MOVING TOWARD DEEP SMART FOR 21ST CENTURY SKILLS: A CASE STUDY OF PROJECT-BASED LEARNING IN SCHOOL

PATTARIN SANGUANKAEW

A THEMATIC PAPER SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MANAGEMENT COLLEGE OF MANAGEMENT MAHIDOL UNIVERSITY 2014

Thematic paper
entitled

MOVING TOWARD DEEP SMART FOR 21ST CENTURY SKILLS: A CASE STUDY OF PROJECT-BASED LEARNING IN SCHOOL

was submitted to the College of Management, Mahidol University
for the degree of Master of Management
on
January 4, 2014

………………………………………….
Miss Pattarin Sanguankaew
Candidate

…………………………………….
Asst. Prof. Vichita Ractham,
Ph.D.
Advisor

…………………………………..…….
Assoc. Prof. Sooksan Kantabutra,
Ph.D.
Committee member

…………………………………..………
Assoc. Prof. Annop Tanlamai,
Ph.D.
Dean
College of Management
Mahidol University

…………………………………..………
Asst. Prof. Winai Wongsurawat,
Ph.D.
Committee member

ACKNOWLEDGEMENT

MOVING TOWARD DEEP SMART FOR 21ST CENTURY SKILLS: A CASE STUDY OF PROJECT-BASED LEARNING IN SCHOOL

PATTARIN SANGUANKAEW 5549094

M.M. (INNOVATION IN MANAGEMENT)

THEMATIC PAPER ADVISORY COMMITTEE : ASST. PROF. VICHITA RACHTAM, Ph.D., ASSOC. PROF. SOOKSAN KANTABUTRA, Ph.D., ASST. PROF. WINAI WONGSURAWAT, Ph.D.

ABSTRACT

Through active learning, deep smarts can be created and transferred from individuals. In order to move toward deep smarts, schools can use project-based learning with learning by doing methods to create and transfer 21st century skills. 'Catch a Star' project of Patai Udom Suksa School is used as a case study, in order to examine the process of project based learning and concerning issues. The findings show that even though project-based learning may require additional effort from teachers and students, it can help develop knowledge and skills that are crucial for 21st century. Through a combination of guided practices, guided observation, guided problem-solving and guided experiment, teachers and student can develop relevant skills of creativity, critical thinking and collaboration.

KEY WORDS: Project-based learning / Deep smart / 21st Century skills / Learning by doing / Guided problem solving

33 pages

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BOD..........Board of Directors

ICT............Information and Communication Technology

KMS ....Knowledge Management System

OBEC ....Office of the Basic Education Commission

PBL   Project-Based Learning

CHAPTER I

INTRODUCTION

It is undeniable that knowledge and skill are fundamental competences for human to live in this world. Even though knowledge and skills are technically two different concepts, they are interdependent. However, not all knowledge and skills are needed or wanted. Certain competences are more desirable during certain time depending on the situation and context (OECD, n.d.). For instance, hunting skill was probably more necessary during the pre-historic era than it is nowadays. The highlight of this era seems to be about the ability to learn so that individuals are able to acquire any knowledge and skills they require. Therefore, 21st century skills have increasingly become emphasized, particularly by education system. The important question is how those skills can be attained.

Since the existence of mankind, people passes on knowledge and skill to others through both explicit and implicit methods (Perrott, 2007). From one to another, from generation to the next; societies are able to achieve what they have today due to the ability to manage knowledge and skill, and then further develop them based on what have been learned. People do not have to re-learn everything right from the beginning because of this ability. It is fundamental to how people come to know about traditions, values and cultures as well as competences. The main rationale behind the continuous improvement in knowledge is to improve the standard of living for each individual and society as a whole.

Throughout the last centuries a lot of things have changed and more rapidly in the last decades, so education system has to change as well. The school education system used nowadays started during the 18th century industrial revolution (May, 2011). The traditional school system was structured to train students to become labour for mass-volume work, so school curriculum was based on the same education standard and used for most places, including learning methods and assessments. Nonetheless, education in the days of knowledge based economy and creative

economy has to answer the change from standardization to individualization by focusing on specific needs and interests of learners.

At the moment schools in many countries are facing challenges resulted from the traditional education system, especially Thailand. One common problem is that students aim to get good grades rather than learning to develop themselves. School has become a place to teach students to be able to give expected answer in the exam. Extra tutorial class and cram school have become increasingly popular for preparing students for the university entrance exam (The Nation, 2011). Nevertheless, once these students graduate from higher education, some of them will have difficulty with work due to lacks of relevant knowledge and skills, as if education has not effectively prepared them for real life situation.

In order to keep up with the change and resolve this challenge, schooling system has to be redesigned for the 21st century education (May, 2011). Rather than preparing children to enter the university and labour market, education should be about creating next generation to be equipped with necessary knowledge and skills. They will become the global citizens who are able to raise the standard of living for the society. Traditional learning methods may be somewhat appropriate for certain context, although new ways of learning are applicable to be used for today's education. Knowledge management concepts and framework can help improve the education system for sustainable knowledge development.

School should provide education that teaches students how to learn so that they will be able to continuously develop themselves. Since each individual is different from others, the school has to embrace and cater for the uniqueness of students. This means that traditional school system that has a single curriculum with the same assessment for all students is not appropriate anymore. The new education system should enrich interests, capabilities and potentials of each student. The ideal concepts schools imposed on students are life-long learning and self-development. The 21st century skills are deemed crucial for students to have, including creativity, critical thinking and collaboration (Saavedra & Opfer, 2012). Engagement in learning for both educators and learners has to more active or to 'teach less, learn more'.

Education in Thailand is now experiencing the mentioned problem about the learning process in school, however things are gradually changing. Thai education

system has gone through several education reforms which intended to improve the learning method to cater for development of students, especially for the 12 years of basic education including primary and secondary levels – Pratom and Mattayom respectively. This formal education is a way to ensure that the next generation will be able to become prepared for the life ahead of them, thus the learning methods in school have to be suitable and appropriate for shaping students to become future valuable assets of the nation, thus the world. Therefore, the objectives of this research papers are to examine the methods schools use to create and transfer deep smarts for 21st century skills through active learning methods, what are the benefits and trade-offs of such methods and how can they be a guideline for other schools.

