Intelligent Interactive Learning Platform for Seamless Learning Ecosystem to Enhance Digital Citizenship's Lifelong Learning

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Abstract—The purpose of this research is to: 1) synthesize documents and international research of intelligent interactive learning platforms for seamless learning ecosystems to enhance citizens' lifelong digital learning 2) design an intelligent interactive learning platform for a seamless learning ecosystem to enhance citizens' lifelong digital learning 3) assess the suitability of the intelligent interactive learning platform for seamless learning ecosystem. Ten experts were selected. They had to have had more than five years of relevant experience in the field consisting of expertise in System. Architecture, intelligent learning platforms, seamless learning ecosystems and citizens' lifelong digital learning. The research instruments were a suitability assessment form for an intelligent interactive learning platform for seamless learning ecosystems to enhance citizens' lifelong digital learning. The results of this research found that the intelligent interactive learning platform for a seamless learning ecosystem to enhance citizens' lifelong digital learning, was developed and it was appropriate.

Keywords—System Architecture, Intelligent Learning Platform, Seamless Learning Ecosystem, Citizens' Lifelong Digital Learning

1 Introduction

Nowadays, the knowledge of various sciences is developing rapidly, especially the knowledge of technology, so learning is not limited to the transfer of knowledge from the teacher to the student, which was a traditional classroom teaching system, but, now teachers have to use technology as a tool for teaching and learning. However, it also encourages learners to seek knowledge for themselves from all of the teaching materials, printed media and digital media, in collaboration with a study group and the introduction of social media (Social Media) can be used as a more modern tool for the

development of teaching and learning. [1] In OKMD (Office of Knowledge Management and Development,) proposed guidelines for learning A-Z, their names are as follows A: Andromo, B: Book Fairy, C: Cybrarian, D: Delft Cultural Heritage Browser, E: EdTech, F: Flipped Classroom, G: Google Classroom, H: HegartyMaths, I: Instapaper, J: Just In Time Learning, K: Kahoot, L: LanSchool, M: mBot, N: Numonics Intelliboard, O: OSMO, P: Piscataway Public Library, Q: QR Code, R: Romibo, S: School in the Clouds, T: Tanvas, U: Underground Education, V: Voice of America Learning English, W: Write About, X: Xcode, Y: YouTube EDU and Z: ZenFone AR. [2] This is a combination of different forms of learning to help learners have access to information at all the times.

Furthermore, in Thailand, the Thai population uses social media. 75% of the population in the country spends 2 hours and 55 minutes a day on social media, of which 54% of them use social media for work. Facebook is number 1 with the highest users, next comes YouTube, WhatsApp, FB Messenger, WeChat, Instagram and TikTok. Around the world, Thailand is ranked 8th for active usage of Facebook. There are 47 million Facebook accounts [3]. As can be seen from the statistics, the population of Thailand has access to information across multiple platforms to learn a variety of information, which is seen as a trend in the form of a greater variety of data access. Therefore, in this research, the elements of an intelligent interactive learning platform for a seamless learning ecosystem (SLE) to enhance citizens' lifelong digital learning are pointing out that, in the smart platform space, they must have access to social media platforms what are the components and what ecosystems in seamless learning are there to enable lifelong learning? There needs to be a design for an interactive smart learning platform for a seamless learning ecosystem to encourage citizens' lifelong digital learning and to assess the suitability of an interactive smart learning platform by experts in the technology field.

2 Theoretical Background

2.1 Seamless learning ecosystem

Definition of a seamless learning ecosystem: The seamless learning ecosystem is a form of learning regardless of the location and the learning process, depending on the need and availability of the learning which can be carried out. It helps to bridge the gap as much as possible, providing easy access and access to content through various mobile and stationary devices [4]. Therefore, the seamless learning ecosystem is looking for strategies to engage learning inside and outside the classroom, finding a method to connect with most of the learners' daily lives [5] and to make the most of the seamless learning ecosystem, that must use various algorithms to develop the system to be most suitable for the learner. [6] Seamless learning focuses on the development of the learner. Therefore, a seamless learning strategy needs to be developed to suit the learner and to increase the motivation and challenge [7]

We can summarize the meaning of a seamless learning ecosystem as the analysis of the original data of seamless learning that finds strategies to engage learning inside

and outside of the classroom. It needs to find various algorithms that create the best learning ecosystem for learners and reduce students' gaps in learning, as well as connecting learners with their daily lives. It needs to increase the motivation of learners to learn by incorporating various elements into the design for fluid learning using mobile devices. It has the greatest potential to foster lifelong learning that is accessible anywhere and at any time. Moreover, it can make the most of a seamless learning ecosystem with both formal and informal learning.

