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Development of Instructional Model Based on Connectivism Learning Theory to Enhance Problem-solving Skill in ICT for Daily Life of Higher Education Students

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Abstract

This research explores that the instructional model based on connectivism learning theory to enhance problem-solving skill in ICT for daily life of university students as well as its impact in the classroom on learning and teaching, especially in student's problem-solving skill and practices that refer to awareness, connection, and contribution process as part of the learning efficacy improvements. In this process, web technology particular social networking site has a necessary role to engage and integrate knowledge and learning activities within the problem based learning (PBL) process. In this respect, this research aims to study and develop the appropriate instructional model based on connectivism learning theory to enhance problem-solving skill in ICT for daily life by the 10 experts' opinion. The research results exhibited that the instructional model based on connectivism learning theory via web-based learning was appropriated and raised the level of problem-solving skill among students.

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Keywords: Connectivism, Information and communications technology (ICT), Problem-solving.

Nomenclature

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|---|---|
| A | Connectivism Learning Theory |
| B | Connectivism Taxonomy |
| C | Information and communications technology (ICT) |
| D | Problem-solving |

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Introduction

There is a need for students to learn these important learning and innovation skills in order to be successful in the work and life. For the 21st century skills, the students need to be taught to facilitate their success in the future. Students need to attain the “3R’s & 4C’s”—Reading, Writing, Arithmetic, Critical thinking and problem solving, Creativity and Innovation, Communication, Collaboration—which are the most important and necessary 21st century skills as defined by businesses, economists, and education experts (Partnership for 21st Century Skills, 2011).

In Thailand, education reform for the 21st century that will lead to a unity of purpose and action among Thai and international educators to realize the goals set forth in the National Education Act (NEA) of B.E. 2542 (1999). This education reform is a move toward student-centered learning and a student-centered classroom. The intentions of NEA aim to improve education on the basis of lifelong learning, social contribution in education, and the development of new content and learning processes. According to Fry (2002), the issues of quality standards, learner-centered approaches, the role of the private sector, and structural reform in decentralization of education to local organizations are significant in this Act. Four new factors have been added to streamline education reform, including (a) quality of the new generation of Thais; (b) new generation of teachers; (c) new generation of educational facilities and centers; (d) new educational administration system which aims at decentralization. Specifically, Section 24 of the Education Act outlines what must be done to improve education performance: (a) arranging learning in line with the students’ interests, aptitudes and individual differences; (b) training students in thinking abilities, especially critical thinking; (c) organizing learning activities that draw from authentic experiences; and (d) promoting situations where learners and teachers learn together.

An aspect of student-centered learning involves questions learners themselves generate from direct experiences. In student-centered learning, the teacher has a number of roles, including scaffolding questions of students when needed in order to make the initial questions more accessible to answering and anticipating sufficient time and tools that help learners pursue their own questions.

In addition to addressing these key issues of education reform in Thailand, indeed in international education, we also focus our attention and resources on the goal of promoting Thai teachers to reach their potential as skilled teachers using teaching methods that engage their students with the result that students love to learn through self discovery. The goal of the education reform is to instill learners with skills that are compatible with the changing economic landscape in the 21st century skills (e.g., critical thinking and problem solving, communication, collaboration, and creativity).

ICT has become an indispensable part of the 21st century. Having basic ICT skills is now seen as an important attribute that students should possess in order to be successful in life. Because of the digital age, there is new learning theory which related ICT workplace and the 21st century skill. It is the connectivism learning theory.

Connectivism learning theory (Siemens, 2005, 2006) and connective knowledge (Downes, 2006) as ways to understand and explore learning in the digital age are timely and particularly useful, both in what they offer and what they question. The idea of organizations as cognitive systems where knowledge is distributed across nodes traces back to the perceptron and is directly borrowed from connectionism, "a paradigm in cognitive sciences that sees mental or behavioral phenomena as the emergent processes of interconnected networks of simple units". The network metaphor allows a notion of "know-where" (the understanding of where to find the knowledge when it is needed) to supplement to the ones of "know-how" and "know-what" that make the cornerstones of many theories of learning.

Siemens (2005) states the eight principles of connectivism, which are also currently through Siemens' writings in Wikipedia.

