# SPACE LEARNING MODEL FOR FLIPPED CLASSROOM: STARTUP TO IMPROVE LEARNING AND INNOVATION SKILLS IN HIGHER EDUCATION

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**Abstract:** This research objectives were to: (1)study the problems of current learning management from five instructors teaching in Software Engineering course by using a semi-structured interview form and the in-depth interviews; (2) examine the level of opinion of 204 students who had studied a Software Engineering course, related to the problems of learning management and learning behaviour in higher education; and (3)find the guidelines for a model of learning management from seven experts on education by using focus group discussions. The data were analysed through the content analysis and descriptive statistics. The findings showed that instructors lacked a variety of processes to transfer knowledge and lacked the motivation to encourage students to acquire learning and innovation skills. The opinions of the students indicated a problem in the measurement and evaluation that emphasised only the final examination, a lack of effective communication in interactions between the students and the instructor in the classroom, and a lack of practice in thinking and problem-solving skills, both in and outside the classroom. The behaviour of the students showed that there was a problem in the students' preparation before class, as well as a lack of knowledge application. From the results of this research, a model for learning management in 5 steps was obtained, including Stimulation, Peer Coaching, Action, Construct Skills and Evaluation.

**Keywords:** Learning Management, Learning and Innovation Skills, Higher Education

## Introduction

Moving to the 21st Century among the change of the world in many aspects of the impact the lives of global citizens. For the Thai social context, the Eleventh National Economic and Social Development Plan (2012-2016) were implemented focusing on the development of citizens to a sustainable quality learning community (Office of the National Economic and Social Development Board, 2012). Since Thailand joined ASEAN Economic Community in 2015, it is necessary to prepare workforce to respond the labour markets. In accordance with the labour requirements of establishments, indicates the entrepreneurs expected that the employees with undergraduate students must have essential skills such as creativity, problem-solving, critical thinking, teamwork, and ability to apply knowledge (OHEC, 2010). With the different quality and variety quantity of educational institutions, learning management focuses just on quantity of graduates and academic knowledge. It also does not serve the needs of the competitive labour market (OHEC, 2008) which contrast with entrepreneurs' requirements such as creativity, problem-solving, teamwork. In order to develop knowledge and skills, the Ministry of Education set the criteria for all curricula to follow the Thai Qualifications Framework for Higher Education which is in accordance with the guidelines for education in the 21st century (OHEC, 2006)

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Consequently, the researchers were interested to develop a learning management regarding to enhance learning and innovation skills, self-developed, and ability to work effectively. The study was conducted with the instructors and undergraduate students in the Software Engineering course at the Faculty of Science, King Mongkut's Institute of Technology Ladkrabang (KMITL), where administration was to produce graduates to become innovators who are capable, knowledgeable and 171otmail in fields and serve the various needs of the society.

**Literature Reviews**

*Instructional Conditions in Thailand*

The Ministry of Education, through the Office of the Higher Education Commission (OHEC) was determined qualification levels within the Thai Qualifications Framework for Higher Education(TQF:Hed) which has the domains of learning five aspects including the moral aspect, knowledge aspect, intellectual aspect, interaction and responsibility aspect, numeric analysis aspect, and communication and the use of information technology.It also the key principles in the development to promote learners to apply knowledge and to develop creative innovations to meet the needs of society as the challenge (OHEC, 2006). It also entails the key principles in development to encourage learners in the application of knowledge and develop creative innovations to meet the needs of society as a challenge.

*Instructional System Design*

The researchers applied the guidelines for instructional system design used in foreign countries and in Thailand to suit the Thai context as showed that there are generally five parts of the model process for the ADDIE Model (Branson & Gerald, 1987), (Watson, 1981), Dick and Carey Model (Dick, Carey, & Carey, 2014), Kemp Model (Morrison, Ross, Kalman, & Kemp, 2010),Gerlach and Ely Model (Vernon & Donal, 1980), and Tissana Khammanee (Khammane, 2012) consisted the input comprised an analysis process that evaluated the needs and problems of instructional management, and the design stage to create the process of learning model development. The process comprised development processes to develop the learning model, which included instructional activity design, and an implementation process to verify the developed learning model in terms of whether the achievement of the learner responded to the objectives or not. Output consisted of an evaluation process to monitor measurement and evaluation. The Dick and Carey Model, Kemp Model, and Gerlach and Ely Model stated that feedback consisted of a revision process to improve the learning model for efficient use.

