SMART CLASSROM DESIGNS IN THE SMART EDUCATIONAL ENVIRONMENT

Yasdinul Huda[1]dan B Herawan Hayadi[2]

[1]Department of ElectronicEngineering, Fakulty of Engineering, Universitas Negeri Padang
[2]Department of Computer, Faculty of Computer, UniversitasPasir Pengaraian Riau

ABSTRACT: The Smart classroom is a typical environment for Smart Education, and this is a high end class of the digital class. This paper addresses the key characteristics of smart learning and the key challenges that must be addressed when designing a smart educational environment to support personalization. Aiming to integrate the smart learning environment into the learning ecosystem and educational context of the smart classroom, Innovative use and new pedagogical approaches need to be implemented to manage formal and informal learning. This contribution illustrates the key characteristics of smart learning and an smart learning environment and supports the relevance of future user engagement taking during the design process, to improve knowledge about the design and application of new pedagogical approaches in the smart learning environment at the UNP Faculty of Engineering.

Keywords: Smart Classroom, Smart education, Seamless learning, Smart learning environments, Participatory design

1. INTRODUCTION

The advantage of using information and communication technology (ICT) in learning in the literature of the 1990s is expressed as an opportunity to learn anywhere, anytime and anywhere [1]. Thus, this statement reveals that ICT has modified the concepts of space and time, providing new opportunities for accessing information and modifying knowledge outcomes. The use of mobile devices in learning alters the conception that the place and context in which learning takes place is of little importance. However, location (physical and virtual) becomes irrelevant; On the contrary, all this is becoming increasingly important, where the design of smart learning environment needs to set up different locations where one can learn, incorporating both formal and informal situations.

The use of mobile devices that will integrate location as an important aspect of adaptation and personalization is also relevant. The use of mobile devices gives users the opportunity to generate and control more aspects of the environment or real location-based contexts [2].

The use of mobile devices not only support learning is everywhere, yet can be applied in real locations or classrooms by integrating smart learning environment into an ecosystem context of learning and education in the smart class. The concept of smart classes associated with the optimization of teaching in backing right presentation of content, easy access to learning resources, teaching and learning interactivity deep, contextual awareness and detection, spatial and management classes, etc. "Pishva and nishantha in [3] defines the class as smart as smart classrooms for educators who are involved in education everywhere that allow teachers to use real approach classroom teaching or learning everywhere or remote classroom.

In traditional classrooms, teachers are the main source of information and students are asked to be in the same place, space and simultaneously participate in the same activities, while in situations of learning activities everywhere can be done in different spaces and times for each student. In addition, teaching materials are available at any time and accessible from any device. The use of the concept of unlimited learning to describe when a person experiences continuity of learning through a combination of location, time, technology, and social arrangements. "Smooth learning can be a collective or individual process It can continue over time and location, offering access to existing learning resources, covering the physical and digital world, involving multiple types of technological devices, and integrating different approaches to learning and teaching [4] Learning to be effective everywhere requires more distributed experience in space and time [5] It is well understood that the learning environment is everywhere an environment where students can learn without being fully aware of the situation. , the boundary between "work/play, learning/entertainment, accessing/creating

information, public/private, formal/informal is a conceptually clear distinction but now becoming obscure" [5].

Digital technology has promoted a new vision for learning. Summarize the challenges of the future in education well when they say that learning is essentially personal, social, distributed, wherever, flexible, dynamic and complex. "Fundamental shifts are required for predictive, social, open, dynamic, flexible, and more personalized models, as opposed to a one-size-fits-all, centralized, static, top-down and knowledgeable model of traditional learning solutions [6]. the desired outcomes of education, their realization requires new learning designs based on new pedagogical approaches and the use of more effective technologies that can support and guide individual learners.The concept of smart learning emphasizes the importance of technology design to make learning better. concept related to the term 'Technology-Enhanced Learning' (TEL), which has been used primarily in Europe.