In the remainder of this paper, the process and related issues concerning the project-based learning with deep smart learning methods in creating and transferring 21st century skills will be discussed. Relevant background in knowledge management, deep smarts and 21st century skills will be reviewed from previously literatures. Next, research methodology will explain about the case study and data collection. The paper will then analyze the obtained data with detailed discussion, where some recommendations are suggested for implications and applications of the study. Finally, there will be a conclusion with summary and limitation, as well as directions for further research.

CHAPTER II
LITERATURE REVIEW

This research aims to investigate the creation and transfer of 21st century skills through project-based learning using „learning by doing" deep smart learning methods within the school education in Thailand. This section will review relevant concepts and frameworks from literature materials, including knowledge management, deep smarts transfer techniques and 21st century skills.

To know how education system can apply deep smarts transfer techniques to design effective learning methods for students, one has to know about knowledge management. It must be noted that data, information, knowledge and wisdom are distinguishable depending on the dimension of context, usefulness or interpretability (Alavi & Leidner, 2001). Data is the discrete element such as words or numbers, which can be analyzed and turned into information. Then, information is converted to knowledge when it is interpreted and evaluated for application. Wisdom is derived from knowledge that is synthesized and applied with experience. Deep smarts can be considered as the experienced-based wisdom (Leonard & Swap, 2004).

Knowledge management has been given many definitions, in which most of them concern common scope and emphasis. Perrott (2007) gathered several definitions of knowledge management which can be concluded that knowledge management is a continuous process in creating, sharing, storing and applying knowledge to enhance performance for operational and strategic benefits of the organization. Although knowledge management can be expressed in forms of both tacit and explicit, it is widely recognized that the major part of knowledge and wisdom are rooted in tacit knowledge rather than explicit knowledge. Thus, effective techniques are required for creating and transferring deep smarts.

Prior the start of planning, an objective has to be set. In this case, one must identify the knowledge gap first before beginning to design a blueprint for knowledge management. The knowledge gap is the difference between current situation and

expected outcome. It can be something that we know, do not know, want to know or do not want to know. For example, the knowledge gap for school can be that Year 1 students do not know about the internet yet but want to be able to use the internet for school work. In order to close this gap, educators need to carefully design a strategic plan. Referring to Hansen, Nohria and Tierney (1999) in choosing the right strategy, school has to consider about whether students rely on tacit or explicit knowledge, the assigned homework is new to students or they have already done similar work, and learning activities should be standardized or customized for students. These concerns will help in designing appropriate plan for learning.

2.1 Knowledge Management Process

Then, educators have to know which knowledge management concept or framework should be applied. According to the knowledge management framework by Alavi and Leidner (2001), there are 4 activities of knowledge management process: (1) creation, (2) transfer, (3) storage/retrieval and (4) application. Knowledge creation is about constructing new content or replacing existing content with tacit and explicit knowledge. Knowledge storage and retrieval concern the coherently gathered knowledge to be securely kept and accessible for application. Knowledge transfer is the process of passing on or exchanging knowledge between individuals, groups and organizations. Knowledge application is the act of using knowledge for competitive advantage to achieve the objective. These types of knowledge management process are all interlinked and important components for deep smarts.

Firstly, knowledge creation that addresses the construction of tacit and explicit knowledge can be clearly illustrated using Nonaka's (2007) SECI model about the cycle of socialization, externalization, combination and internalization. Socialization is a term coined for tacit-to-tacit communication where people share knowledge through implicit means such as verbal conversation. Externalization is a tacit-to-explicit communication where knowledge is articulated such as conversation dialogue. Combination is knowledge created from explicit-to-explicit communication such as written instruction manual. Internalization is an explicit-to-tacit communication in which individuals take in knowledge to broaden and extend their

own knowledge. An organization can become a knowledge-creating company by enhancing strength and minimizing weakness within these patterns of knowledge conversion.

Furthermore, SECI model can be aligned with the concept of "Ba" or "place" for building knowledge creation foundation (Nonaka & Konno, 1998). Ba is a Japanese word with a rough translation of place, in this case it means the place for knowledge to be created. It can be either physical or mental place. Since SECI model illustrates an ongoing knowledge conversion, ba concept has to support the continuous communication of tacit and explicit knowledge. The 4 types of ba are originating ba for socialization, interacting ba for externalization, cyber ba for combination and exercising ba for internalization. Each ba facilitates the knowledge creation and transfer of deep smarts.

Secondly, knowledge transfer is the key process in education as it aims to expand knowledge base across individuals, groups and organizations. Each user should be able to easily access the knowledge base anywhere at any time (Fulmer, 2002). Also, the knowledge base system should be real-time where content is automatically at the time of knowledge transfer. Alavi and Leidner (1999) believed that users of the system can be both contributor and beneficiary, where reinforcement from the organization is needed for sustainable contribution and usage. Even though technology is not an essential element to knowledge management, but it facilitates the knowledge processes particularly for knowledge sharing when individuals exchange knowledge with one another.

Thirdly, knowledge storage and retrieval are the processes in which knowledge is securely kept within the organization and later recalled for application. Knowledge Management System (KMS) facilitates knowledge management process, particularly integration of knowledge to create knowledge base (Alavi & Leidner, 1999). Nonetheless, the concern for this process is usually about the usefulness of knowledge including issues of the accuracy, obsolescence and redundancy. Technological tools can be helpful in creating an effective KMS for storage and retrieval process.

Fourthly and lastly, knowledge application takes into account the validity and managerial issues when applying knowledge for use. This is because if knowledge

is invalid then it is hardly any use for application. In some cases, ineffective application resulted from invalid knowledge can lead to negative consequences and worsening outcomes. As for managing knowledge application, codification and personalization strategies are adopted in order to make the most of knowledge in hand (Hansen, Nohria & Tierney, 1999). Codification strategy is appropriate for providing knowledge in high-quality that is reliable and fast from existing collection of knowledge. On the other hand, personalization strategy is appropriate for providing knowledge that is creative on high-level problems from individual expertise.