*Learning and Innovation Skills for the 21st Century*

The researchers synthesised the components of learning in the 21st Century. Of course, basic skill development and workforce preparation skills are important in the Thai context. The corresponding values enhance the learners to develop their learning skills, leading to their real-life situation. In this research, the researchers implemented learning and innovation skills, which helped the learners to apply them to daily life and connect them to other learning skills. There are numerous learning techniques through which stimulus students' creative and innovative thinking, critical thinking and problem-solving, and communication, and teamwork for instance project-based learning, group investigation, and flipped classroom (P21, 2015), (NCREL and the Metiri Group, 2003), (OECD, 2015), (LEAP, 2007).

*Flipped Classroom*

The Flipped Classroom is the learning process that the classroom lecturing has been transferred outside the classroom. Video created by the instructors are mostly used or other materials to transfer to the learners, so they can learn outside the normal learning time. Activities in Classroom are used to allow the learners to participate and practice to create their learning, as well as working together. Moreover, the instructors can evaluate learner progress, and provide help, give advices, and motivate the learners. Jonathan and Aaron called this the "Flipped Classroom" (Bergmann & Aaron, 2012). With this learning approach, it provides a change of learning management from instructors-leaded to students-centred. The conclusion, the study includes Thai Qualifications Framework for Higher Education (TQF: Hed) onto the 21st Century Skills. Transform teaching and learning approach into a more potential way. The

flipped classroom encourages students to prepare the materials before class and instructors get a chance in students' practice and activities include various measures and evaluation of the learning results.

**Research Objectives**

*There are three objectives:*

1. To study the problems of current learning situations from instructors.
2. To examine the level of opinion related to the problems of learning management and learning behaviour of students.
3. To find the guidelines for the flipped classroom model to enhance the learning and innovation skills of undergraduate students

**Conceptual Framework**

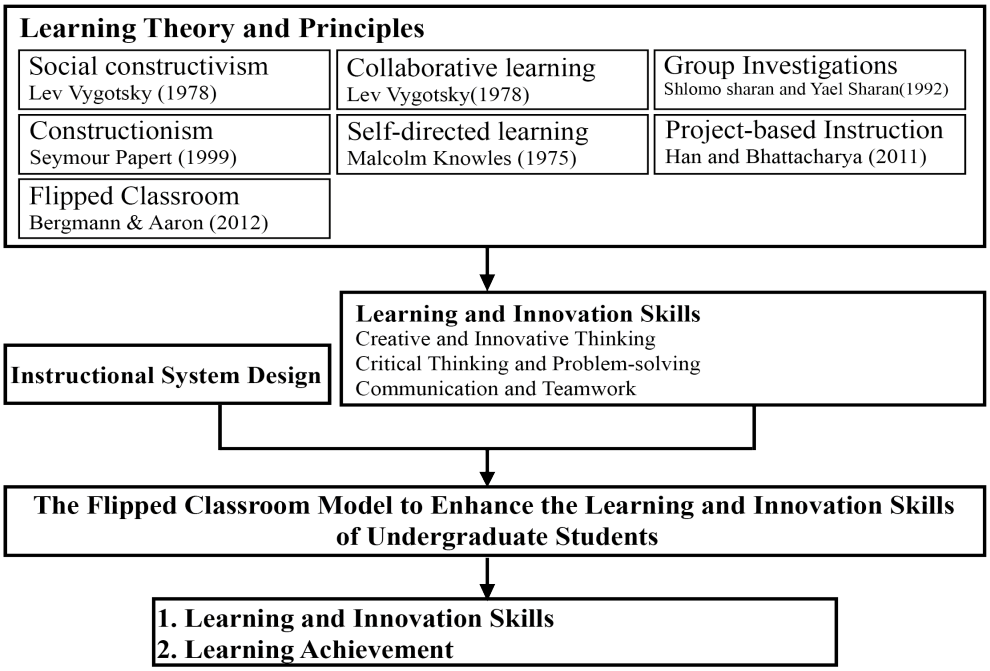


**Figure 1. Conceptual Framework of Study**

This conceptual framework was based on fundamental learning theory and principles, including instructional system design, flipped classroom method, and innovation and learning skills as show in Figure 1.