Unlike other terms, TEL implies an assessment: 'enhanced' suggests that something is enhanced or superior in some ways, but what exactly will be improved when technology is used for teaching and learning, how can improvement be achieved, and how is improvement determined? What are the enhancements related to the increased use of technology or the improvement of the environment in which educational activities are conducted? Similar questions arise when talking about learning smart. However, the term 'Smart Learning' refers not only to the idea of improving learning, but also emphasizes the need for adaptation and personalization, taking into account the places where learning takes place. In smart learning, real-time location is the critical data needed by the system to tailor the content and situation to the learner.

The purpose of this contribution is to analyze the key challenges that must be addressed when designing a smart educational learning environment. The author argues that one of the most important features of smart learning is that the data used serves as feedback for learners to support personalized learning. Based on personal experience, current authors believe that applying participatory formulation methodologies helps develop an smart learning environment tailored to the needs and socio-cultural context of learners.

The following sections address the key characteristics of smart smart classrooms, smart learning environments and smart education, and analyze key challenges faced in designing smart learning environments.

2. CHARACTERISTICS SMART EDUCATIONAL ENVIRONMENT

The following sections review the main characteristics of the smart classrooms (smart classroom) learning smart (smart learning), smart learning environments (smart learning environments) and education smart (smart education), and analyze the main challenges faced in designing smart learning environment.

2.1. Smart Classroom

Detailed description of first-generation smart classrooms and second-generation smart class requirements is available at [7]. For example, Huang et al. in [8] proposed "... a smart classroom SMART model characterized by showing, easily managed, accessible, interactive and testing. ... The smart classroom deals with the optimization of content presentation teaching, easy access to learning resources, deep teaching interactivity and in-depth learning, contextual awareness and detection, classroom layout and management, etc. "Pishva and nishantha in [3] defines the class as smart as smart classrooms for teachers involved in distance education which allows teachers to an apparent engguna p p endekatan classroom teaching to learning everywhere. "The classrooms are smartly integrate voice recognition, computer vision, and other technologies, which are collectively called smart agents, to provide tele-education experience that is similar to the traditional classroom experience" [3]. Glogoric et al. in [9] discussed the potential use of technology Internet-of-Things (IOT) to build a smart classroom. "Combining IoT technology with social and behavioral analysis, ordinary classes can be transformed into smart classes that actively listen and analyze sounds, conversation, movement, behavior, and so on, to reach conclusions about the presentation of educators and audience satisfaction "[9].

2.2. *Smart Learning*

According to Zhu et al in [10], "there is no clear definition of smart learning and integrated so far. Multidisciplinary researchers and education professionals continue to discuss the concept ". In fact, many different definitions can be found in almost all articles that emphasize the various aspects and characteristics of smart learning published since 2014 in the journal Smart Learning Environments. However, there are some common and important element identified by most researchers d i this field. y ang first highlight that smart learning based on two different types of technology: smart devices and smart technology.

Smart devices refer to artifacts that show some of the ubiquitous computational properties,

including (though not necessarily) artificial intelligence; For example, internet, technology can be used in the form of accessories such as glasses, backpacks, or even clothing. The use of smart technologies, such as cloud computing, learning analysis or large data, focuses on how learning data can be captured, analyzed and directed to improve learning and teaching, and support the development of personalized and adaptive learning [11], [12].

Regardless of the difference between smart devices and this smart technology, both are actually related, because there is no independent type of technology. For example, the Internet and the most usable technologies require large data to generate personal information and provide feedback to users.

In addition to technical characteristics, it is useful to analyze the characteristics that describe smart learning. Related to this, Zhu, et al. In [10] describes ten key features that define smart learning:

a. ***Location-aware***: in real time smart location learning is the critical data the system needs to tailor the content and situation to the learner;
b. ***Context-aware***: explores various scenarios and activity information;
c. ***Socially-Aware***: feel social relationships;
d. ***Interoperable***: sets standards for different resources, services and platforms;
e. ***Seamless connection***: provides continuous service when there is a connected device;
f. ***Adapting***: encouraging learning resources according to access, preferences and demand;
g. ***Ubiquitous***: predict the demands of learners until expressed clearly, provide visual and transparent access to learning resources and services;
h. ***Whole record***: recording the learning path data to the data mine and analyzing in depth, then provides a reasonable assessment, suggestion and boost of on-demand services;
i. ***Natural interaction***: transfers the senses of multimodal interactions, including the recognition of facial and facial expressions;
j. ***High engagement***: immersion in a multidirectional interactive learning experience in tech enriched environments.

