation.

7. Conclusion
The conclusion obtained is that the research produces a design model that can be used in the implementation of e-learning courses at the Faculty of Engineering. The use of e-learning in lectures that requires good planning, complete student data support, implementation and operation up to improvement and re-initiation of all components in the work system method. The purpose of this research is the use of the work system method as a framework in e-learning design, where the analysis that has been carried out shows that this framework can be used in the design of e-learning in Engineering faculties as shown in the snapshot analysis. The research produces an analysis of opportunities at each stage that can be used to improve the quality of e-learning, then what can be done to improve the more in-depth analysis of opportunities that have not been anticipated in the work system life cycle, for example on the dissemination of knowledge and educational culture that can help the implementation of e-learning in private universities.

Acknowledgment
The author thanks the Faculty of Engineering and Informatics Engineering Study Program Pasundan University, students and fellow lecturers for their advice and assistance in carrying out this research.

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