**Methodology**

In designing and implementing the model, the researchers used research and development approach by adapting the Borg and Gall Model (Borg, Gall, & Gall, 2007), which consists of 10 pillars. However, this research employed 4 pillars, including Research and Information Collection for needs assessments, Planning related to determination of objectives, Course plan, and Developing a preliminary form of product to include preparation of instructional materials. Preliminary field testing was validated by educational technology experts.

*Participants*

1. The 5 Instructors of the Software Engineering and System Analysis and Design course, who had teaching experience for 3 years as a minimum selected by purposive sampling method.
2. 204 students studying the Software Engineering course in Semester 2, 2015 from Faculty of Science, were selected by stratified random sampling method from 415 students.
3. 7 experts on educational technology were selected by purposive sampling method.

*Instrumentation*
There were 2 instruments used in this phase including: (1) semi-structured, in-depth interviews for instructors which questions related to problems and processes of current instructional management, (2) questionnaire related to the opinions of students on problems of instructional management and learning behaviour. The questionnaires were evaluated content validity using index of item-objective (IOC) obtained 0.67-1.00 and Alpha coefficient (α) at 0.97 and at 0.93 in order.

*Procedure and data collection*
The research was conducted according to the following 4 stages:
1. Research and Information Stage, consisting of a review of the literature concerned which led to interview-related processes in instructional management to develop a given learning model product. In this step, the researchers interviewed instructors in Semester 1 of 2015, which included using survey questionnaires with the undergraduates. The data was done collection during Semester 2 of 2015. The total sample consisted of 204 respondents. Out of the 204 returned questionnaires, there were 192 questionnaires that could be analysed, accounting for 94.11%.
2. Planning Stage, in which the researchers focused on determining the learning material, course plan, learning activity and validation of instruments.
3. Developing a preliminary form Stage, during which the initial planning was completed. This step involved developing methodology preliminary prototype of the learning model.
4. Preliminary field testing Stage, which involved the researchers receiving experts' comments in detail for clarification through focus group discussion in Semester 1 of 2016.

*Data analysis*
The qualitative data were analized content using analysis using Atlas.ti™7 to arrange the data. The quantitative data analysed using descriptive statistics: frequency, percentage, mean, and standard deviation.

**Results**

*1. The problems of current learning situations from instructors*
The researchers conducted in-depth interviews with five software engineering instructors. The majority of the sample was men (80 %), and of the five instructors, three having obtained a master's degree. Only one instructor had less than five years of teaching. Only three of the five interviewed (60%) had used the Internet and networks for measurement and evaluation. Interviews with instructors probed their experiences in Software Engineering course. As well, interviews with instructors their attitudes, opinions, and teaching method about the status and problems of current learning situations was presented in the following:
- *Course content:* In learning situations, instructors managed the instructional plan based on TQF. There was also use of other instructional material such as video clips, documents, PowerPoint, and websites, but most of the video clips were in foreign languages or contain content that was inapplicable. Some were overloaded with content not possible to complete in each class period. Thus, they wanted to make video clips by themselves.
- *Students:* Instructors had opinions related to students' basic knowledge prior to learning. The students lacked preparation before class, lacked essential skills such as problem-solving, critical thinking, and teamwork skills. In the same manner, they lacked skills to apply knowledge in practice.
- *Instructors:* Instructors had preparation before class but did not include important activities such as stimulation and pretesting. Moreover, there were very few activities for students to practice their knowledge in the classroom. Instructors still employed a traditional approach, which was the most commonly used in class.
- *Learning environment:* Of course, a classroom-provided lecture based on 80 students per class had the difficulty in observing students when instructors provided activities in the classroom, such as group discussion.