In short, in smart learning, real-time location is important to tailor the content and situation to the learner. However, location is not always an important requirement in smart learning. The most important characteristic is the system will be able to advise and predict the needs of learners. Smart learning is a learning system that advises learners to learn in the real world.

2.3. Characteristics of Smart Learning Environments

Implementation of smart learning environment beyond the application of smart technology. A smart learning environment not only allows learners to access digital resources and interact with learning systems in any place and at all times, it also actively provides the necessary instructional guidance, instruction, support or learning advice in the right place, at times right. and in the correct form.

Spector in [13] considers that a smart learning environment is an "effective, efficient and attractive" environment. Furthermore, today's authors find it imperative to support the integration of technology and pedagogy to create a coherent ecosystem that provides "an ongoing evidence of ongoing knowledge and knowledge change, instilling skills that are seamlessly transferred to learners as they move from one context learn the other "[14].

According to Hwang in [15] the three main features define an smart learning environment:

a. ***Context-aware***: the system should be able to provide learning support based on the online and real-world status of learners;
b. ***Adaptive Support*** : The system should offer instant and adaptive support to learners based on individual needs from different perspectives (learning performance, learning behavior, profile, personal factors, etc.), as well as the online and real-world context in which they are ;
c. ***Adaptive Interface***: the system must be able to customize the interface with the user (how to present information, learning preferences, learning performance etc.) The user interface can be a mobile device (smartphone, tablet computer, etc.), wearable device (digital watch) or even the ubiquitous computing systems embedded in everyday objects.

Hwang at [16] establishes potential criteria for a smart learning environment as context-conscious, able to offer learners instant and adaptive support and customize the learner's interface and subject content. A smart learning environment aims to support learners to gain new knowledge, even as they engage in leisure activities. It plays the role of a coach, or guide, who seeks opportunities to advise learners in their daily lives by considering their needs and preferences. In short, the purpose of a smart learning environment is to provide self-service learning, personal and personal motivation.

According to Spector in [13], it is also highly desirable to design an smart learning environment to provide motivation for diverse learners,

recognize the competence of learners, learning styles and interests. In addition, the learning environment should provide personalized tasks and / or formative feedback, and should include a supportive pedagogical strategy:

a. ***Conversation:*** learning environment can engage students in dialogue or facilitating a dialogue group on the relevant topic or issue;
b. ***Reflection:*** the learning environment can produce an independent assessment based on the progress and performance of students, should suggest activities and attributes in a learning environment that can be adjusted to improve the overall effectiveness;
c. ***Innovation:*** the learning environment using new technologies and emerging and utilize innovative technology with creative ways to support learning and teaching ;.
d. ***Self-organization:*** the learning environment can rearrange the resources and control mechanisms to improve its performance over time based on the data that is collected automatically and used to improve how the environment interacts with students in a variety of situations

2.4. Smart Learning Environments And Learning Ecology

The author argues that an smart learning environment is an important component in the ecology of learning. The concept of learning ecology provides a systemic picture that goes beyond a simple techno-centric standpoint. It is important to understand that technology is embedded in the life experiences of learners. John Seeley Brown introduced the idea in an influential article from 2000 entitled *"Growing Up Digital:* How to Change Web Works, Education, and How People Learn". Seeley uses it to show how new technology is driving new niches and habitats, which require new collective and individual behaviors.

Related to study the ecological framework Barron in [17] explains how learning takes place in various settings and identify possible synergies and barriers between them, including the role of technology in making the boundary more permeable and allows the new agents in the learning levels. Barron develop learning ecology framework based on three assumptions [17] various ideational resources can trigger and sustain interest in learning; 2) people not only choose, but also develop and create learning opportunities for themselves once they are interested, assuming they have the time, freedom and resources to learn; and 3) interest-based learning activities are limits and self-defense. Individual views about the ecological study looked at students as major actors in the network, is responsible for maintaining social relationships and create meaning in the whole context of the physical and virtual [18].

