Connectivism Learning Activity in Ubiquitous Learning Environment by Using IoE for Digital Native

กิจกรรมการเรียนการสอนตามแนวคิดคอนเน็คติวิซึมในสภาพแวดล้อมการเรียนรู้ยูบิคิวตัสร่วมกับการใช้เทคโนโลยีอินเทอร์เน็ต ออฟ เอเวอรี ธิง สำหรับพลเมืองดิจิทัล

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Abstract

This research study aims to 1) develop a Connectivism learning activity in Ubiquitous learning environment by using IoE for Digital Native. 2) To evaluate the developed learning model. The research samples 12 participants, namely 6 instructional design experts and 6 ICT for education experts. The instrument used in the study was evaluation form. Mean and Standard Deviation were used to analyse data. The results of the study showed that learning activities based on the concept of Connectivism in the Ubiquitous Learning Environment combined with the use of IoE technology for Digital Native consist of 7 steps including 1) Planning, 2) Accessing, 3) Thinking, 4) Connecting, 5) Deciding, 6) Creating and 7) Showing & Sharing. The evaluation of learning styles was found at very good level ($\overline{X}$ = 4.66, SD = 0.41).

Keywords: Connectivism, ULE, IoE, Digital Native.

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บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อ 1) พัฒนารูปแบบกิจกรรมการเรียนรู้ตามแนวคิดคอนเน็คติวิซึมในสภาพแวดล้อมการเรียนรู้ยูบิควิตัสร่วมกับการใช้เทคโนโลยีอินเทอร์เน็ต ออฟ เอเวอรี ธิง สำหรับพลเมืองดิจิทัล 2) เพื่อประเมินรูปแบบการเรียนรู้ที่ได้พัฒนาขึ้น กลุ่มตัวอย่างที่ใช้ในการวิจัยได้จากการเลือกแบบเจาะจง จำนวน 12 คน ได้แก่ ผู้เชี่ยวชาญด้านการออกแบบการสอน จำนวน 6 ท่าน ผู้เชี่ยวชาญด้านเทคโนโลยีสารสนเทศและการสื่อสารเพื่อการศึกษาจำนวน 6 ท่าน เครื่องมือที่ใช้ในการวิจัย ได้แก่ แบบประเมินความเหมาะสม และใช้สถิติในการวิเคราะห์ได้แก่ การวิเคราะห์ข้อมูลด้วยค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน ผลจากการวิจัยพบว่า กิจกรรมการเรียนรู้ตามแนวคิดคอนเน็คติวิซึมในสภาพแวดล้อมการเรียนรู้ยูบิควิตัสร่วมกับการใช้เทคโนโลยีอินเทอร์เน็ต ออฟ เอเวอรี ธิง สำหรับพลเมืองดิจิทัลประกอบด้วย 7 ขั้นตอน ได้แก่ 1) Planning, 2) Accessing, 3) Thinking, 4) Connecting, 5) Decided, 6) Creating และ 7) Showing & Sharing และผลการประเมินรูปแบบการเรียนรู้ที่ได้พัฒนาขึ้นอยู่ในระดับดีมาก ($\overline{X}$= 4.66, SD = 0.41)

คำสำคัญ: คอนเน็คติวิซึม, ยูบิควิตัส เลิร์นนิ่ง เอ็นไวรอนเมนต์, อินเทอร์เน็ต ออฟ เอเวอรี ธิง, พลเมืองดิจิทัล

Introduction

A number of psychologists have said that learning is one of human's lifelong processes. From practicing or reinforced practicing, learning permanently changes human's behavior. Additionally, learning in modern world from pre-kindergarten to doctoral degree must be 'Transformative Learning' which means learning to be leader, having leading skills and leadership in order to take part in change (change yourself first) because everything in modern world is changing all the time (Panich, V. 2013).

Tangkitvanich, S. (2015) mentioned current instructional problems and solutions in the 21st century that classroom hours should be reduced while various approaches suitable for the development of students' 21st century skills should be launched, for example project-based learning, problem-based learning, using technology for content delivery, interaction, participation, Constructivism and Connectivism. Connectivism is a network base pedagogy constructed from the limitation of George Siemens' traditional learning theory (Siemens, G. 2005). It arises from the creation and link of knowledge to a network. Learners are the one who choose and screen learning resources for themselves, particularly from online network. Through this process, they will construct new knowledge from the link of their society and the creation of learning network with instructors, others learners and media (Phumpuang, K. 2015).