1. Learning and knowledge rests in diversity of opinions.
2. Learning is a process of connecting specialized nodes or information sources.
3. Learning may reside in non-human appliances.
4. Learning is more critical than knowing.
5. Maintaining and nurturing connections is needed to facilitate continual learning.
6. Perceiving connections between fields, ideas and concepts is a core skill.
7. Currency (accurate, up-to-date knowledge) is the intent of learning activities.
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. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

Siemens (2006) proposed connectivism taxonomy that a staged view of how learners encounter and explore learning in an ecological leaning community or networked manner. The taxonomy begins with the basic and moves to the more complex:

1. **Awareness and receptivity** – at this level learners acquire basic skills for handling information abundance, have access to resources and tools. (e.g., internet, blogs, wikis, aggregators)
2. **Connection-forming** – at this level learners begin to use tools and understanding acquired during level 1 to create and form a personal network. Learners are active in the learning ecology/space in terms of consuming or acquiring new resources and tools. Selection (information filtering) skills are important. Affective/emotive factors play a prominent role in deciding which resources to add to the personal learning network.
3. **Contribution and involvement** – at this level learners are fairly comfortable within their self-created network (though instructors or teachers may continue to guide and direct their access to particularly valuable resources toward intended educational competencies or outcomes). The learner begins to actively contribute to the network/ecology – essentially, becoming a ‘visible node’. The learner’s active contribution and involvement allows other nodes on the network to acknowledge his/her resources, contributions, and ideas – creating reciprocal relationships and shared understandings (or, if wikis or social bookmarking is used, collaboratively-created understanding). The learner should also be capable of choosing the right tool for the right learning task. For example, the learner may opt to take a course, attend a conference, solicit a mentor, or subscribe to blog feeds – all based on what the learner needs to know, do, or believe. Selecting the right element within the learning ecology is valuable in ensuring the efficiency and effectiveness of the learning process.
4. **Pattern recognition** – at this level the learner is “network aware” and competent. As a dynamic participant in the ecology, the learner has moved from passive content consumption to active contribution. Time in the network has resulted in the learner developing an increased sense of what is happening in the network/ecology as a whole. Having mastered the basics of being a participant, the learner is now capable to recognize emerging patterns and trends. Experience within the network has resulted in the learner understanding the nuances of the space (online or physical). The longer the learner spends in the learning space, the more adept she/he will become at recognizing new patterns or “changing winds” of information and knowledge.
5. **Meaning-making** – at this level the learner is capable of understanding meaning. What do the emerging patterns mean? What do changes and shifts in trends mean? How should the learner, adjust, adapt, and respond? Meaning-making is the foundation of action and reformation of viewpoints, perspectives, and opinions.
6. **Praxis** – at this level, the learner is actively involved in tweaking, building, and recreating their own learning network. Metacognition (thinking about thinking) plays a prominent role as the learner evaluates which

elements in the network serve useful purposes and which elements need to be eliminated. The learner is also focused on active reflection of the shape of the ecology itself. The learner may engage in attempts to transform the ecology beyond his/her own network. Praxis, as a cyclical process of reflection, experimentation, and action, allows the learner to critically evaluate the tools, processes, and elements of an ecology or network.

Connectivism is a theoretical framework for understanding learning. In connectivism, the starting point for learning occurs when knowledge is actuated through the process of a learner connecting to and feeding information into a learning community (Kob and Hill, 2008).

The problem solving skill as an individual thought process because the previously learned law can be applied in solving problems in any situations (Jonassen, 2003). It is also deemed to be a new type of learning and is the result of application of knowledge and procedures of the problems (Mc Gregor, 2007). Generally, each individual requires knowledge and skills to solve problems (Taconis et al., 2000). Halakova and Proksa (2007) stated that the solution of problems in any subject area is a highly complex human behavior. This matter is documented in a large number of studies and articles which have appeared in journals of research and teaching. It has reflected a new interest regarding how students solve problems. Problem solving has always been a stumbling block for students who are studying chemistry, and most of the teachers in the field of chemistry are aware of this. According to Jawhara (1995), problem solving activities can open opportunities for students to learn freely. In their own ways, students will be encouraged to investigate, seek for the truth, develop ideas, and explore the problem. Students are also trained not to be afraid to try various ways to solve problems, as well as having the courage to make decisions, act on the decisions and be responsible for the products of the action. The experiences gained through problem solving will help our students to become progressive, creative and ambitious. These features are necessary in order to face the challenges of becoming a developed country based on science and technology (Lim et al., 1999). Problem solving is also deemed to be what is done by an individual when faced with a question or situation where the solution is not available. In seeking a way out from any obstacle, students should think, make decisions and use specific strategies. Therefore, to achieve this, the activity of thinking and skills to rationalize a solution plays an important role. It will require students to generate and induce a systematic and logical thinking. This ability requires students to follow certain steps and logic because it requires a revision to determine the reasonableness of a settlement. Thus, any successful attempt will encourage a students' positive attitude towards problem-solving skill.