- *Learning activity management:* Most instructional management was from lecture/case study/experience of instructors. Some instructors did not have extra class activities, but only lectures.
- *Evaluation and Measurement:* The instructors assessed students using homework, assignments, midterm exams, final exams, and class attendance, which is the norm referenced evaluation used. On the other hand, project scores did not take into consideration outside group participation activity and was thus limited to classroom presentation only.
- *Learning Outcome:* In fact, the distribution of scores after the final exams was normal. On the one hand, opinion of instructors indicated students lacked experience in analysis and design systems (compared with instructors asking questions to check understanding for project presentations in classroom). Students lacked teamwork skills, creative ideas, and problem-solving skills.
- *Revise:* The instructors used the results from the Office of the Registrar for discussion in department meetings to find solutions to develop the learning method and evaluation.

*2. The opinions of undergraduate students concerning problems in current instructional management and learning behaviour*

*2.1 The findings from opinions of 192* undergraduate *students related to* the problems of current instructional management *in Software Engineering course*, as shown in Table 1 and Table 2.

**Table 1: General Data of Undergraduate Students**

| General Information Data | Number | Percentage |
|---|---|---|
| Gender | | |
| Male | 80 | 41.67 |
| Female | 112 | 58.33 |
| Age | | |
| 20-21 years old | 126 | 65.63 |
| 22-23 years old | 66 | 34.37 |
| Program | | |
| Computer Science | 130 | 67.71 |
| Applied Mathematics | 63 | 32.29 |
| Information on Learning and Innovation Skills | | |
| Know | 78 | 40.63 |
| Don't Know | 114 | 59.38 |
| Information on Flipped Classroom | | |
| Know | 66 | 34.38 |
| Don't Know | 126 | 65.63 |

**Table 2: The opinions of *undergraduate* students related to the current problems of instructional management in Software Engineering course (n=192)**

| Instructional Management | Mean | SD | Problems |
|---|---|---|---|
| 1. Evaluation and measurement | 3.69 | 0.40 | High |
| 2. Learning environment | 3.62 | 0.58 | High |
| 3. Learning activities management | 3.52 | 0.48 | High |
| 4. Learner | 3.52 | 0.44 | High |
| 5. Instructor | 3.19 | 0.59 | Moderate |
| 6. Content | 3.02 | 0.52 | Moderate |
| Total | 3.39 | 0.27 | Moderate |

In conclusion, the main problems of instructional management were evaluation and measurement that emphasis on the final examination result regardless of his or her project. The second problem was the learning environment, which was inconsistent with the learning activity such as classroom conditions space limited were not conducive to group learning, too many students in a classroom. The third problem

was learning activities management indicated that most of the instructors gave few activities for students to practice skills during classes. The last high-level problems were learner which indicates that students lacked motivation to learn software engineering courses.

*2.2 The learning behaviour of the undergraduate students studying Software Engineering is shown in Table 3*

**Table 3: Level of learning behaviour of the undergraduate students studying Software Engineering course(n=192)**

| Learning Behaviour | Mean | SD | Behaviour |
|---|---|---|---|
| 1. Preparation before class | 3.05 | 0.69 | Moderate |
| 2. Communication and Collaboration | 3.36 | 0.54 | Moderate |
| 3. Critical Thinking and Problem Solving | 3.37 | 0.57 | Moderate |
| 4. Creativity and Innovation | 3.51 | 0.48 | High |
| Total | 3.32 | 0.45 | Moderate |

In short, learning behaviour of the undergraduates was indicated there had preparation before class. In sections communication and collaboration, they could open mind to accept criticism within the different working groups include sections critical thinking and problem solving, they could apply the knowledge or principles used to solve problem. Consequently, most students were ready to accept the new ideas, the situation, and different viewpoints, as well as to apply knowledge to other situations or daily life.

*3. Creating the flipped classroom model to enhance the learning and innovation skills*

To answer the third objective of the research, the researchers proposed the guidelines for improving the learning model by analysed the problems of current learning situations from instructors and the level of opinion and behaviour of students to obtain the framework for developing the learning process. Then, the researchers proposed the framework to the experts in education to verify and modify the model. The researchers developed the model following the systems approach and applied the suggestions of the experts to enhance the learning process to finalise the framework as shown in Figure 2.