Elements of a seamless learning ecosystem: The components of seamless learning are the study of all elements for the realization of learners. For example, in the research by Zarzour et al. [8] students' behavior was studied by analyzing the factors of learning, such as the age of the instructor, the classroom, the place of study and the environment of the students. It examined the behavior of learners with a blended online chat system, online and in the classroom, using the asynchronous Facebook chat activity model and using the asynchronous conversation activity model. It is asynchronous in MSN Messenger using a smart device, laptop or desktop computer. In addition, there is research by Bernacki et al. [9] on mobile learning approaches and learning psychology. In the first step, the fundamental factors of learning were analyzed, including age of the instructor, classroom, learner and place of learning. This analysis of the factors contributing to continual learning must be achieved using technology that supports the learning community in that area, including challenging learning styles. Challenges that arise before school, during study and when learning is complete. are something that helps students to develop themselves sustainably. Crompton and Burke [10] researched mobile learning and access to learning content using SAMR, (Substitution, Augmentation, Modification, Redefinition) which studies have shown encourages learning using mobile devices to access more content and to transform learning styles to include online learning and motivating self-challenges in order to result in more continual learning. It is also interested in the surrounding areas that will be connected to access learning materials.

Nonetheless, there is much research using teaching techniques which include various innovations such as being a peer component to a seamless learning occurrence. For example, Hill and France's research [11] has been working on innovative teaching and learning models by studying the learners' original information as follows: the age of the instructor, the classroom and the environment such as the student's address. It was then suggested that the teaching and learning model should be experiential learning, where experiential learning connects traditional classroom learning with learning outside the classroom systematically. This helps to foster the development of learners through active participation in experiential learning as well as the use of technology enhanced learning (TEL) by applying information and communication technology (ICT) to improve the processes and outcomes of learning and assessment. In other words, learning with more technology will enhance the learning experience of the learners. In his research, Alalwan et al. [12] proposed models of the use of virtual and augmented reality with teachers teaching in the classroom at school. In this research, VR:AR was applied to science subjects at the elementary school level with a challenging learning model. In its original form, lack of interest, lack of time, and limited learning resources were obstacles to learners' learning. Adopting both technologies

(VR & AR) can help promote learning behavior and realize the benefits of science with a deeper understanding and it can help to develop a more positive attitude to science. It is consistent with the research of Martínez-Cerdá [13] who has created innovative e-learning for the development of social skills using ICT technology to assist in the continuity of learning to improve the employment skills of adults for the 21st century. She uses age factors, teachers, classrooms and learners to analyze and create innovation by using the experiential learning model to help develop e-learning innovation by analysis of many experiences. Many of them have come to develop and assist in the obtaining of information learning styles with the online learning community. Souabni et al. [14] research conducted the design of a multidimensional framework for the study of situational perception from various perspectives of Ubiquitous Learning. To achieve comprehensive learning, they used an online learning model combined with challenging learning to achieve the desired motivation. This is the unification of a community of experienced people in various fields who share information online to create continual learning. That is based on the following learning factors: instructor, classroom, learner, place of learning and the living environment of the learner.