Smart Learning Environment. Hwang [16] presented the concept of an smart learning environment "... which can be regarded as a technology-powered learning environment which makes adaptation and provide appropriate support (eg, guidance, feedback, guidance or tools) in the right place and at the door the right time based on the needs of individual learners, which may be determined by analyzing the behavior of learning, performance and real-world and online context they're in. in short, according to Hwang [15], an smart learning environment should:

a. Place the learner in a real-world scenario.
b. Adaptation of learning interfaces for individual learners.
c. Customize learning tasks for individual learners.
d. Provide personalized feedback or guides.
e. Provide interdisciplinary learning or support.
f. Provide learning or support guidance throughout the context.
g. Recommend a learning tool or strategy.
h. Consider the online learning status of learners.
i. Consider the real-world learning status of learners.
j. Facilitate formal and informal learning.
k. Consider some personal and environmental factors.
l. Interact with users through multiple channels.
m. Provide learners with support first, across real and virtual contexts.

The use of technology embedded in the life experiences of learners has important consequences for pedagogical formal education methods. The inclusion of a smart learning environment within the educational context of increasing complexity and educational professionals needs to introduce innovative uses and new pedagogical approaches. The next section discusses major pedagogical challenges when designing ecosystem learning that integrates smart learning.

2.5. Smart Learning and Smart Pedagogies

In the early 1990s, the use of technology to support classroom teaching is very rare because of the lack of knowledge of educators. For this reason, the earliest professional development program focused on the use of hardware and software. However, it soon became clear that this was not a good strategy, as the use of ICT should be embedded in educational methodologies. Many attempts have been made to effectively integrate technology as an

educational tool as a means to promote student-centered learning, in line with Government Regulation No. 32 of 2013 concerning the use of ICT in learning. Currently, the next challenge is to design an ecosystem learning that integrates smart learning for personalization and self-organizing learning. According to Zhu, et al. in [11], "Objective smart education is to improve the quality of learning lifelong learners. It focuses on contextual learning, personal and indefinitely to promote intelligence of learners and facilitate troubleshooting capabilities m hey in an smart environment ". Similarly, Kim et al. in [19] assumes that smart education is centered educational paradigm and service-oriented employees. Middleton in [20] also believe that smart education should be developed based on a learner-centric aspect. MEST in [21] serves as an smart learning is defined as a *self-directed*, motivated, adaptive, enriched resources and the technology embedded, while Lee [22] proposed that features smart learning includes formal and informal learning, social learning and collaborative. , personalized learning and learning, and the focus of apps and content.

What is clear is that this type of education will address new pedagogical issues. Researchers and educators need to develop new thinking about pedagogy based on the existing theories, such as constructivism, cognitive load theory and the theory of the new relationship as connectivism and network learning [23]. The new learning concept can provide an excellent opportunity for researchers to develop new strategies to help learners more effectively and efficiently gain knowledge and solve real-world problems.

Smart pedagogy must take into account the metaphorical learning of knowledge creation that highlights competence in generating knowledge. "Knowledge-pull approach to learning is based on providing students with access to seju mlah node tacit knowledge / explicit and handing over control to them to choose and combine the knot in accordance with their wishes, to enrich their personal knowledge networks" [24]. These skills are increasingly related to the use of digital technology that provides a flexible way to support modeling, sketching, testing and social interaction.

The presence of technology requires a shift from the use of low-level technologies, such as drilling, drilling and searching for information. Instead, smart education encourages the use of 'high-level' technology, using it as a 'thought tool' or 'intellectual partner' for creativity, collaboration and multimedia productivity. Technology must enable and accelerate the learning relationship between teachers and students and between students and other learning partners, such as coworkers, mentors and others who have a similar interest in learning. Deep learning tasks reconstruct learning activities from focusing on mastery of content to explicit student capacity building for learning, creating and proactively implementing their learning. In the most effective example, in-depth learning tasks are guided by clear and precise learning objectives, ideally combining curricular content and student interests or aspirations; involves specific and appropriate success criteria that help both teachers and students know how well objectives are achieved; and, incorporating feedback and formative evaluation cycles into learning and work, building student self-confidence and proactive disposition.