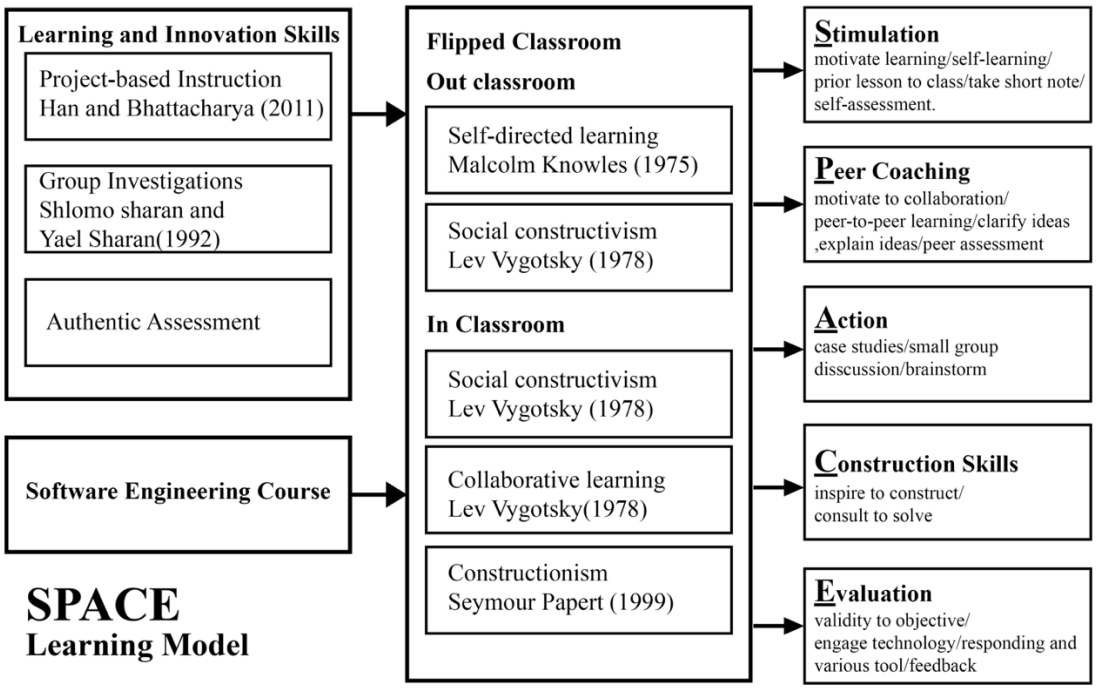


**Figure 2. SPACE Learning Model for Flipped Classroom.**

**Discussion**

The analysis of the problems of instructional management of the instructors and learners, learning behaviour of the students, and the opinion of the experts on the instructional management process provided the information to refer to, analyse, and synthesise the need for the development of flipped classroom learning to improve learning and innovation skills. It could be concluded that there were five steps of instructional management in the process to enhance learning and innovation skills called SPACE that stand for Stimulation, Peer Coaching, Action, Construction Skills, and Evaluation. Each steps are provided as following:

*Stimulation*

Learning outside of the classroom helped to prepare the learners before entering the learning process. The Stimulation step the researchers focus on motivate learning, self-learning, prior lesson to class and self-assessment. Jonathan Bergmann and Aaron Sams (2012) pointed out that if the learners studied the lesson before class, it provided revision for more understanding in class while class activities would enhance the comprehension. From the interview they said the instructors should create the video by themselves, so the learners would have more understanding.

By connecting the gap between theory, knowledge and practice, instructors can use video material to develop practices and emphasises creating a community in which to build learning motivation from video. Likewise, Dick Walteret al. (2014) pointed out that creating motivation for learners was the most important factor of success. If the learners had motivation or were interested in the subject, learning would follow. The developed model created by Keller (1987) called the ARCS model (attention, relevance, confidence, and satisfaction) was used for successful and efficient teaching.

*Peer Coaching*

Classroom/outside the classroom learning emphasises the capability of learners. The Peer Coaching step was focusing on motivation to collaboration, peer-to-peer learning, and peer assessment as well as clarifying, explaining, and exchanging ideas. Furthermore, Nee Nee Chan, Caroline Walkerand Alan Gleaves (2015) presented various uses for smart phones in the context of learning that could be developed to pursue new knowledge and skills. Smart phones encouraged motivation for social learning activities and education.