There are many studies that have applied the knowledge of technology as a component for the environment in learning, such as in the work of Koukopoulos and Koukopoulos [15] who studied the integration of the theory of education into a viable digital environment. The direction of the development is to bring more than one technique and method to learners for maximum benefit. The research studied three components: learning objectives, collaborative learning space and learning through mobile devices. In a paper by Shorfuzzaman et al. [16], research was conducted in the analysis of big data in the cloud to support learning analysis in a mobile learning environment in which behavioral aspects were studied. Teacher learning and teaching learners requires understanding of their study place and residence as well as study about teaching and learning techniques, their ability to collect data, processing limitations, etc. From research, it can be analyzed that the application of conventional teaching methods in classroom teaching and online learning has to be applied to improve learning. Teaching is more challenging and makes the class exchange experiences together, have a community to express opinions together, such as in the classroom using group presentations. An online use of the built-in Q&A forum is consistent with Xiao et al. [17] research conducted for the development of seamless learning in China. The area factors that must be studied for seamless learning to emerge are the age of the instructor, the classroom, the place of study and the living environment of the learner. It can be concluded that the component of non-circular learning must consist of formal learning and informal learning, both of which are divided into traditional learning (individualization) and the use of sympathizers (socialization) by traditional formal learning using technical methods, (3D Experience Learning) or situational awareness learning. Sociology uses a game-based learning technique or a flipped classroom style. In the traditional informal learning style, it uses a learning technique as well. Mobile learning or online course learning (MOOC) and socially based learning methods use Multi-terminal Interactive Learning or Community Learning with various forms of access to information such as iPad, mobile phone, computer, television,

using the internet, digital TV, satellite, etc., and are processed and managed in the cloud. There is also big data for seamless learning, such as virtual storage as well as access time and management of computer resources and data storage. From various researchers, the components and strategies used in teaching and learning to achieve seamless learning can be summarized in Figure 1.

2.2 Intelligent interactive learning platform

Definition of an intelligent interactive learning platform: The intelligent interactive learning platform is an intelligent data access area in different zones with sufficient data access elements to needs [18] and the application of technology on different platforms to multiple devices. Automatic interaction is becoming popular today and use of techniques that assist in data analysis should make the data interconnected as a networked system. [19] For this, intelligent interactive learning platforms are required. They must take into account the facilities that are available to access information, such as the internet signal, a central area for accessing information and devices that allow easy access. Robots are used to answer basic questions that arise in the workplace, [20] including connection points. Information service points are used to make alternative decisions, both mobile and non-mobile devices to access sensors, intelligent interaction systems, etc. to enable systematic use of smart spaces [21]. There is also a need to think about existing ecosystems such as cultures, communities or organizations to make the connection. Link data have to be relevant in the area for intelligent access functionality [22].

Therefore, the intelligent interactive learning platform can be summarized as connecting various data to form an ecosystem of technology applications with elements, such as culture, internet networks, data connection points, sensors, servers, communication devices, access, etc., with the use of technical methods with technology to analyze various users, such as having sufficient information to meet the needs for the user to use the intelligence systematically.

Elements of an intelligent interactive learning platform: There are elements which are needed to create a multi-task intelligent interactive learning platform. The research of Data et al. [18] has applied the following technologies. Research on IoT project management in the smart city area concluded that data access must take into account both portable and tabletop data access devices on areas with extensive internet connectivity. There must be analysis of sensor usage and automated response patterns, such as: Conversational Agents and Social Robots. When accessing large amounts of data, there must be a server to provide information services such as Data Server, Processing Server, Display Server etc. There must also be a Security Server, Area Management and use of learning techniques in order to be a smart city that responds to the use by people who have access to information. The study in this research proposes an application of the SCRUM Approach technique, which will enhance the service of information in the smart city area. This is in line with research by Khan et al. [19] who conducted research into shaping future directions on the possible evolution and impact on technology applications. Studies have shown that the application of technology across platforms and multiple devices to achieve automated

interactions is becoming more and more popular today. Both techniques, that assist in data analysis should make the data interconnected and networked. The research presents the technique to be used on intelligent systems such as: Deep Neural Networks, Artificial Neural Networks, Classified, Prediction, Decision Technology, along with a central area of data storage. Li et al. [23] conducted research on distributed perception and model inference with smart technology in the automotive connectivity in smart cities. It describes the system architecture and application scenarios of distributed environmental awareness for city streets, including indoor and residential parking.