2.2 Deep Smarts

Nevertheless, it is arguable that there are overlaps between the 4 knowledge management processes. One aspect of the overlap between knowledge creation and transfer concerns deep smarts. According to Leonard & Swap (2005), deep smarts can be considered as wisdom that does not only account for intellectual but also emotional and moral intelligences accumulated through experiences. This experience-based expertise can be shaped and acquired from internal and external influences. Although formal education alone cannot accomplish deep smarts, but it can be created, transferred and developed with cautiously designed learning method. For this paper, deep smarts can be considered in forms of knowledge as well as skills.

Deep smarts are created and transferred from expert to novice using modes of knowledge transfer (Leonard & Swap, 2004). Passive reception methods such as directives/presentation/lectures, rules of thumb, stories with a moral and Socratic questioning are still options for knowledge transfer. However, the more active learning it is, the increasing cultivation of deep smarts it is. In order to move towards deeps smarts, learning by doing mode of knowledge transfer is adopted with the use of knowledge coaching techniques. Learning by doing includes guided practice, guided observation, guided problem solving and guided experimentation, in respective order towards active learning. Figure 2.1 illustrates transfer techniques ranging from passive reception toward active learning for deep smarts.

Moving Toward Deep Smarts

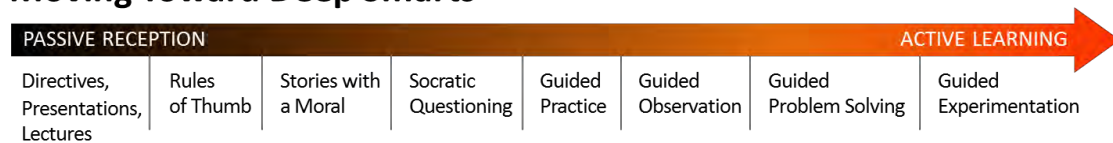| PASSIVE RECEPTION							ACTIVE LEARNING
Directives, Presentations, Lectures	Rules of Thumb	Stories with a Moral	Socratic Questioning	Guided Practice	Guided Observation	Guided Problem Solving	Guided Experimentation

Figure 2.1. Moving toward deep smarts (Leonard & Swap, 2005).

Gaining knowledge and skills are much more effective though knowledge coaching techniques. Even though it is sometimes difficult to measure expertise, experts are those who have consistent high performance, produce concrete results that can be replicated and measured (Ericsson, Prietula & Cokely, 2007). Experts act as a coach and provide novices with experience, knowledge and skill within their areas of expertise using appropriate and preferred method. Knowledge coach can help accelerate learning process. However, these learning techniques require close monitoring and feedback. For instance, guided practice refers to a deep smarts transfer technique through the act of doing with reflective feedback. Practice of learner will be assessed by the knowledge coach who will provide constructive comments to improve the performance (Leonard & Swap, 2004).

Leonard and Swap stated that guided observation and guided problem solving are effective methods in transferring deep smarts (2005). Guided observation is intended for recreating deep smart and challenging assumptions based on experience. Learner can gain deep smart from observation of knowledge coach's actions, since sometimes expert may not be able to express something out explicitly but they can show it. Moreover, guided problem solving is one of the transfer techniques for deep smarts that involves active engagement from both knowledge coach and learner. For this technique, the knowledge coach may or may not already have the solution for the question but can apply existing expertise to find the answer together with the learner.

Guided experiment is another technique that is useful for attaining deep smarts but perceived as risky and costly (Leonard & Swap, 2004). Experimental learning can often be seen in children at young age where they learn at a fast rate, but it also results in a great level of unsuccessful attempts. This is why, in many occasions, there's contemplation in using this technique when failure is not an option, nonetheless

pilot study and small-scale experiment are rolled out to minimize the risk. This technique requires the most active learning engagement and maybe hard to adopt, but it is a high-risk high-return method.

Gary (2005) mentioned additional insights to the concept of deep smarts by Leonard and Swap (2004) on how to get started in re-creating deep smarts. There are 3 steps to re-create deep smarts which are to calibrate the knowledge gap, create dual-purpose projects and help managers become knowledge coaches. In order to expose deep smarts, a context like a scenario can be helpful in recalibrating and determining the gap to find the difference between expert and novice. Next is the dual-purpose project that helps organization achieve multiple objectives with minimal resources, in which also reduces risk of expert absence. Then, experts should be encouraged and supported to become knowledge coach. This is because not everyone with expertise is good at coaching another person, and vice versa. Nonetheless, teaching skill can be developed and improved so that deep smarts can be effectively created and transferred.

Although there are several 21st century skills, 3 particular skills can be considered significantly important – creativity, critical thinking and collaboration (Saavedra & Opfer, 2012; Trilling & Fadel, 2009). Many studies have found a number of skills that are necessary for students to have in this century, these 3 skills are commonly found among the articles. Creativity is the skill required particularly for economies that need innovative and creative work. Since there is a greater flow of information in which ranging from reliable to misleading, critical thinking and problem solving are needed for being able to effectively use the information. Collaboration is another crucial skill as people become more connected via the aid of Information and Communication Technology (ICT), because effective teamwork can help achieve many goals.

Project-Based Learning (PBL) is an approach that caters for 21st century skills, where there is a systematic organization of learning activities on a project basis. According to Bell (2010), it is a learning approach that is driven by students and facilitated by teachers. Learners are involved with real-world problems where they will gain abilities to design, plan, organize and implement learning in their own ways. The typical phases for PBL include developed question, knowledge inquiry, analytical

thinking, and sharing results. „Learning by doing" methods of deeps smarts are used for learners to acquire knowledge and skills.