Currently, educational management of Thailand is organized and directly supervised by the Ministry of Education (MoE). However, private sector is allowed to take part in educational management from early childhood to higher education. Educational management

nowadays allows learners with different generations to study in the same class, particularly in higher education or graduate school. This provides learners in the same class with varieties of ideas and beliefs. Researchers in Social Sciences have been interested in behaviour, values, characteristics, lifestyle and thought of learners with different generations in the same classroom. Their studies are useful for educational improvement for learners with different generations concerning, for examples, learning styles, thinking process and learning accessibility.

The aligning the country to Thailand 4.0 strongly requires human resources development. To achieve this, suitable instruments and approaches are needed. In the fast-changing world in the 21st century, digital technology has great impacts on people. A new generation of young people nowadays is called Digital Native which refers to those who grow up with electronic devices and internet. They constantly use information and technology, and possess knowledge and skills in using electronic devices and social networks (Facebook, Twitter, Instragram, Line). This group of people, therefore, can access to information and technology, learn independently and interact with their surroundings all the time (Office of the Education Council, 2012).

Internet of Every Thing (IoE) or Internet in all things is a new term referring to digital devices or things that are connected to the Internet. These cover not only tablet, smartphone but also electrical equipment and other electronic devices e.g. watch, eyeglasses, refrigerators, smart TV and other smart devices. Kevin Ashton founder of "Auto-ID Center" project of Massachusetts Institute of Technology developed RFID technology to global standard. RFID sensors enable electronic devices to talk to each other through the Internet. Human can see, command and control the use of things or devices (Madakam, S. et. al 2015), for examples, turning on and off electric appliances, cars, cell phones, communicative devices, office supplies, agricultural tools, machinery in industrial plants and household appliances via portable devices connecting to the Internet. It is, therefore, interesting to apply the above mentioned management to education nowadays.

Due to the fast and endless advancement of technology and the instruction of knowledge in digital age, schools, institutions and instructors need to adapt themselves to a new world of learning. The adaptation of instruction, techniques and instructional media as well as attitudes towards the perceptions of learners' behavioral changes affect instructors regarding the use of modern technology to stimulate Digital Native learners. This is considered challenging for instructors themselves and institutions. In other words, instructional design and creating learning society cover not only getting knowledge from teachers but also setting up

learning environment system intending students to learn and do activities through digital devices in the 21st century (Sarnok, K. 2017).

From the above mentioned, the researcher was interested in the development of Connectivism learning activity in Ubiquitous learning environment by using IoE for Digital Native. This is to encourage and offer opportunities to improve learning for new generations through fast and continuous growing technology.

Research Objective

1) To develop a Connectivism learning activity in Ubiquitous learning environment by using IoE for Digital Native

2) To evaluate the developed learning activity.

Scope of Research

1) The population in this study refers to educational experts with specializations on instructional design and ICT for education.

2) The samples were 6 instructional design experts and 6 ICT for education experts with at least 5-year experience in the fields. They were selected using purposive sampling techniques.

