

*The Effect of Project-Based Learning on Cloud Computing
to Enhance Collaborative Skills*

Siripon Saenboonsong, Phranakhon Si Ayutthaya Rajabhat University, Thailand

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Abstract

Learning by Doing is the key factor in acquiring knowledge through practice from their own experiences. It addresses teaching methods, which are believed to achieve a beneficial outcome to the learning ability of students. This study investigated the effect of combining a Project-based Learning (PjBL) with Cloud Computing. The learning and teaching model designed was based on the PjBL seven steps principles using the cloud computing on six components as a tool for learning management and the PjBL activities to increase motivation and collaborative learning. Thirty-three undergraduate students taking a Innovation and Technology for Science Teachers course were required to work in groups to complete a PjBL project. The students will be assigned to work cooperatively to create projects using tools on cloud computing. The teacher acts as a facilitator and provide the students with a good learning environment. Results indicate that the learning and teaching method had a positive impact of on the development of Collaborative Skills of the students which are useful for their daily and work life after graduation.

Keywords: Project-based Learning, Cloud Computing, Collaborative Skills

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Introduction

In recent years, Thailand educational technology and social developments has been changed via a new techno-cultural revolution to improve any active learning methods which can influence both instructors and students (Adkins, 2002). Resulting in a developed instruction, this output generates a new principle of learning for students. Many institutions are embracing these technologies into their system. Especially in education, development, science and technology applications have influenced the learning process (Inthachot, Sopeerak, & Rapai, 2013). Thus, this technology can be used to encourage learning process, support communication setting, assess learning activities, manage resources and create learning materials (Che Ku Nuraini, Faaizah, & Naim, 2014).

One of the newest technologies for online learning is cloud computing that has garnered a considerable amount of attention. In particular, students and teachers have to use applications without installing the cloud into their computers. They are also allowed an any access to save files from their own computer under internet connections (Siegle, 2010). In such a model, users access services based on their requirements without regard to where the services are hosted or how they are delivered (Buyya et al., 2009). Thus, these technologies must be suitable to the essential skills. Interestingly, students have leant pre-skills or fundamental abilities of the technologies from schools, and they are capable to build up and study new skills during undergraduate period (Vockley, 2007; Nevin, 2009).

The distinctive features of indigenous education are learning by doing, learning through authentic experiences, individualized instruction, and happy learning (Ratana-Ubol, & Henschke, 2015). One model of learning that emphasizes collaborative skills of students is a Project-based learning (PjBL). This learning model allows students to develop their creativity in designing and creating a project that can be used to overcome the problems. PjBL is a comprehensive approach to classroom teaching and learning that is designed to engage students in investigation of authentic problems in a learning environment that fosters creativity and teamwork, and advocated for more student-centered and experiential approaches to education that support deep learning through active exploration of real-world problems and challenges (Blumenfeld et al., 1991; Pellegrino & Hilton, 2012). During to do the project, students will be trained and developed their communication skills of observing, using tools and materials, plan projects, applying the concepts, ask questions, and communication through technology. They must apply those skills to create a work from any situations, problems or interests of learners.

This article is describing an existing the effects of PjBL on cloud computing to support meaningful learning outcomes. The core of the discussion. All students worked collaboratively with PjBL using cloud computing tools for their learning. Students expressed problems as a challenge or a question that must be exchange ideas and managed their own time to complete the project.

Methodology

1. Participants

The participants were undergraduate students who registered the innovation and information technology for Science teachers course in the second semester of 2017 academic year, Faculty of Education, Phranakhon Si Ayutthaya Rajabhat University, Thailand. The students were 33 undergraduate students in Major of Science, Faculty of Education divided into 7 groups which the activities were run parallel by seven steps of PjBL.

2. Learning process

The researcher studied the document and related research then synthesize the learning process of teaching was found process of learning consist of seven steps as shown in Figure 1.