Therefore, it is evidently important that 21st century skills are crucial for the future human resources to have. Deep smart's learning by doing techniques can help students attain creativity, critical thinking and collaboration skills. Through the formal education system, school can organize learning activities to achieve this objective. Students are able to learn from teachers who play the part of experts in coaching knowledge and skills. This case study will investigate PBL in school, creation and transfer of 21st century skills and impacts of PBL on each party involved. This can be used as a guiding idea for further improvement for education in Thailand and other nations.
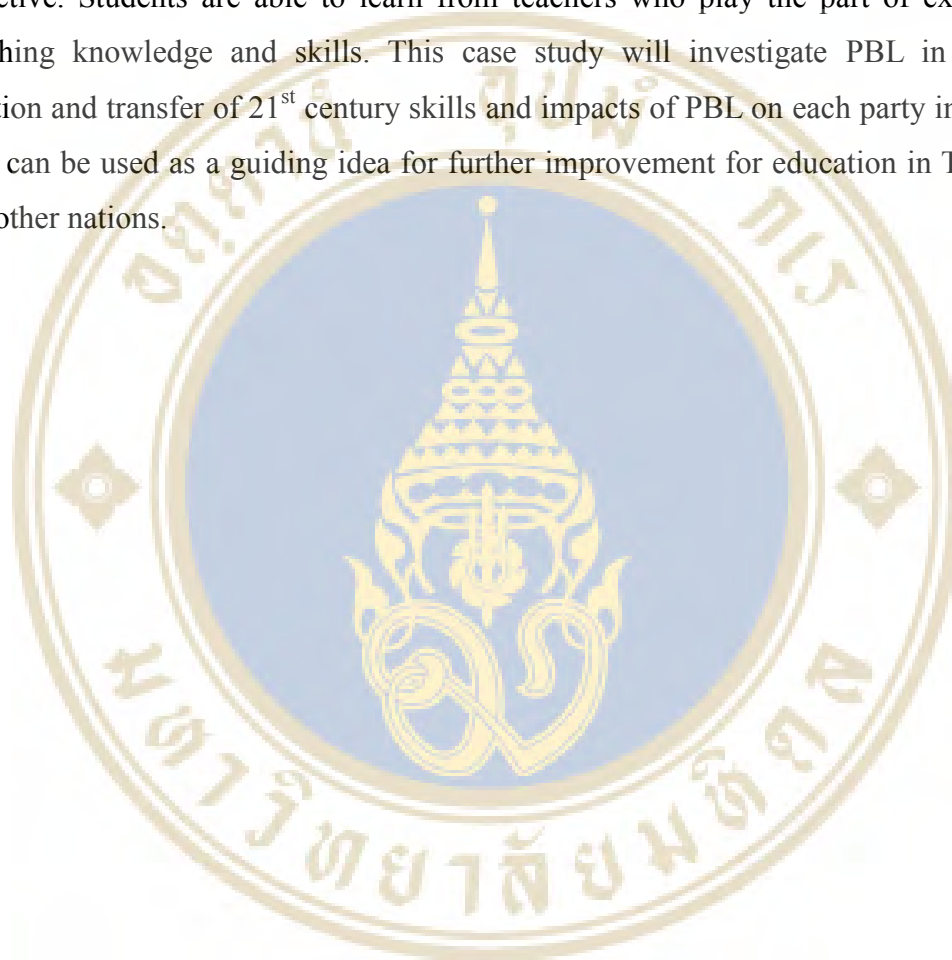
CHAPTER III
METHODOLOGY

Even though knowledge management research can use either quantitative or qualitative research methods, it is based on the strategy used for data collection in accordance to the research objectives (Guta, 2013). Quantitative research concerns statistical analysis of data obtained from samples, however it gives objective results which may or may not be representable to the population. On the other hand, qualitative research is suitable for in-depth study of an event that occurs in the organization.

Qualitative research method was selected as an appropriate method for data collection, as it can gather descriptive information on the given issue. It helps gain better understanding of complex reality of the situation. This method is appropriate for research that wants information about the 'human' side of an issue, especially for social sciences and management. Also, it can collect data on intangible factors that sometimes are not obviously expressed or projected by participants unless stimulated by someone or something. Furthermore, qualitative research is especially suitable for gathering information that is contextually specific such as values, opinions, behaviours and interactions (Brikci & Green, 2007).

In order to answer the research question, focus group and non-participant observation techniques were adopted as the data collection approaches to obtain qualitative information about the learning methods. Since the research topic concerns the knowledge creation and knowledge transfer between experts and novices, focus group method was able to draw data from the interaction of those 2 parties. Moreover, such interaction stimulated discussion on ideas which lead to in-depth information about the topics (Brikci & Green, 2007). In contrast, non-participant observation allowed data collection of genuine event and procedures. For instance, data on the actual interactions including conversation discussed, action performed and techniques used between experts and novices during the learning activities are obtained.

Patai Udom Suksa School was chosen to be a case study for this paper

because it is highly recognized for its learning activities within the private school community. The school, established in 1971, is located in Bangkok, Thailand catering for kindergarten, primary and lower secondary students (K-9). Its mission is to provide excellent education for life-long learning in developing human resource with exceptional academic, emotional and moral intelligences. The school strives to offer well-balanced learning activities that enhance each individual's potential by providing challenges and opportunities for learners to develop themselves. The school has received a number of awards from the Ministry of Education of Thailand, government organizations as well as private organizations, such as 'One School, One Innovation' and 'Information and Communication Technology Model School'.

One of the learning activities that contribute to the school's success is called 'Project Approach in Patai's Style'. This learning activity is a PBL, in which is believed by the school and some external parties that it can create 21st century skills for students. Therefore, focus group questions were developed base on 'Project Approach in Patai's Style' learning activity. Open-ended questions were used for focus group to stimulate discussion between participants as well as not to strict their ideas and opinions (Brikci & Green, 2007). A list of open-ended question was developed to investigate learning management in creating and transferring 21st century skills using deep smarts learning by doing techniques. These questions were as followed: What is 'Project Approach in Patai's Style'?, What are the roles and responsibilities of each person?, What happens during the project?, What did you get from project-based learning?, What are the advantages and disadvantages? And What are the impacts of this learning method?

To ensure the validity of the data, the probing technique was adopted. Probing technique was intended for encouraging conversation and further investigation on the discussed issues. There are 3 types of probing questions used for the data collection which were questions for clarification, questions that probe reasons and evidence, and questions about viewpoints and perspectives (Changing Minds, n.d.). Probing for clarity was used to find more specific response when general information was given by participants, for examples 'what do you mean', 'could you be more specific about' or 'could you tell me a little more about'. Whereas probing for additional information was used to obtain more response on certain issue from the

participant, for example 'what are other reasons for that', 'what else did you do' or 'other than that, what else'. These probing questions helped gain in-depth information on the issue. Reflective note taking was also used to record observed data during the focus groups and observation. Important data was interpreted and recorded during the time it was given.