Similarly, Yung-Ting Chuang (2015) mentioned that the use of smart phones supports team learning and Zhang, Liu, & Wang, (2017) suggest the teachers use online professional learning community to improve learner's performance including courses, activities, and interactions with peers likewise Sina Sobhanian & Yan Ye (2016) findings indicate peer learning has been effective strategies for improving students' learning, boosting motivation, and strengthening friendship.

*Action*

The findings of the teaching method found lecture-based method with fewer activities in the classroom. The Action step was focusing on case studies, small group discussions, and brainstorming. Likewise, Krista Uibu et al. (2017) presented teaching goals and practices that are preferred for social and cognitive development. Knowledge derived from actions affected the ability of self-adjustment to learn or think, as well as to create a new process.

This is consistent with Chang & Yu (2015) who explained the positive relationship between the perception of a new innovation environment and creative work efficiency through activities to build relationships or allow students to ask questions.

*Construction Skills*

Well-Organised activities allow the students to practice thinking and problem-solving skills during class time. From the findings, teachers did not have time to consult with students and check group projects adequately. This phase focuses on inspire learner to construct and consult to solve. The findings by Jonathan

Bergmann and Aaron Sams (2012) proposed the approach to upgrade class learning so the learners learned via activities, research, projects for practicing problem-solving skills, expressing opinions, and communicating in class.

This was consistent with Jacqueline O'Flaherty and Craig Phillips (2015) who studied the use of the flipped classroom at the higher education level. They found that the use of the flipped classroom focused on the learner and thus helped the instructor to develop the significant learner skills to promote lifelong learning as the flipped classroom helped to increase the efficiency of learning, so the learner developed critical thinking and problem-solving skills, as well as stronger participation both inside and outside the classroom.

Learning and innovation skills are becoming ever more important in a highly complex, technological world and identification of learning concepts and skills is necessary to help students prepare for life and work environments in the 21st century.

Therefore, focus needs to be given to creativity, critical thinking, communication and collaboration, all of which are crucial for student's preparation for the future (Scott, 2015). In order to gain a future competitive advantage, student's today needs to develop strategies that are flexible and able to adapt to changes as they occur (NCREL and the Metiri Group, 2003).

*Evaluation*

*A*lthough measurement and evaluation were determined in the instructional plan, the application of rubric scores was used to evaluate. In the Evaluation step, the researchers focused on validity to objective, engaging technology, responding to various tools, and feedback. Ernesto Panadero and Anders Jonsson (2013) studied evaluation during class with rubric scores and showed that the use of rubrics as the means to improve the students' efficiency.

This approach provided transparency of evaluation and might decrease the anxiety of the learners. The use of rubrics for scoring helped on the suggestion of the improvement of the students' performances.

**Conclusion and Suggestions**

This research provides a guideline for instructors and students to develop their learning process. The instructors should adjust the teaching strategy beyond lectures and emphasise activities that promote and develop the learning outcomes. The learners should take part in changing their learning behaviour in order to ensure that they have the essential skills in learning and innovation skills for undergraduate study and also learn the basic skills necessary for the workplace.

The new learning model for flipped classroom called SPACE has been developed for starting up to transform learning and innovation skills in Higher Education. The research of Pradubthong, Petsangsri, & Pimdee, (2018) expressed that using SPACE Learning Model indicate the learning achievement results and the innovation and learning skills of the undergraduate on the software engineering course, the students responded well to learning developments.

With the SPACE Learning Model, the learning method focused on student-centred learning, promoted self-learning, knowledge sharing between learners and the teacher it led to action and construction skills practical activities in the classroom such as discuss, give opinions, and had the ability to communicate, think, 177otmail, and solve problems with their classmates. The evaluation procedure, the teacher also opportunity the students a chance to exchange opinions and ideas on their classmates' work to benefiting from other experiences. The model ensures the significant phases that enhance the potential career that respond to entrepreneurs' requirements and society.

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