However, there is much research that has developed a digital directing application, building architecture for example. Vaishya et al. [24] developed an artificial intelligence (AI) application for the spread of COVID-19 on a smart phone using original data from previous research reviews. Summarize, collect data and develop applications to predict where the COVID-19 virus will affect people in the future. It is also built as an intelligent interaction system to help answer questions of people wondering whether they are infected with COVID-19 by using information to network and make decisions in the app itself. Which is Thanachawengsakul et al. [25] conducted to the knowledge repository management system architecture of digital knowledge engineering using machine learning to promote software engineering competencies research has found that 4 past of component as follow 1) device service, 2) application service, 3) module service of the KRMS-SWE and 4) machine learning service and storage unit. And also, Songsom et al. [26] studies system architecture of a student relationship management system using internet of things to collect digital footprint of higher education institutions research has found that 6 past of component as follow 1) service stations, 2) system identification, 3) system integration API, 4) SRM internal system, 5) report analytic and 6) web server and database server. In this research, Baptista et al. [20] have been working on research into digitalizing the digital workforce in modern organizations to digitize and transform organizations into a digital society. Studies have shown that, for transforming the organization into a digital organization, it must have facilities that are ready to access information, such as an internet signal, and a central area for easy access to various devices' information. The presence of robots are useful to answer basic questions that arise in the workplace. Once the facility is complete, the subsequent analysis is to analyze the people working in the organization by studying their working behavior, speech and life in order to create a digital working space. This is consistent with the research of Zhang et al. [27] who studied understanding the relationship between data architecture and business models of empirical studies on determining the success of smart communities. They achieved this by doing a study of various factors and forms, as shown in Figure 2, to create an intelligent community which, from the picture of the technology factor networking, data warehousing, access point, access sensors, in terms of applications such as general use used in educational health management. It is similar to Kirwan and Zhiyong [22] and has worked on the study of technology in smart city society and the use of artificial intelligence systems. For example, culture, network, data connection, etc. Then these elements are inserted into Connect data to be related to each other in the work area to create a smart access area.

In many studies there are components for intelligent space applications, for example, Mele et al. [21] researched on the use of cognitive technologies to create alternative architectures for value Co-Creation, in the construct architecture, it analyzes the following as: internet signal, access point and data service point used to make alternative decisions. Both mobile and stationary devices are used to access sensors, intelligent interaction systems, etc. The alternative was created using deep neural and neural structures, including data classification, to help make the right choice, resulting in a systematic co-value. This is similar to Guo et al. [28], the faculty who studied advanced intelligent applications for engineering processes in the industrial field of big data. This is the introduction of Big Data into the techniques of deep neural structures. Assortment and decision-making techniques are used to manage data to analyze and apply engineering in industry to create an intelligent connection area that allows for faster operations. This is in line with the research of Lyapin et al. [29] to establish a strategy and develop a regional model of a smart logistics transportation system. It is an element in the use of intelligent logistics transportation. Various devices are used in the application of sensor samples, target path cameras, etc. from classification and prediction techniques, in order to make the logistics system able to work smartly, in which the research work and mobile devices are used as work tools. Yaseen et al. [30] developed the engineering reinforced rod prediction system. In this research, the techniques of artificial neural structures, prediction and response surface methodology were used in the research, whereby the system can be used for both mobile and desktop devices. A database design that can be dynamic, which is derived from various research components of the intelligent interactive learning platform, can be summarized as shown in Figure 2.

2.3 Citizens' lifelong digital learning

Citizens with lifelong digital learning are very important. Nowadays, it is a technological society where citizens are able to use various machines in the search for self-control and know them well. In this study, it was related research which can summarize citizens' lifelong digital learning on the following topics:

Digital literacy: Digital literacy is an understanding of the skills and understanding of how to make the most of our existing digital tools, equipment and technology. It can also give access to help in the development of youth with developmental disadvantages. In the research, it was found that young people have problems and obstacles in digital literacy, such as basic literacy training, access to information, design, other accommodation, etc. Therefore, these issues need to be addressed in order for young people with developmental disabilities to develop digital literacy. In the research by Abdulai et al. [31], digital literacy of the public has been used to analyze information about COVID19 because the release of the news has led to many misunderstandings in the online world. A high level of digital literacy, gender, age, literacy accessing information of ordinary people online in Ghana, affects digital literacy. Demirbag and Bahcivan [32] studied the exploration of digital literacy between the self-control skills in digital literacy and the epistemological beliefs of digital literacy. The results of the research were as follows: There were no signs of epistemological belief or Self-

control skills in digital literacy, but there were different results when they tested the knowledge of science teachers.