The data was collected from 2 focus groups with the total of 12 interviewees. Participating teachers and students are from lower secondary section at Patai Udom Suksa School who have been taking part in PBL. Each focus group comprised of 1 facilitator, 1 recorder, 2 teachers and 4 students. The same facilitator and recorder participated in both focus groups whereas interviewees belonged in either the first or second group. The focus groups were taken on 2 different days at Patai Udom Suksa School – Tuesday the 19th November 2013 at 3PM and Thursday the 21st November 2013 at 3PM. Each focus group took approximately an hour and a half in order to collect relevant data.

These interviewees are 4 teachers and 8 students, who volunteer to participate in the study. The 4 teachers, including 3 females and 1 male, have different areas of expertise, backgrounds and experiences. Teacher A is the principal of lower secondary section with extended teaching experience. Teacher B is a new mathematics teacher who just started working at the school. Teacher C is the head of lower secondary level teachers with expertise in Thai language. Teacher D is an English teacher who recently transferred from primary section to lower secondary section. On the other hand, the 8 students are 6 females and 2 males who also have different knowledge, skills and experiences. As for level of their education, half of the students are from Year 8 while the rest of the students are from Year 9.

Table 3.1 Statistical description of focus group participants with teacher role

Roles	No. of participants	% of total participants	Average age (years)	Male (%)	Female (%)	Years of working (%)		
						< 2	2 - 10	> 10
Teachers	4	33%	34	25%	75%	25%	50%	25%

Table 3.2 Statistical description of focus group participants with student role

Roles	No. of participants	% of total participants	Average age	Male (%)	Female (%)	Level of education	
						Year 8	Year 9
Students	8	67%	14.5	25%	75%	50%	50%

Following the previous studies by Leonard and Swap (2004 & 2005), the deep smart transfer technique model is adopted as the framework to collect and analyze data. The framework concerns 'learning by doing' methods that require learners to be actively involved in the learning process with guidance from a coach. The knowledge coaches can be considered as experts who are experienced, knowledgeable and skillful in those particular fields (Ericsson et al., 2007). It is believed that the more active learning is, the better learners are able to gain deep smarts. Thus, in this case, guided observation, guided practice, guided problem-solving and guided experimentation learning methods should be the evidence of creation and transfer of 21st century skills including creativity, critical thinking and collaboration (Saavedra & Opfer, 2012; Trilling & Fadel, 2009).

CHAPTER IV
FINDINGS

In the following section, the data obtained from the focus groups about PBL of lower secondary level section at Patai Udom Suksa School is analyzed, discussed, given recommendation. The first part is data analysis focusing on interpretation of the collected data, which will be structured in the manner of input, process, output, feedback. Next, it is examined using rationales to explain the data analysis in the discussion part with underlying factors that have impacts on the project. Then, some recommendations are suggested to justify the implications and applications of the research.

4.1 Data Analysis

From the data collection, 'Project Approach in Patai's Style' can be summarized as a PBL used to explore a chosen theme with curriculum integration that is suitable for Patai Udom Suksa School's context. Unlike the primary section where a project is assigned for each of the levels, the students from lower secondary levels all take part in the same project. In other words, students from Year 7, 8 and 9 learn together in a multi-level project. It is adopted as part of the in-class learning curriculum, because one day of the week is particularly dedicated to PBL. A theme is devoted to the whole term and sometimes continued throughout or in the later year.

For the academic year of 2013, Patai lower secondary section's project is called 'Catch a Star' where students learn about issues related to astronomy with the integration of learning modules of various subjects such as science, maths, arts, music, social sciences, Thai and English languages. Teachers and students are put into 8 groups named after the planets in the Solar System. A challenge is posed onto each week's activity, which mainly bases on one or two subjects with indirect integration of other subjects. Some examples of objectives were to find a solution to deal with space

debris that orbits around the Earth or how stars influence culture, arts and music. The data analysis based on the 'Catch a Star' project, illustrated in figure 4.1, shows that there are 8 steps of conducting 'Project Approach in Patai's Style', which be categorized into 3 groups – pre-project, during project and post-project.

Pre-project period includes the steps taken during school break up to the point where the project starts, which are 1) select theme, 2) design curriculum and 3) prepare resources. A theme is selected by the school's Board of Directors (BOD) based on 2 criteria which are real-life topic of discussion and student's interest. Although the topic may be broad for academic learning, the curriculum, including courses and activities, has to be designed in a manner that exceeds the school's assessment standard for each subject and still is interesting for students. This is drafted by teachers and approved by the BOD. Once it is approved, preparation process requires teachers to product paper-based, activity-based and web-based teaching materials as well as to contact outsource experts.

All of the teachers said that the hardest part about the project for them is during the pre-project period. This is because sometimes they do not know much about the selected topic themselves, so they have to study about it before they can begin designing the curriculum. The methods they use to acquire knowledge are reading from books and websites, talking with experts who are from organizations that deal directly with that particular topic and discussing among colleagues. Then, teachers of the same subject will work together before collaborate with teachers from other subjects to apply their knowledge about that particular theme in preparing subject-integrated learning activities. Usually an experienced teacher is paired with a new teacher, and if needed they will help each other across subjects to complete the work.

Next, the period during the project takes place during the school term, where there is a learning activity organized for each week. The steps during the project include 4) conduct activities, 5) create product and 6) present project. There is a different learning activity every week, in which students participate in the activity in groups with the guidance of teachers. Roles and responsibilities of each student within the group are assigned according to their knowledge, skills and interests. As part of the activity, students create products related to the topic such as posters, models or video clips. These products are presented along with what they have learned to other groups

during activity and at the end of the day.