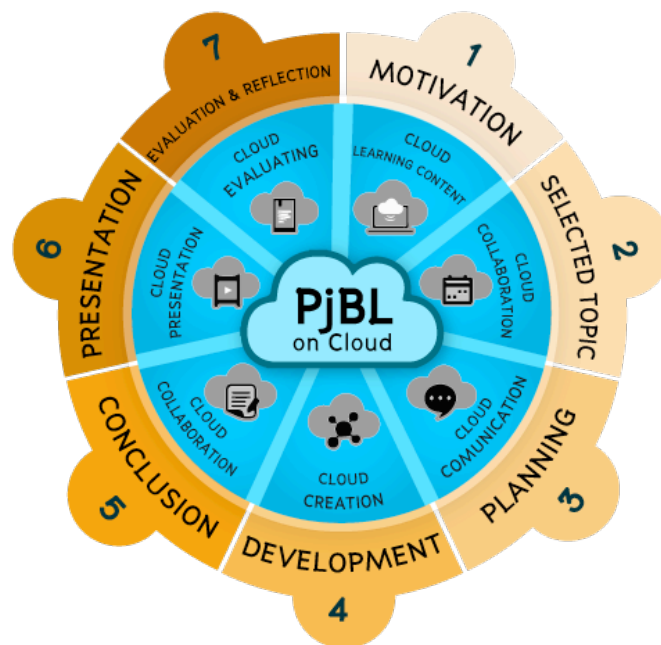


Figure 1: Learning process of PjBL on Cloud Computing

2.1 Motivation

The first phase of learning. Students were activated via questions or problems and designed a project to solve their interested topic which was based on an actual content through the tool or system to manage the learning. The teacher will upload the content and instructional materials onto the web site for students to easily access. At this point, teacher and students can communicate via the communication tools provided by the system, such as Edmodo, Edpuzzle, Google Classroom, etc.

2.2 Selected Topic

Each team of students was chosen the project topic based on their knowledges and experiences. In case the students had less experiences providing case studies, it was important to provide access to relevant experiences. Students could refer to them by linking relevant experiences as a way for learners to connect their experiences to learning. Students could use the tools to create together and fix it simultaneously. To create a document or collect documents of those involved in teaching. Examples of collaboration tools such as Google Drive, Google Docs, Google Calendar, Diigo, Linoit, etc.

2.3 Planning

The team of students was discussed, planned, and executed on the topic received. It was step that students need to think creatively ideas consist of designed to work a lot, think in many different ways, think a new idea and more complete details. Students could use the tools to communicate with their team, teacher and the expert in anytime anywhere for advice and suggestion. Examples of communication tools such as Google Hangout, Line, Google+, etc.

2.4 Development

The project was developed according to the operational plan. Students created a project that designed to be complete, clear and distinctive in terms of the identity of their team. Teacher gave advice that encourages the students to use the thinking process to correct the learning task that leads to creativity. Students chose tools that promoted the development of their work through the website, resulting in a collaborative skill. Examples of creation tools such as Google Drawings, MindMeister, Pixlr Editor.

2.5 Conclusion

The students summarized the thinking of the work process more clearly and accurately. The teacher and expert provided guidance and encourage the students to think of finding answers to unmet mission to learn actively through collaboration tools.

2.6 Presentation

Students created a media presentation using cloud presentation tools that convey the ideas of the team prominently in front of the class, classmates asked questions and exchange ideas with each other. Examples of presentation tools such as Google Slides, SlideShare, Issuu, Prezi, Emaze, etc.

2.7 Evaluation and Reflection

It was the final step of project. Teacher, expert, and classmates shared idea and change their experiences in order to broaden their perspective could further improve the project for the future. The evaluation was based on cloud evaluating tool with clear

scoring criteria. Examples of evaluating tool such as Google Form, Google Sheets, Rubistar etc.

Data Collection and Analysis

The students performed seven steps activities over a five weeks' period using a cloud computing tools and group work together. The teacher assigned the students to design project about video media on scientific knowledge while each student during the design of the project, the teacher observed the behavior of each member within the team encourage participants to express their opinions and work with students to complete their project then evaluate the collaborative skills after that to analyze the mean and standard deviation.

This study developed the evaluation form of collaborative skills by the concept and theory of Friend & Cook (1992) and Randy, Ken, & Alan (2014) had actual conditions assessment with multiple rating scales using five-level rubrics, consisted of 5 factors and 15 questions and the reliability of the evaluation was .83 at high reliability as shown in Table 1.

Table 1: Scoring Criteria for Measuring Collaborative Skills

Factors	Scoring criteria
1. The voluntary and willing to work	
1.1 Preparation	Prepare to work as a team
1.2 Participation in work	- Provide useful information and feedback - Provide a leadership skill - Attempt to engage with the team
1.3 The enthusiasm to tackle the problem	Be enthusiastic, try to solve problems arising from their own ideas
2. The goals of the work	
2.1 Targeting	- Engage the target team clearly - Provide feedback and useful comments and suitable immediately
2.2 Planning the work	- Engage in team planning - Provide feedback and useful comments and suitable immediately
2.3 Quality of targeted work	Can work on the target and achieve the quality work of its target
3. The interaction with others	
3.1 Communication for the exchange of ideas	Talking to team members on a regular basis on various issues that are beneficial to work
3.2 Working with others	- Participate in all team work processes - Support the work of all the team
3.3 Listening and understanding the ideas of others	- Listen to the opinions of others - Do not criticize the opinions of others in a negative light - Try to understand the ideas of others, and can be deployed in the operation.
4. Responsibilities	

Factors	Scoring criteria
4.1 Time Management	- Manage time in work to be done in time - Have responsibility, do not modify the deadline to submit applications
4.2 Attention to work	- Have commitment to work and what needs to be done continuously - Can control their own work as assigned
4.3 Working on their duties	- Can work on their own as well, no defects - Help the others
5. Shared resources	
5.1 Search and storage	- Find the information from a variety of sources - Save the searched data in every detail
5.2 Information gathering for sharing	- Gather information that you find yourself and from team members - Share all information to be able to get to work
5.3 Sharing information	- Cooperate to synthesize information - Select the appropriate information for team work from different sources

Interpretation Levels of Collaborative Skills meaning as:

Score	Range
4.51 – 5.00	Very Good/Highest
3.51 – 4.50	Good/High
2.51 – 3.50	Intermediate
1.51 – 2.50	Poor
0.00 – 1.50	Need to be improved

Results

The result divided into 2 parts: as 1) Collaborative Skills, and 2) Satisfaction of Learners.