Despite advances in psychological research and vocational technology education, assessment practices in educational institutions has not changed for decades. There is a need to move beyond the traditional form of assessment, using new methods to combine different levels. The development of smart learning technology provides great potential for automated assessment enhancement. According to Kopainsky et al. in [25] learning analysis system can be used to balance real-time assessment of evidence-based (especially self assessment) with smart digital system designed to encourage critical thinking and problem solving. Data from tracking and management of learning activities can inform instructional design by providing evidence to support media choice and sequence of activities. Such analytical feedback to students can continue during the course and allow students to focus on areas of material poorly understood.

In addition to the use of technology, new pedagogies emphasize the active involvement of students in their own learning, student responsibility, metacognitive skills and a dialogical and collaborative learning and learning model. For this reason, self-assessment and peer assessment are also very important. Andrade and Du in [27] gives the definition of the principle of assessment is very helpful that focuses on learning formative be promoted: "Self-assessment is the process of formative assessment where students can reflect on and evaluate the quality of work and their learning, assess the extent to which they reflect the objectives or explicitly stated criteria, identify strengths and weaknesses in their work, and revise them accordingly ".

Peer appraisals involve students who take responsibility for assessing the work of their peers. Therefore they can be involved in providing feedback to their peers. This is a powerful way for students to gain a better understanding of the assessment criteria and also be able to transfer

some ownership of the assessment process to them, potentially increasing their motivation and engagement.

3. THE DESIGN OF SMART LEARNING ENVIRONMENTS: PARTICIPATION AND FEEDBACK

In the author's view, the learning environment involves pertimbang an smart context, a source of cultural and socio-cultural features of formal and informal learning environments. The smart learning environment is not only related to ideas for improving learning, but also emphasizes the need for adaptation and personalization depending on where the learning takes place. Thus, the smart learning poses an important challenge for the evaluation because the content may not be repaired and activity may extend across both formal and informal settings. The author now considers that there are two main issues to consider when designing an smart learning environment: 1) user participation in the design, and, 2) providing useful support to offer appropriate feedback to the user.

a. Participatory design

Traditional design methodologies limit the participation of students in a consultative role, in which the de sain decision taken by the designer and / or developer. Traditional development adopts a systematic approach to analysis, design and testing, without having to use a specific user model. However, users are an important source and can be partners in the design process to ensure that the technology is useful and useful. The authors assume that the potential of smart learning depends on the design of the learning environment and it is important to design the learning ecosystem using a participatory process. In contrast to the image of students measured as actionable data objects with algorithmic techniques, smart learning should emphasize the idea of 'smart learners'.

The field of instructional design has evolved in recent years and now offers a set of methods, tools, systems and models in [27], [28] which can empower educators in designing scenarios that provide a richer learning experience. The design must articulate and organize the content disciplines, pedagogical theories, based on practical experience and the use of technological resources are increasingly diverse and sophisticated [27]. The design is, naturally, iterative and collaborative. This requires discussion, reflection, criticism and implementation. Designing a collection of complex human and objects require fluency epistemic rare, sometimes it is not preferred in the practice of education [29].

In designing an smart learning environment, it is necessary to take into account that users will interact with heterogeneous devices that must be successfully integrated and interconnected. According to Pons et al. in [30] , "it is impossible developer can produce a system that is able to find preference contextual users with a high degree of accuracy in all cases without any input from the user. Therefore, user preferences should form a key knowledge to be identified during the initial stage configuration. " .

Participatory design is used to increase knowledge about the design of smart devices. For example, Pons et al. in [30] applying participatory methodologies to design and visual language tools that will be used when creating table-based real tangible editor to personalize smart environments. The design serves to identify the characteristics of visualization, taking into account different learners' knowledge.