During this time, teacher has less work to do whereas students have to put in a lot of efforts in participation of learning activities. Nonetheless, all of the focus group participants feel that they are stimulated by activity in each week and eager to learn. There is a friendly-competition between each group, where both students and teachers want their group to do well for the activities results. This encourages group members to be constantly well-prepared for each week, by having relevant knowledge prior the start of the activity.

When facing a problem, teachers and students seek knowledge from various sources to solve the problem. While participating in the activity or creating products, younger students go to older students for assistance and vice versa. Then, they ask teachers of their own group about the problem or seek advice from teachers who are experts in that particular field for in-depth knowledge. Similarly when teachers face problems, they consult with other teachers or get help from students. For example, older teachers are less familiar with software application so students who are accustomed to technology provide guidance to the teachers. Nevertheless, ICT is one of the key tools that helps in finding and sharing of knowledge among students and teachers, such as online encyclopedias and social networks. Currently, 'Catch a Star' project is utilizing Facebook and Blogger as means of communication. In addition, external parties such as parents, foundations and non-government organizations are the sources of knowledge for the project.

The learning activities adopt various knowledge transfer techniques ranging from traditional to innovative methods. The learning methods used depend on the appropriateness of the context, such as content and time. However, the experienced teachers say that students learn better if they get do hands-on activities so teachers try to arrange that kind of activities as much as possible. Generally, students will first prepare relevant materials prior to project. Next, teachers use multimedia resources to teach students so that they have basic knowledge. With guidance from teachers, students usually either learn through observation of experts during workshops or explore possible solutions for the given problem. Sometimes students try out their ideas by themselves, and then feedback is given by teachers.

One of the most common problems found among students is that they do

not have enough time to complete the product assigned for each week's activity. A reason behind this is because by the time they finish planning for the solution for that week's objective, they do not have enough time to produce quality work in time for end-of-the-day presentation. Another reason is that on top of their regular class workload, PBL requires more time in preparing for and completing learning activities.

Steps 4, 5 and 6 are repeated weekly until the end of the project, where there is a final presentation with stage show, exhibition and booths. The end-of-project presentation takes a whole day where the project is presented to the whole schools including students and teachers of other levels as well as parents. Each group of students, with the help and guidance of teachers, puts on an exhibition of their products made during the project period. Within the group, some are assigned to put on learning activities such as games and shows while others are assigned to give academic presentation.

Then, the post-project period occurs right after the project concludes with final presentation and usually is the end of the term, in which the steps are 7) evaluate and 8) feedback. Students write an evaluation about their opinions on the project, which includes what they have gained in terms of knowledge and skills, what they like or dislike about the activities as well as which theme do they want for the next project. Teachers also have to do an evaluation about the project, learning activities and student's performance. These evaluations become the feedback for the next project. Principal of the lower secondary level section then has to write up a project report, in which is reviewed by the school's BOD.

If deemed outstanding, the project is entered into a competition organized by external parties as a learning product. Not only that the award can be an evaluation of the project's success, lower secondary teacher and students are proud to be a part of award-winning project. This is believed by most of teachers that it is a driving force for continuous development of 'Project Approach in Patai's Style'.
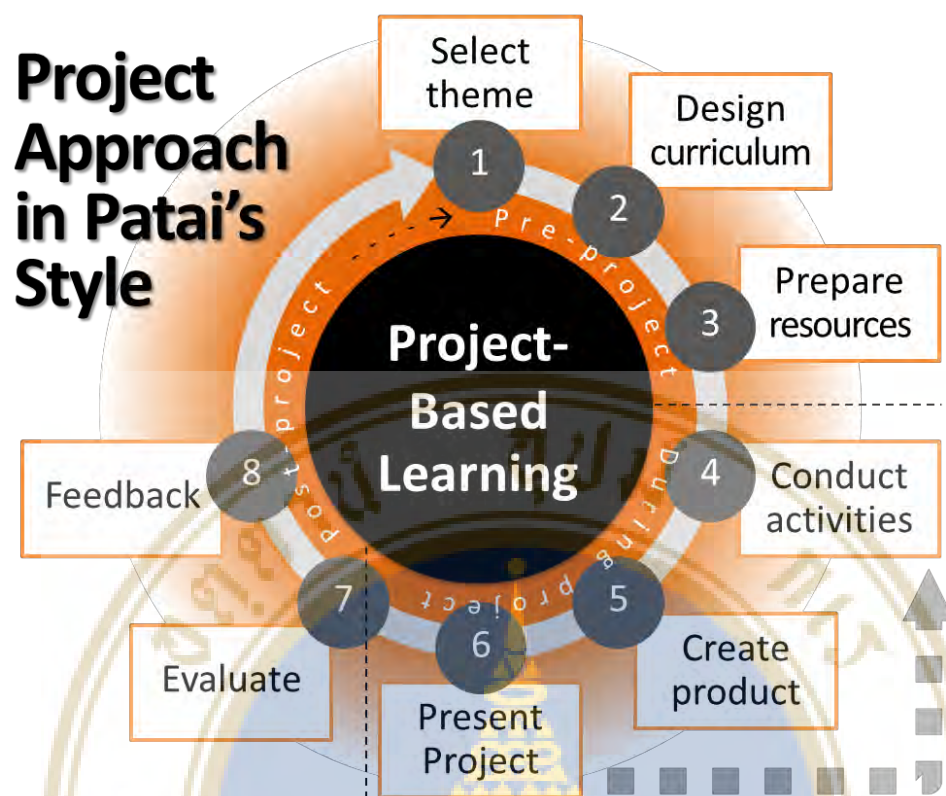
Figure 4.1. Project Approach in Patai's Style process.

The outcomes of the project are not only academic and applied knowledge, but also skills obtained by both teachers and students who actively participate in the PBL. Skills that are mostly acquired by the focus group participants include time management, collaboration, creativity, critical thinking and courage. Also, with the support of fellow students and teachers, they are not afraid to take risk because they think that they can also learn from failures. Most importantly, majority of the students state that they are fortunate enough to be given opportunity to show their competencies and improve themselves through the project.