According to Reid and Yang (2002), a problem exists when a person feels the gap between where it is and where it should be but do not know how to cross the gap. This broad definition also covers social issues and what might be stereotyped exercises by problem-solving trainers. Students' problem solving abilities is the desired result after going through the process of continuous education as emphasized in the National Education Philosophy and Philosophy of Science Education. Troubleshooting is also the highest hierarchy of learning by Gagne (1985) and problem solving ability reflects the level of student learning. According to Robinson (2003) the ability to solve problems is being considered as an integral part of each science course. In addition to strengthening and clarifying the principles taught in each lesson, systematic approach to problem solving enable students to learn better.

Furthermore, they will have to explain their thoughts and thus promote intellectual development. This ability enhances students' opportunities when they are faced with daily lives problems. Although the benefits of problem solving as an educational tool has long been known, appreciating the skills, techniques and procedures required for effective problem solving have not been adequately taught specifically. This teaching method is significant in order to address and solve problems involving new situations.

Concurrently, application of knowledge and skills which are based on connectivism learning theory and ICT will enable students to make decisions and solve problems in life more effectively. As a result, they will be able to explore the treasures of nature, adapt to the environment, make innovative creations, and even manage to overcome problems and difficulties. Hence, these visions become one of the goals emphasized in the national curriculum, especially in science education.

Interest in this approach to learning has been maintained because fundamental ideas underlying PBL have related directly to connectivism taxonomy concepts about teaching and learning in ICT, and to ongoing debate about the nature of professional practice. By framing courses around “real” problems in the context of “real” practice, PBL has presented a coherent and practical approach to learning which incorporates “active” rather than “passive” approaches to the development of critical thinking skills, problem-solving skills, experiential and social learning in the form of collaborative inquiry based on engaging with authentic problems, and more dynamic interactions between teachers and learners based on respect for students prior learning and experience (Hendry, Frommer, & Walker, 1999; McPhee, 2002)

Thus, the main purpose of this study is to analysis and design learning activities styles to be appropriate with the learners that integrated with the concept of connectivism learning theory and problem based learning. The question then becomes, “How to develop the appropriate instructional model based on connectivism learning theory; and to what extent the online learning environments were associated with certain learner characteristics”. The expected benefits are the appropriate model that is the systematic approach to enhance university student’s problem-solving skill. More over the results of quality assessment of instructional model that is body of knowledge to develop the problem-solving skill of students. In addition the results can be the information to support the higher education systems policy.

Objective

This exploratory sought to study, develop, utilize, and evaluate the instructional model based on connectivism learning theory to enhance problem-solving skill in ICT for daily life of based on connectivism learning theory to enhance problem-solving skill in ICT for daily life of higher education students.

Methodology

The research procedure includes three phases:

The first phase: Studying the instructional model based on connectivism learning theory to enhance problem-solving skill in ICT for daily life of higher education students (Rampai and Sopeerak, 2011).

1. Analyzing the elements of connectivism learning theory are included the elements of the connectivism taxonomy states (Awareness & receptivity, Connection-forming, Contribution & involvement, Pattern recognition, Meaning-making, Praxis).

2. Analyzing the elements of social networking are included the elements of web-based learning, learning management system (LMS) with social media, m-learning (tablet & smart phone).

3. Analyzing the elements of ICT for daily life are included ICT competency- the body of knowledge and skills an individual must possess at a recognized level of competence in specific ICT for daily life.

4. Analyzing the elements of the 21st century skills: problem-solving skill by using problem-based learning (PBL) process.

5. Integrating the elements of connectivism taxonomy, social networking, ICT competency for daily life, and problem-solving skill.

The second phase: Developing the instructional model based on connectivism learning theory to enhance problem-solving skill in ICT for daily life of higher education students.