Therefore, digital literacy can conclude that it is the digital knowledge of the individual in deep understanding and effectively professional access selection and the implementation of tools for maximum efficiency (Professional Use). A wide knowledge continues to create innovation and the result is to make the most of the skills development for oneself.

Digital competency: Digital performance is the knowledge and ability of various digital technology applications. To be efficient and capable of the best from the individual, there are studies which have been conducted in digital performance analysis, such as Shiferaw et al. [33] assessing the digital competency of healthcare providers in seven public health centers in northwestern Ethiopia. In this research it is thought that digital competencies should be a fundamental ability to use technology successfully. Research has tested the digital performance as follows: data analysis content creation, communication, security, and trouble shooting. It is aligned with Falloon's research [34] to develop a conceptual framework which includes approaches, techniques, knowledge and skills in order to develop teachers' digital competencies. The competency of teachers has developed in various areas as follows: work, communication and collaboration, integrated thinking, data management, security of personal information technology applications, learning information, making decisions, being yourself, and management all of which are different aspects which should be learned before going to the test with the examiner to test the digital performance. In the research Holguin- Alvarez et al. [35] studies digital competences in the elderly and university student's didactic interaction from the use of social networks has found six-month digital competences of the elderly and university students that can be access to information was more efficient. And the Research by Mangiri et al. [36] was studied in a similar way by studying the digital competencies of teachers on the professionalism of teachers in vocational secondary schools. The study looked at teaching ability, professional competence, social competence and personality. The results of the assessment revealed that the digital competency and professionalism of the instructors were highly competent, as well as positive thinking, which is essential to the professionalism of the instructor.

Therefore, it can be concluded that digital competency is the development of the skills of people in the digital world. In a nutshell, components of digital competency must include retrieval and use, creativity, innovation, self-Improvement and quality of life, teaching and learning as well as the ability to use tools and technology, communicate and Coordinate.

Digital intelligence: DQ: Digital intelligence is a creative mind. It is knowing how to use digital technology in the present day, adaptation to access information, and various lifestyles that are compatible with the digital age and to have emotional, social and learning intelligence in order to watch and listen to the media or the daily news with an open mind Several studies have been conducted on digital intelligence, such as Candra and Suryadi's research [37] on the creation of digital intelligence among millennials or Generation Y. This research discovers all three elements of digital intelligence which emerge: sufficient knowledge of various matters, a genuine under-

standing of matters and an awareness of the use of technology. In the DQ Institute's digital intelligence book, digital intelligence and digital citizens are identified as follows: Digital Citizen Identity, Screen Time Management, Cyberbullying Management, Cybersecurity Management, Privacy Management, Critical Thinking, Digital Footprints and Digital Empathy. [38]

Therefore, these three elements, digital literacy, digital competency and digital intelligence combine to create lifelong learning for today's digital citizens.

3 Research Methodology

The research method was divided into three phases according to the research objectives as follows:

3.1 Phase 1

Phase 1, an international synthesis of documents and research of an interactive, intelligent learning platform for a seamless learning ecosystem to promote lifelong learning of citizens in the digital age.

- A study of documents and research related to elements of a seamless learning ecosystem with seamless learning strategies. There must also be elements of an interactive learning system architecture with a smart interaction strategy for citizens with lifelong digital learning. Published in the international research base system from 2016-2021, there were a total 38 issues.
- To synthesize elements of a seamless learning ecosystem. The essay diagrams in Figures 1-2 show seamless learning strategies, elements of an interactive learning system architecture, smart interaction strategy and lifelong digital learning.

The research tool was content analysis form and data analysis by content analysis technique.

3.2 Phase 2

Phase 2 draws on information gained from the synthesis stage to design an intelligent interactive learning platform for a seamless learning ecosystem to promote lifelong digital learning for citizens, comprising a seamless learning ecosystem. Seamless learning strategies, elements of an interactive learning system architecture, smart interaction digital strategy for citizens with lifelong learning are presented in an illustration plan and in the essay in Figure 3.

3.3 Phase 3

Phase 3 assesses the suitability of an interactive learning platform for a seamless learning ecosystem to promote digital lifelong learning for citizens.