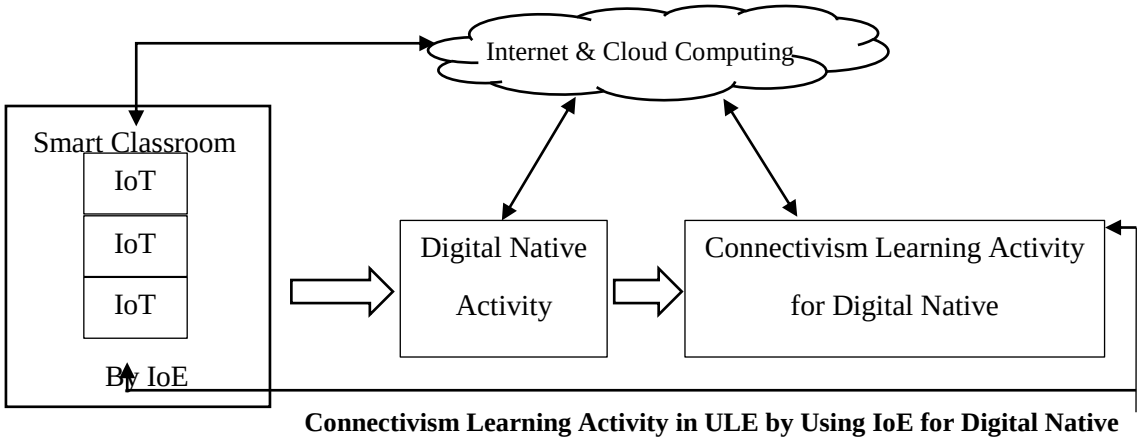

Figure 1. Conceptual Framework

Research Methods

The researcher reviewed previous studies in the field and developed the Connectivism learning activity in Ubiquitous learning environment by using IoE for Digital Native. This covered 9 steps as follows:

1. Reviewed of literature and previous studies regarding Digital Native, learning activities based on Connectivism, Internet of Every Thing technology, Ubiquitous Learning Environment & Cloud Computing.

2. Studied relevant studies of learning activities of Digital Native and use the information to analyse groups of learners.

3. Conducted front-end analysis in three parts: (1) Context analysis including needs analysis, curriculum analysis and module analysis, (2) Learner analysis including new generations' lifestyle, needs for education, accessibility to content knowledge and the critical thinking and (3) Learning task analysis.

4. Designed and developed a Connectivism learning activity in Ubiquitous learning environment by using IoE for Digital Native by analyzing the following parts:

- Part 1: Learning activity based on the concept of Connectivism.
- Part 2: Internet of Every Things.
- Part 3: Ubiquitous Learning Environment & Cloud Computing.

5. Developed learning activity model based on the concept of Connectivism for Digital Native.

6. Had the developed learning activity model checked and revised by the research advisor.

7. Created research instrument namely the evaluation form for the suitability of learning activities based on Connectivism concept for Digital Native

8. Had the instrument checked for content validity through the Index of Item Objective Congruence (IOC) by 5 experts. The selected questionnaire ranged between 0.50-1.00. It was found that the suitability of questionnaire from the IOC was at 0.83.

9. Had the learning activity model based on the concept of Connectivism for Digital Native checked for the suitability by 12 experts and made a conclusion.

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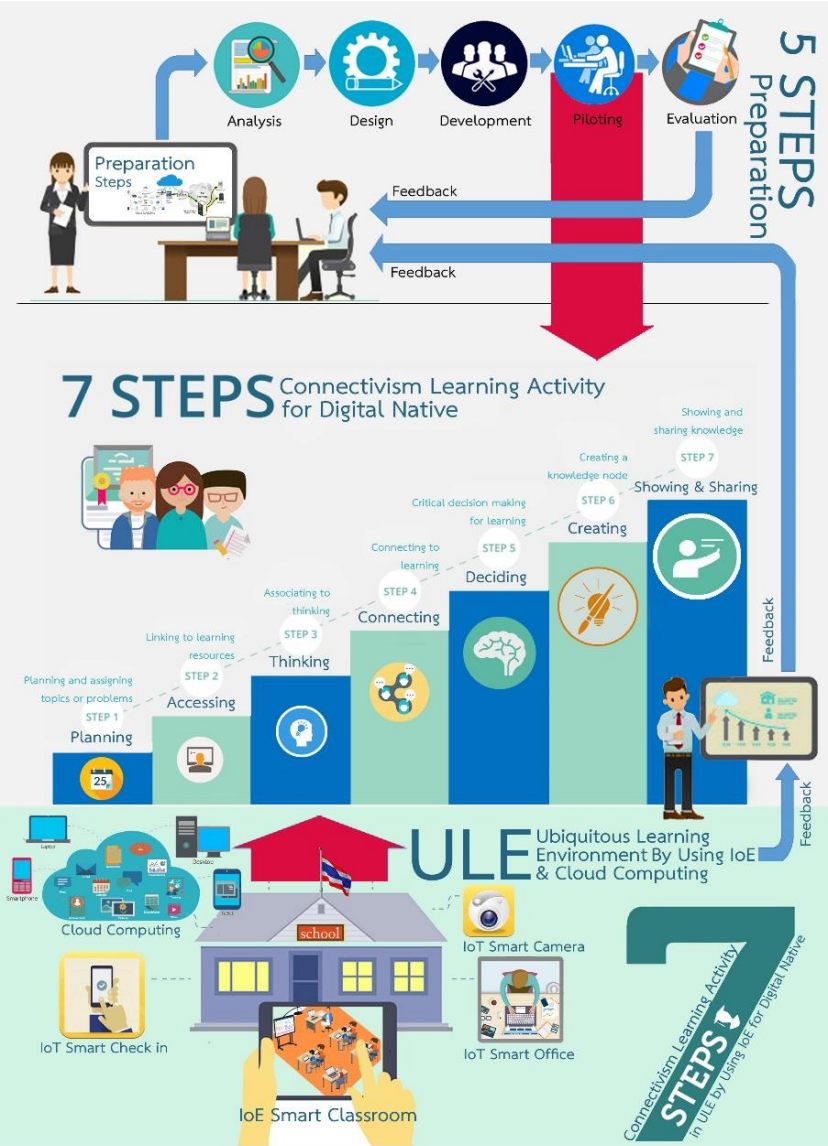
Results