4.2 Discussion

Patai Udom Suksa School wants students to be able to apply what they learn from the project to current situation and feel happy to study what they like, a PBL is designed to be appropriate for its context. The school, under the governance of Office of the Basic Education Commission (OBEC), has to comply with the national

assessment standard. Since the school decides to implement PBL as part of in-class curriculum, the outcomes of learning activities have to be assessed accordingly with the standard. Also, the adoption of curriculum-integration to ensure that the PBL can demonstrates real-life situation where knowledge and skills are not segmented subject by subject.

Prior the project starts, a lot of work from PBL goes to teachers who have to prepare learning resources for the project on top of their regular-class workload. Not only that they have to put extra effort into preparation, teachers have to make sure that they have enough basic knowledge about the selected theme and in-depth knowledge in their fields of expertise. However, since the lower secondary level section of Patai Udom Suksa School is relatively small in size as well as having a credible leadership from the principle, lower secondary teachers are able to build teamwork mentality. Once the project takes places, teacher's workload is reduced as they are then generally focused on giving guidance and ensuring that activities go as planned.

In contrast, students have to take a lot of actions since they have to participate in the learning activities weekly. Despite more workload, the students still enjoy learning in project-based approach. This has to do with real-world connections that the project's theme concerns, so it engages students more in learning necessary knowledge and skills (Bell, 2010). Also, it is because of the friendly competition between groups. Winner or top performer does not only get good grade but also prizes and recognition by the teachers and fellow students. With these incentives, students are encouraged to do better leading to continuous development in creation of knowledge and skills.

Even though not all types of learning by doing are evident from the data collection, additional information received from the school confirm that there is every type of deep smarts transfer techniques adopted in the learning activities (Leonard & Swap, 2005). Since PBL emphasizes the concept of learning by doing, the curriculum plan shows that guided observation, guided practice, guided problem solving and guided experimentation are included in the activities. However, it is possible that the plan is adjusted to fit with the context during the project. This means that certain methods like guided problem solving are used more often than others.

According to Leonard and Swap (2004), deep smarts are created and

transferred better through the active learning, however there is still passive reception methods used in the PBL. It is possible that in certain context, learning by doing is not achievable so traditional learning methods have to come in play. Moreover, some student may not be effective in learning via active methods but prefer more traditional methods such as reading or listening.

Since deep smarts are created and transferred from experts to novices, teachers must have sufficient knowledge about the selected topic in order to be able to guide students during the project. However, when they cannot obtain such knowledge in limited time period, they seek for expertise from external sources who can act as experts. These people are coaches and mentors for the project, who are more than happy to assist to accelerate the learning process. With the connection of student's parents, the school can contact various organizations for guest speakers, workshops, on-site and off-site field visits.

Nevertheless, deeps smarts created and transferred in PBL for Patai Udom Suksa School are from multi-directional collaboration of teachers and students who can be considered as both experts and novices. A person who is an expert in one field may be a novice in another area. It also means that teachers are not always experts, while students are not always novices. The criteria of an expert defined by Ericsson et al. (2007) about having consistent high performance may not be applicable in this dynamic PBL approach. In that sense, unlike Leonard and Swap's (2004) definition, the creation and transferring of deeps smarts can be done between people who may know a little bit better than the other person, in which becomes the basis for further improvement. The important point is that whether learners know where to seek for relevant knowledge and skills.

The 21st century skills are not direct output but rather outcomes obtained from PBL. As mentioned that both teachers and student gain various skills, the 3 important 21st century skills of creativity, critical thinking and collaboration are evident. These skills can be improved through PBL activities, because that teachers and students are given opportunity to develop themselves as mentioned previously. Both teachers and students, in this case, are learners who drive learning process forward with the guidance and support of others people involved in the project. In contrast to tangible output such as teaching materials and student's products, these

skills are intangible and hard to directly measure. Yet, the importance of these skills is not lessened.

Other than knowledge and skills acquired from PBL, teachers and students are actively engaged in learning. They look forward to participate in project's learning activities intellectually and emotionally. In addition to IQ and EQ, MQ or moral intelligence is stimulated since teachers and students have to be able to apply morals and ethics when working together as a learning community.

With the aid of technology, learners can build can use it as a tool and resource to create and transfer 21st century skills. ICT is more recognizable that it is able to create and transfer knowledge than skills. For example, learners access the internet to inquire or share knowledge. Although, it is less aware that technology can help learners acquire skills including creativity, critical thinking and collaboration. With limitless information shared on the internet, learners are able to build their creativity as they gain more ideas from other people. Next, information obtained from the internet may or may not be valid so learners have to develop critical thinking skill to process such information. Furthermore, there are various methods of communication using ICT which can be a means to gain collaboration skill.

4.3 Recommendation

Based on the analysis and discussion of data collection, suggestions are recommended in 2 parts including implication to the frameworks and application for the school. Findings from this research can make a contribution to moving towards deep smarts by (Leonard & Swap, 2004) used as a framework for this research.

As discussed above, the definitions of expert and novice who are involved in the creation and transfer of deep smarts may not be applicable. Learning can occur between student and teachers who constantly switch roles. This means that teachers who are knowledge coach for the project is not always an expert, and can sometimes be novice when performing certain tasks. Years of experience in teaching does not always correctly determined the expertise of teachers. Students, on the other hand, are supposedly the protégé can be experts for certain tasks.

Particularly for 21st century skills as it is experienced based, steady

creation and transfer process of deep smarts are needed. These skills are created bit by bit through practice. A person cannot transfer creativity, critical thinking and collaboration skills overnight, but rather guide one another to the right path in obtaining these skills. It can be considered as fulfilling each other's gap. Therefore, figure 4.2 illustrates that the roles of experts and novice should not fixed and exchangeable during the transfer of deep smarts depending on the task and situation.
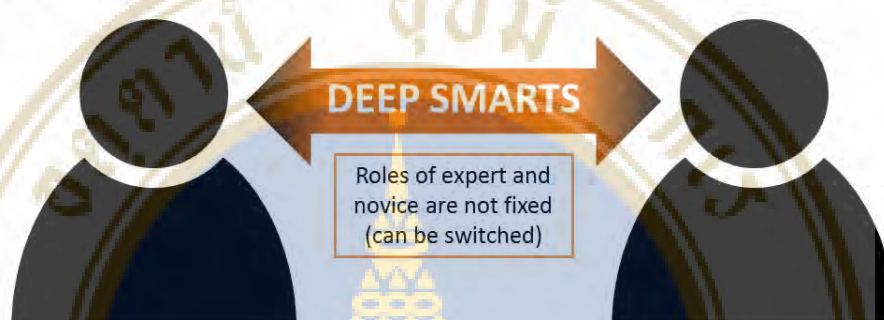

Figure 4.2. Exchange of roles between expert and novice.