The third phase: Evaluating the instructional model based on connectivism learning theory to enhance problem-solving skill in ICT for daily life of higher education students by using focus group discussion method. The participants of this study were specialists who were involved in curriculum and instruction, instructional design, information and communication technologies from universities in Thailand. There were ten experts focus group discussion in accreditation the developed instructional model based on connectivism learning theory to enhance problem-solving skill in ICT for daily life of higher education students.

Results

After the ten experts’ focus group had evaluated the developed instructional model, they suggested the opinion that the design instructional model based on connectivism learning theory to enhance problem-solving skill in ICT for daily life of higher education students is developed to be in the high level of appropriateness. The instructional model based on connectivism learning theory to enhance problem-solving skill in ICT for daily life was appropriated with the quality of learning, as called “pbCONNEC model”, detail are as follow:

1. The learning input is including the Conceptual framework and Motivation.
2. The online learning processes are driven connectivism (Awareness, Connection, and Contribution) within the problem-based learning or PBL approach (Problem assigned, Identify what we need to know, Learn what we don’t know, and Apply it to solve the problem).
3. The learning outcomes consist of Knowledge, Attitude, and Skill (Figure 1).

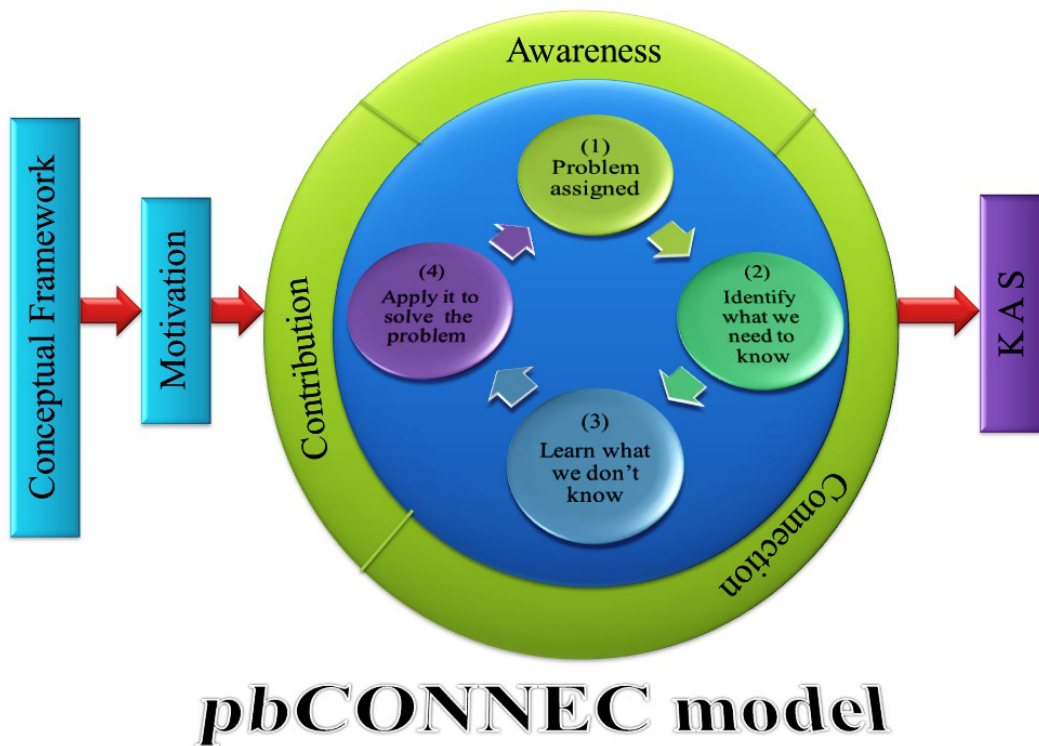


Figure 1: pbCONNEC model, the instructional model based on connectivism learning theory to enhance problem-solving skill in ICT for daily life of higher education students.

Conclusions

The research results exhibited that the instructional model based on connectivism learning theory to enhance problem-solving skill in ICT for daily life of higher education students was appropriated and fit to the quality of education. The study was successful in connectivism learning theory the importance of incorporating problem-solving skill approaches in order to enable learners to acquire the 21st century skills, and create a learning environment where they are engaged in the dynamic contents and process. Here the results provide very suitable and encouraging results for using ICT for daily of higher education student.

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