- Assesses the suitability of a smart interactive learning platform for a seamless learning ecosystem to promote lifelong digital learning for citizens. Ten experts were selected, each with more than five years of relevant experience, including expertise in System Architecture, Intelligent Learning Platforms, Seamless Learning Ecosystem and Citizens' Lifelong Digital Learning.
- Improves the intelligent interactive learning platform for the seamless learning ecosystem to promote lifelong digital learning.

The research instruments were a smart interactive learning platform for a seamless learning ecosystem. The statistics used for data analysis were a 5-level evaluation scale. The statistics used in the data analysis are arithmetic mean and standard deviation.

4 Results

4.1 The results of the synthesis documents and research

Part 1 results of an international synthesis of documents and research related to an intelligent interactive learning platform for a seamless learning ecosystem to promote lifelong digital learning.
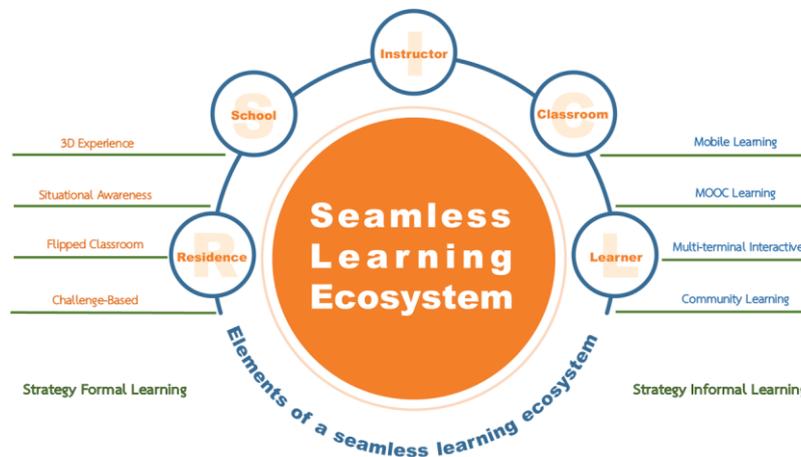
a) Summary of the seamless learning ecosystem

Fig. 1. Seamless Learning Ecosystem

Figure 1, it can be concluded that elements of a seamless learning ecosystem consist of two major elements, eight sub-elements, namely the first large element: Instructor, Classroom, Learner, School and Residence. The second large component contains subsection elements: Formal Learning and Informal Learning. These are the elements that must be taken into account for the seamless learning ecosystem to occur

and Seamless Learning Strategy is used to aid learning as a seamless learning platform consisting of eight learning strategies: Flipped Classroom, Challenge-Based Learning, Mobile Learning, Massive Open Online Courses (MOOC) Learning, Multi-terminal Interactive Learning, Community Learning, Situational Awareness Learning and 3D Experience Learning.

Intelligent interactive earning platform: Figure 2, it can be concluded that an intelligent interactive learning platform consists of four major elements and fourteen sub-elements. These are the first major hardware device access and the three sub-elements, which are: Smart Device, Desktop Device, and the Sensor. The second big element is the intelligent agent which has two sub-elements: Conversational Agents and Social Robots, which are part of the third component, the Network System and Terminals and they have three sub-components: Conversational Agents, Social Robots, 4G/5G/Wi-Fi / DSRC ADSL, Terminals. There is also the application enablement platform, the big four components of the database center, which have six sub-components: Data Server, Decision Server, Processing Server, Display Server, Security Server and Area Management. When combined with a strategy for analyzing learners. Various learning processes create a complete intelligent interactive learning platform, which includes Hardware, Software, Networking, People ware, Procedure and the Database
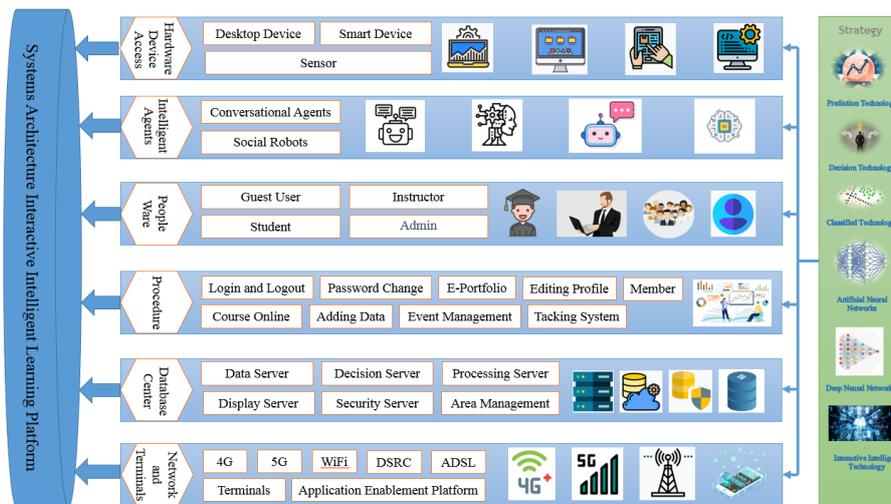