Table 2: Overall of Collaborative Skills

Factors	\bar{x}	S.D.	Level of meanings
1. The voluntary and willing to work	4.47	0.56	Good
1.1 Preparation	4.48	0.57	Good
1.2 Participation in work	4.29	0.53	Good
1.3 The enthusiasm to tackle the problem	4.65	0.55	Very Good
2. The goals of the work	4.58	0.60	Very Good
2.1 Targeting	4.55	0.57	Very Good
2.2 Planning the work	4.55	0.62	Very Good
2.3 Quality of Targeted Work	4.65	0.61	Very Good
3. The interaction with others	4.32	0.53	Good
3.1 Communication for the exchange of ideas	4.32	0.54	Good
3.2 Working with others	4.32	0.54	Good
3.3 Listening and Understanding the	4.32	0.54	Good

Factors	\bar{x}	S.D.	Level of meanings
ideas of others			
4. Responsibilities	4.32	0.57	Good
4.1 Time Management	4.29	0.59	Good
4.2 Attention to work	4.29	0.59	Good
4.3 Working on their duties	4.39	0.56	Good
5. Shared resources	4.46	0.56	Good
5.1 Search and storage	4.32	0.54	Good
5.2 Information gathering for sharing	4.52	0.57	Very Good
5.3 Sharing Information	4.55	0.57	Very Good
Overall	4.43	0.57	Good

Table 2, results showed that overall collaborative skills of learners that learned with PjBL model was classified as good score at $\bar{x} = 4.43$, S.D. = 0.57. This finding implied that the PjBL model provided a positive influence over successful in collaborative skills of students.

Table 3: The Satisfaction of Learners

Factors	\bar{x}	S.D.	Level of meanings
1. The process of learning and teaching	4.47	0.50	High
1.1 Preparation before learning	4.42	0.50	High
1.2 The process of PjBL	4.52	0.51	Highest
1.3 Measurement and Evaluation	4.48	0.51	High
2. Support for learning and teaching	4.55	0.51	Highest
2.1 Cloud learning manage tools	4.58	0.50	Highest
2.2 Cloud collaboration tools	4.58	0.50	Highest
2.3 Cloud communication tools	4.84	0.37	Highest
2.4 Cloud creativity tools	4.35	0.55	High
2.5 Cloud presentation tools	4.48	0.51	High
2.6 Cloud evaluation tools	4.48	0.51	High
3. The benefits that learners receive	4.63	0.48	Highest
3.1 benefit from teaching and learning	4.68	0.48	Highest
3.2 contributions can be developed collaborative skills	4.68	0.48	Highest
3.3 should be teaching this course to others	4.48	0.51	High
3.4 can be guideline for developing other learning	4.71	0.46	Highest
3.5 students are happy with the teaching	4.61	0.50	Highest
Overall	4.56	0.50	Highest

According to the table 3, the satisfaction of learners after learning with the PjBL model found that the learners satisfied with the designed instruction at the highest level ($\bar{x} = 4.56$, S.D. = 0.50), the most satisfied topic was “cloud communication tools” which was 4.84 of mean and 0.37 of standard deviation.

Conclusion

The aforesaid results imply that the PjBL model have a positive influence over learners' success to working together because PjBL encourages students to organize and present information while working with others who have different thought processes and use different approaches to the same problem. The project work assigned required students to investigate a workplace problem in a real workplace setting (Musa et al., 2012) Students are taught using PjBL model turned out to have good learning outcome as well (Ardhyani & Khoiri, 2017). Moreover, optimal use of modern technology to facilitate access to student information. The use of cloud technology in educational process gives the chance to educational institutions to use computing resources and program applications as a service through the Internet; it allows intensifying and improving training process (Emelyanov & Klygin, 2016). Students and teachers have the opportunity to quickly and economically access various application platforms and resources through the web pages on-demand (Ercan, 2010). This automatically reduces the cost of organizational expenses and offers more powerful functional capabilities gives learners and teachers a potential environment to learn and teach more effectively. Therefore, this finding indicated that the learners with learning process that focused on practical skills using PjBL and learning environment on cloud computing appropriately affected to the collaborative skills with applications to the future which apparently will fulfill the needs of the 21st century education.

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Contact email: ssiripon@aru.ac.th