Durall and Leinonen in [31] apply participatory design to develop Feeler, a prototype designed to help people develop an awareness of how differences in habits and mental state of an impact on their learning. Thus, Feeler aims to raise awareness and reflection on learning activities. Feeler design is based on the assumption that learning technologies are built on the monitoring of physiological data should aim to empower students by helping them understand the various aspects that affect their learning performance. Therefore, Feeler explore some strategies to support reflection in the design of the prototype e such as the creation of time, ask reflective questions and letting some aspects incomplete to encourage users to ask the meaning. Although these cases there was a prototype, some authors [30] , [31] to consider the draft is adopted that is very relevant to open a discussion about the role of data to support the meaningful and personal information.

b. Data visualization

Feedback has been regarded as a key tool to help students improve performance. Feedback is usually associated with traditional communication mechanisms learners with educators and their colleagues. As mentioned in the previous section, the use of technology to add new possibilities to track the activities of the students and give them feedback sooner about their learning performance. However, most efforts to use learning analysis focuses on providing information for instructors to improve their pedagogical strategy [32] . Very rarely students is considered as a major recipient of learning analytics data or given the opportunity to use the information in reflecting their learning activities and learning to manage them more efficiently.

Some authors cautioned that actual learning analysis can paralyze learners by making them dependent on institutional feedback [33] . Se part of the research anali tik have examined historical data to identify patterns in the learning behavior of the students then associated with academic performance and / or retention. However, most of the studies did not have an understanding of the pedagogical context that affects the activity of students, and how to identify patterns in the behavior of student learning that can be used to influence and contribute to the teaching and learning experience more positive.

Essentially there are gaps in knowledge for teachers who are trying to bridge the gap between the information provided by the analysis of instructional and pedagogical action types are designed by teachers to support learning. The field of instructional design offers a way to address this gap by helping teachers to articulate the design and purpose of learning activities that can be used as a guide for interpreting the data analysis of learning. T presumption against the use of learning analytics as a tool to serve the institution, the more scientists began to promote student-centered analysis [34] . In line with the statement , we assume that learning analysis can and should be used as a tool for reflection and metacognition to support independent learning [35] .

It is important to identify the main challenges in the design of learning environments that utilize learning analysis to encourage reflection. The most urgent challenges to be faced are divided into two categories: data and visualization. What kind of data that is most meaningful to students? What visualization types that can encourage reflection of the most successful?

Converting data into knowledge is a cognitive process that can be supported by the availability of data. Visualization of information has been recognized as a tool for the creation of a sense, because it helps synthesize complex information and facilitates comparisons and conclusions [32]. Therefore, in order to actually use the analytics that help students become independent learners, need to adopt a student-centered approach.

There is a need to rethink how learning indicators chosen and the extent to which they contribute to the understanding of learning as a process, not in terms of results. In this case, allows the students to decide what aspects will they monitor and analysis can help make learning analysis as a tool for reflection in an smart learning environment.

4. CONCLUSION

Learning anytime, anywhere is not a new concept. However, where the process considered a general activity during life, it is important to be explicitly designed and deliberately supporting them. As stated above, the smart learning environment should integrate formal and informal learning to create an adaptive autonomous learning environment to support individual learners. This environment requires using smart data analysis and learning techniques to integrate real-time information about student locations and historical data to identify meaningful learning patterns. It is very important to take into account the smart learning environment Context of consciousness that can combine physical classes with many virtual learning environments.

A new concept of 'Education as a Service' According to Boulanger et al. in [36], is emerging as an approach to addressing global and open market challenges. Educational resources in this approach are easily accessible to global learners by providing them as a service. From this perspective, one can expect traditional organizational education structures and teaching processes to undergo major changes. For example, lectures can be separated from the course itself. Some lectures may be given by a teacher other than the teacher who is responsible for the course. Assessment can also be separated, where a third party can test, not a subject matter.

This service should take into consideration the student's point of view and learning experience. In an smart learning environment, learners have different service options at different stages of learning, where these services are provided by various educational facilities, both online and physically. Due to the rather vague line between formal and informal learning, and increased focus on informal learning, it may not be necessary to distinguish these two different learning formats in the future.

Knowing more about student performance and perceptions is essential for researchers to develop more smart learning environments more effectively and deployment in smart classes with the advantages of appropriate technology tools. Evaluation can be done using various aspects, such as learning achievement, problem-solving skills, self-efficacy and self-regulation. In the meantime, it is necessary to investigate the impact of smart learning environments on learning performance and students' perceptions with learning styles, cognitive styles, or other personal characteristics.

Having an in-depth understanding of learners' behavior and learning patterns will be essential for researchers and educators in developing more effective learning tools and strategies especially in

smart classroom environments.

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