The results of the developed learning activity model based on the Connectivism under the Ubiquitous learning environment by using IoT for Digital Native are as follows:



Figure; Disign of Connectivism Learning Activity in Ubiquitous Learning Environment by Using IoE for Digital Native (Sarnok, 2017)

Figure 2. Connectivism Learning Activity in ULE by Using IoE for Digital Native Model

Part 1: Preparation and application of activities consisting of 5 steps as follows:

1. Analysis step covers needs analysis, curriculum analysis, module analysis, learner analysis and learning task analysis

2. Design step covers content design, learning task and learning environment

3. Development step covers the development of learning activities and digital instrument in regular context

4. Piloting step covers the preliminary tryout of the developed learning activity model based on Connectivism in Ubiquitous learning environment by using IoE. This step consists of the following 7 steps:

4.1 Planning includes planning, assigning tasks or learning goals for each activity based on individual's learning context under coaching of instructor

4.2 Accessing includes the link and accessibility to learning resources through IT tools and data management from cloud computing resources that are consistent with the topic or subject matter of the study.

4.3 Thinking includes connecting thinking from analyzing and interpreting content, key concepts, principles and theories. Learners may study by themselves, exchange knowledge with other learners and summarize main points for further study and activity.

4.4 Connecting includes the link of learning. Learners need to distinguish, discuss and exchange main points with other learners and instructors and create new ideas from their own analysis.

4.5 Deciding includes critical decision making. Learners are required to have critical mind in order to make meaningful decision based on morals, ethics, academic accuracy and social interests.

4.6 Creating includes the creation of new knowledge nodes e.g. new ideas, new content, new principles and new theories to develop, for examples, new media, new works, new research studies and new innovations.

4.7 Showing and Sharing includes knowledge transference which learners present, describe and distribute their own works as resources to network on Cloud computing.This emphasizes on the knowledge transference for sustainable knowledge.

5. Evaluation step covers knowledge evaluation, skill assessment and evaluation of learners' attitude as follows:

5.1 Knowledge evaluation is the evaluation of learning progress, content knowledge and revision of content.

5.2 Skills assessment is the assessment of ICT skills, use of technology and information, knowledge and skills related to learning module.

5.3 Evaluation of learners' attitude is the evaluation of perception of usage, satisfaction and others related to learning through Connectivism learning activities in Ubiquitous learning environment by using IoE.

Part 2: Ubiquitous learning environment combined with the use of IoE technology are as follows:

This part involves the application of Internet of Every Thing technology (IoE) to create a Smart Classroom with U-Learning environment in combination with cloud computing. The classroom consists of three facilitating systems for teaching and learning:

1. IoT Smart Check in System is the use of electronic tagging, sensor, and environment monitoring to report to learners and instructors through their own smart devices, for example, attendance time, learners' health readiness, classroom temperature, academic results statistics, etc. The data will be collected on the Cloud, so that instructors will be able to use the data for analysis and design of instructional management or design learning the next time.