Fig. 2. Systems Architecture of the Interactive Intelligent Learning Platform

Digital lifelong learning: Analysis of synthesized research papers relating to citizenship's lifelong learning. Digital lifelong learning for citizens will consist of, Digital Literacy, Digital Competency and Digital Intelligence, each of which consists of the following sub-components: Digital Literacy has four sub-elements as: Deep Understanding, Professional Access, Professional Use and Creativity. Innovation and Result and Digital Competency have six elements: Retrieval and Usage Skills, Creative Innovation Skills, Self-Improvement and Quality of Life Skills, Teaching and Learning

Skill, Use of Tools and Technology. Skill and Communication and Coordination and Digital Intelligence have eight sub-elements: Citizen's Digital Identity, Screen Time Management, Cyberbullying Management, Cybersecurity Management, Privacy Management, Critical Thinking, Digital Footprints and Digital empathy. From all the three major elements and eighteen elements analyzed, document synthesis will enable citizens to have lifelong digital learning.

4.2   Platform design

In this step, it is the design of an intelligent interactive learning platform for a seamless learning ecosystem to promote citizens' lifelong digital learning, comprising a seamless learning ecosystem. This includes seamless learning strategies, elements of an intelligent interactive learning platform and a smart interaction strategy for citizens with lifelong digital learning. Outlined in Figure 1-2 is a summary and design of an interactive, intelligent learning platform for a seamless learning ecosystem to promote lifelong digital learning for citizens as illustrated in Figure 3.
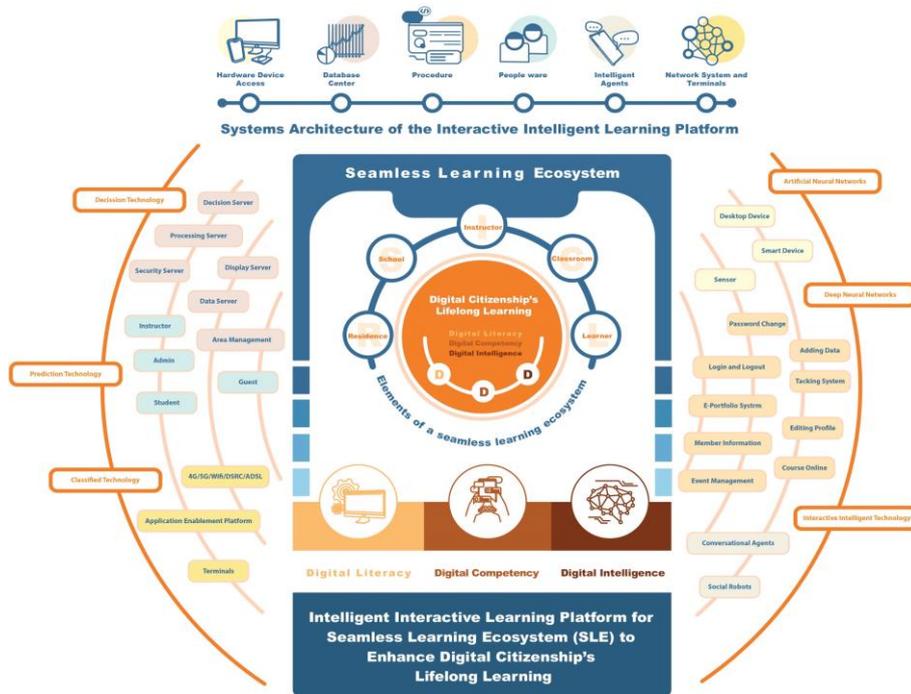

Fig. 3. Intelligent Interactive Learning Platform for Seamless Learning Ecosystem (SLE) to Enhance Digital Citizenship's Lifelong Learning

4.3 The evaluation results platform

Part 3 Assessment results of an intelligent interactive learning platform for a seamless learning ecosystem to promote lifelong learning of digital citizens.