2. IoT Smart Camera System is a system for observing and storing photos and video in the classroom. This can be instructed and controlled by instructors to check classroom environment, readiness and safety, and to observe learners' learning activities through the camera installed. It is also used as a teleconference system.

3. IoT Smart Office System is a system that facilitates instructors and learners to organize learning activities. This includes basic office equipment such as computers, scanners, 3D printer, electronic board, or other devices based on Ubiquitous environment using additional IoE technology to serve the needs, budgets, and technology possibilities.

Results of Evaluation of Learning Activity

Table 1 The evaluation of the appropriateness of the learning activities based on Connectivism learning activity in Ubiquitous learning environment by using IoE for Digital Native

Issues	Level of appropriateness		
	$\bar{X}$	S.D.	Description
1. Preparation for learning in Ubiquitous learning environment by using IoE			
1.1 Analysis step	4.50	0.58	Highest
1.2 Design step	4.92	0.15	Highest
1.3 Development step	4.75	0.38	Highest
1.4 Piloting step	4.83	0.28	Highest
1.5 Evaluation step	4.33	0.67	High

Table 1

2. Preparation of Ubiquitous learning environment by using IoE			
2.1 IoT Smart Check in System	4.50	0.50	Highest
2.2 IoT Smart Camera System	4.33	0.56	High
2.3 IoT Smart Office System	4.83	0.31	Highest
3. Application of learning activities based on Connectivism learning activity in Ubiquitous learning environment by using IoE			
3.1 Planning	4.50	0.58	Highest
3.2 Accessing	4.67	0.50	Highest
3.3 Thinking	4.75	0.38	Highest
3.4 Connecting	4.92	0.15	Highest
3.5 Deciding	4.75	0.38	Highest
3.6 Creating	4.83	0.28	Highest
3.7 Showing & Sharing	4.42	0.58	High
Total	4.66	0.41	

Table 1 shows the appropriateness of the Connectivism learning activities in Ubiquitous learning environment for Digital Native with the Internet of Every Thing rated by 12 experts. According the table, it was found that the appropriateness of learning activity model was at very high level ($\overline{X}$ = 4.66, SD = 0.41).

When considering in each step, it was found in the first phrase, the preparation for learning in the Ubiquitous learning environment by using IoE, that the design step was rated the highest appropriateness at the highest level ($\overline{X}$ = 4.92, SD = 0.15), and the evaluation step was rated the lowest appropriateness at high level ($\overline{X}$= 4.33, SD = 0.67). However, the evaluation was not clear because of variety of activities, students' application of activities according to their aptitude, learning environment and the availability of technology.

In the second phrase, the preparation of Ubiquitous learning environment by using IoE, the results showed that IoT Smart Office was rated the highest ($\overline{X}$ = 4.83, SD = 0.31), and IoT Smart Camera was rated the lowest ($\overline{X}$ = 4.33, SD = 0.56). Because learners and instructors felt like being watched and monitored all the time, they were wary and lacked of concentration.

In the third phrase, the application of learning activities based on Connectivism learning activity in Ubiquitous learning environment by using IoE, it was found that connecting step was rated the highest ($\overline{X}$ = 4.92, SD = 0.15), and showing and sharing was rated the lowest ($\overline{X}$= 4.42, SD = 0.58). Because it is an advanced skill, learners have to study and build up enough knowledge before distributing their knowledge correctly.

Apart from the mentioned highest and lowest of application of learning activities, the appropriateness can be ranged from high to low as follows: creating the knowledge node ($\overline{X}$ = 4.83, SD = 0.28), connecting ($\overline{X}$ = 4.75, SD = 0.38), deciding ($\overline{X}$ = 4.75, SD = 0.38), accessing ($\overline{X}$= 4.67), SD = 0.50) and planning ($\overline{X}$ = 4.50, SD = 0.58), respectively.

Disscussion the Results

Connectivism learning activity in a Ubiquitous learning environment by using IoE for Digital Native is a model developed based on Connectivism theory. It concerns the study of learning lifestyle of Digital Natives who access learning resources and facilitate their learning through technology. The developed learning activity model consists of 7 activities: 1) Planning, 2) Accessing, 3) Thinking, 4) Connecting, 5) Decided, 6) Creating and 7) Showing & Sharing. This is consistent with a study of Ruamkaew et. al (2016) about three components of learning activity based on Connectivism to support creativity of undergraduate students. The components are 1) learning environment 2) context and 3) six steps of learning process (problem solving, connect node, self monitor, create and construct, evaluation and share). Also, it is consistent with what Bunnapasut, P. (2014) mentioned about 8 cores of learning based on Connectivism theory of Siemens as follows: 1. learning and knowledge rest in diversity of opinion, 2. learning is process of connecting specialized nodes or information sources, 3. learning may reside in non-human appliances, 4. capacity to know more is more critical than what is currently known, 5. nurturing and maintaining connections is needed to facilitate continual learning, 6. ability to see connections between fields, ideas, and concept is a core skill, 7. currency accurate up to date knowledge is the intent of all Connectivism learning activities and 8. decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. In the study of Internet-based instructional model based on Connectivism at Chaiyaphum Rajabhat University, it was found that the Internet-based learning activity “A4S Learning Model” consisting of 1) awareness, 2) specification, 3) start, 4) summary and 5) show & share (Nitisak & Pattanasit, 2014). In the studies in UK institutions to investigate the effects of using

Connectivism, the results showed that the Connectivism is an apporipate learning theory for the digital age used to create learning activities (Garcia, E. et. al, 2013).

The Ubiquitous learning environment for Digital Native with the Internet of Every Thing system was designed using Cloud computing technology and smart classrooms consisting of three systems: 1) IoT Smart Check in, 2) IoT Smart Camera and 3) IoT Smart Office. These are designed to support and facilitate learners' learning through portable digital devices which connected to the Internet at any time to search, report and use through Cloud computing. This is consistent with what Lertchaiprasert, P. et. al (2012) mentioned that the Ubiquitous learning environment (U-Learning) is the harmonious combination of both the computer and the physical world. It is the use of desktop PC, notebook computer, PDA, mobile phone, tablet PCs and so on to access information technology through the Internet anywhere and anytime. Phumeechanya, N. et. al (2015) said that instruction needs to emphasize on learners. The U-Learning environment or Ubiquitous Learning Environment (ULE) provides learning environment that enables learners to access learning resources anywhere at any time though portable devices. The Ubiquitous learning environment consists of 4 parts: 1) mobile device, 2) wireless communication, 3) ubiquitous learning management system, and 4) learning context detection. Ubiquitous learning is the use of Ubiquitous learning technology for instruction. It is considered learning development that enables learners to learn anywhere at any time through variety of portable devices not only PC. This offers flexibility and quickness in learning under the availability of Internet connection (Laisema, S. et. al, 2015).

Ubiquitous learning can be effectively applied to Constructivism which employs learning theories to construct a link between learners' knowledge and environment. (Laisema, S. et. al, 2015). Additionally, instructors need skills to motivate, give advices and prepare relevant learning resources for learners. This is called scaffolding or assisting learners in the form of supporting them. Instructors decrease the level of support gradually until learners can be responsible to achieve any tasks by themselves (Phumeechanya, N. et. al, 2015). One of the suitable theories for U-Learning is the problem-based learning (PBL) which refers to a method of teaching and learning that support learners' problem-solving skills. Learners will construct new knowledge from authentic context of learning (Phumeechanya, N. et. al, 2015).

Suggestions

In this learning management, there are several theories that can be applied to design instruction for digital Native who possesses high technology skill. However, it is important to consider the learners' educational levels, content and efficiency of the technology. This is consistent with what Hayeewangah, N. et. al (2012) mentioned that the dimension of the learners is the main thing to consider when setting up Ubiquitous learning environment. Learners must control their own self-study method and apply various learning methods to autonomous learning. Learning process and the learning outcome will relate to experience and building up new experience. And learners will create meaning though understanding and lifelong process. Another dimension is supporting factors which encourage learners to control self-learning from situations and media from individuals, families, communities, society, work experience, daily living and from both existing and natural environments.

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