The results of the assessment of the suitability of an interactive learning platform for a seamless learning ecosystem to promote lifelong digital learning for citizens. The results of the evaluations of each component can be summarized as follows:

1. Results of evaluation of the composition of the seamless learning ecosystem. Overall, it was found to be at the optimal level (Mean = 4.83, S.D. = 0.35). When examining each component, formal learning: challenge-based learning and informal learning, mobile learning was the most appropriate (Mean = 5.00, S.D. = 0.00).
2. The result, of assessing the system architecture composition of the intelligent interactive learning platform overall, was found to be at the optimal level (Mean = 4.83, S.D. = 0.33). When examining each component, it was found that the aspects of network and decision technology were the most appropriate (Mean = 5.00, S.D. = 0.00).
3. The result of assessing the components of lifelong digital learning for citizens was found to be at the optimum level (Mean = 4.93, S.D. = 0.22). When examining each component, the digital intelligence aspect was the most appropriate (Mean = 5.00, S.D. = 0.00).
4. The evaluation result for the design of an interactive learning platform for a seamless learning ecosystem to promote lifelong digital learning for citizens was found to be at the optimal level (Mean = 4.78, S.D. = 0.44).

When applying the results of the evaluation of various components to find the combined mean of all the evaluations of an intelligent interactive learning platform, this was found to be the most suitable (Mean = 4.84, S.D. = 0.34).

5 Conclusion and Discussion

Based on the research of designing an intelligent interactive learning platform for a seamless learning ecosystem to promote lifelong digital learning for citizens, it can be summarized as follows:

A seamless learning ecosystem and strategies used in the seamless learning ecosystem. The components are as follows: learners, teachers, schools, living classrooms, learning strategies, patterns and learning strategies without patterns as seen in the research of Xiao et al. [18] conducting research for the development of seamless learning in China. According to the study, it was found that the development of seamless learning must consist of the above elements. Also, in line with the research of Souabni et al. [14], who conducted research into designing a multidimensional research framework for education, creating a multidimensional framework to achieve comprehensive learning, using a learning model. Online should be combined with challenging learning to stay motivated for what you want to learn. It will use all the elements mentioned above as well.

Intelligent interactive learning system architecture consists of the following components: Hardware, Intelligent Agents, Peopleware, Network, Procedure, Database and strategies used to result in intelligent interactions such as: Deep Neural Networks, Artificial Neural Networks, Classified Technology, Prediction Technology, Decision Technology and Intelligent Interactive Technology. Kirwan and Zhiyong [24] conducted research on the study of technology applications in smart city society and the use of artificial intelligence systems. The above elements are made to form a smart data access area in urban society and the research of Data et al. [19], conducting research on IoT project management in data access in smart city areas. The same elements are used in research to create a smart city learning experience that is responsive to people who have access to learning information.

Citizenship with lifelong digital learning. There must be the following components: Digital Literacy, Digital Competency and Digital Intelligence in order to enable lifelong learning to occur. This is consistent with Candra and Suryadi [37] researching digital intelligence generation in millennials or generation Y. In this research they discovered a complementary element early in enhancing digital intelligence among Generation Y. It is also aligned with Falloon [35] to develop a conceptual framework consisting of approaches, techniques, knowledge and skills. To develop teachers' digital competencies which, from the above elements, help teachers to come up with ideas for teaching learners and also to encourage teachers to achieve lifelong learning in the development of various skills.

From an assessment of ten experts who had more than five years' experience in the relevant field, they found that an intelligent interactive learning platform for a seamless learning ecosystem to promote lifelong digital learning is very suitable as a result, this platform is suitable and applicable to the development of lifelong digital learning for citizens.

6   Acknowledgement

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