Perhaps 'Project Approach in Patai's Style' may be more tuned toward guided problem solving, as evident by the learning collaboration between teachers and students. Even though there are many types of learning activities each week, many of them start with a problem. This means that throughout the project, teachers and students have to find solutions for questions that challenge their knowledge and skills to develop. When faced with a problem, teachers who act as experts also learn with students who have the role of novices. Both of them have to seek for and exchange relevant knowledge and skills in order to solve the challenge together.

Rather than one method over the other, it may be better to use a combination of methods to improve the learning process that caters for individualized student's needs. This is because guided learning methods require learners to work closely with their coaches, and if it is not done properly it can lead to ineffective learning process, where learners take longer time to acquire deem smarts or may head to the wrong direction completely. Examples of reasons that guided learning become less effective are lack of time or unbalance proportion between mentors and learners.

Other than guided practice, guided observation, guided problem solving

and guided experiment, an active learning method that can be used in moving toward deep smarts is 'learning by teaching'. The best way to understand sometime is trying to teach it to someone else (Rusczyk, n.d.). This method of learning occurs when learners take the coach's task in mentoring another person, where learners must have sufficient deep smarts prior beginning to teach. Not only that learners move toward deep smarts but they are in the process of becoming experts, as figure 4.3 illustrates an additional active transfer technique of 'learning by teaching' to Leonard and Swap's (2005) framework.
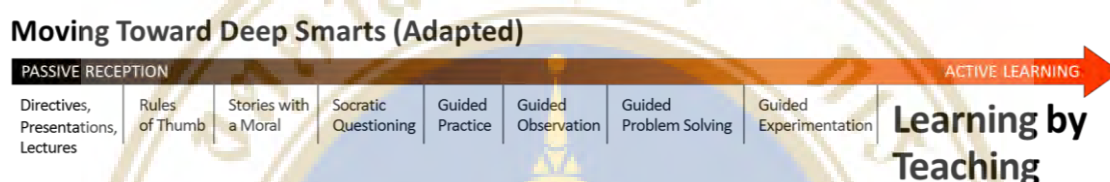

Figure 4.3. Moving toward deem smarts (adapted).

The findings show that Patai Udom Suksa School is on the right track in creating and sharing of deep smarts for 21st century skills, although there are possible improvements to continuously develop the PBL. These improvements are in the area concerning the ability to utilize technology, timeframe for the project and learning activities, connection with other schools.

Due to the fact that ICT is becoming undeniably important as the internet becomes part of people's daily life, the school needs to ensure that teachers are able to take advantages of technology. Experienced teachers, who are usually senior teachers, do not have a chance to use technology as much as new teachers who are more familiar with technological devices and software applications. These experienced teachers can be considered as experts in their areas and is valuable assets to the school. If they are trained to be able to utilize technology in teaching that aid learning process, these experienced teachers can contribute much more to education. Regular training and support are needed, in which the teachers feel comfortable enough not to take pride in their expertise and be opened in learning new things from less experienced, younger teachers.

Also, teachers and students have to know how to use technological

devices and software applications appropriately. This means that they should be able to utilize the right device with the right application to aid the learning process. Social network is useful for communication, as it allows for project's collaboration to build an e-learning community. As Facebook and Blogger are the currently used as online tools, there should be a group of teachers and students who are responsible for controlling the content. It is necessary to monitor and control KMS because it can affect the quality of knowledge shared and well as contribution of users.

As there is a lot of additional workload for teachers and students at certain times of the PBL, the school may need to re-organize the timeframe for the project and learning activities. During the curriculum design stage, teachers may need to take into account other works that students may have to complete. This way, work schedule is not cramp during certain time of the school year. Teachers can balance out the workload that is put on students throughout the year. Also, schedule on the project day can be adjusted where students are allowed more time to complete their products and then present it in the following week. With some adjustments, teachers still get desired output while students are not rushed to complete their works.

Another recommendation that the school should consider is that 'Project Approach in Patai's Style' learning method is not used at other schools. Even though it is PBL that may be used elsewhere, but it has a unique process for teachers and students to learn together. Students who finish Year 9 from Patai Udom Suksa School have to enter another school that may or may not have PBL. Although, it still cannot be guaranteed that the skills obtained from this method of learning will be continuously developed. Perhaps the school should consider building connection with partner schools to adopt the same approach, so that students can have to option to further develop themselves. It may be difficult for another school to implement the exact same curriculum, however Patai Udom Suksa School can act as a coach to guide about implementing PBL.

Moreover, since the school has to comply with OBEC assessment standard, they can introduce extracurricular PBL. This means that PBL can be implemented outside class time so curriculum is not restricted by the assessment standard. Given that the school provides after school class and weekend class, Patai Udom Suksa School can have a course that adopts 'Project Approach in Patai's Style'

during those times. This does not only broaden the topics that can be learned, but also increase learning opportunities, develop 21st century skills and cultivate life-long learning.

CHAPTER V
CONCLUSION

In conclusion, this research paper seeks to investigate the creation and transfer of deep smarts for 21st century skills through project-based learning in Thai schools. With the goal to develop the nation's future human resources, education industry realizes the importance of knowledge management in schools. Now that the economy in the 21st century is less about production but more about knowledge and creativity, a new set of skills is becoming increasingly important for people to have. Students, seen as the future of the nation, are deemed to have these 21st century skills.

Even though there are several skills that are believed to be essential, the common 3 key skills that can be found in many literatures include creativity, critical thinking and collaboration (Saavedra & Opfer, 2012; Trilling & Fadel, 2009). These skills are stressed due to the context of the world's economy and trends. The creative economy encourages innovation as a competitive advantage, while the better flow of information aided by technological advancement requires critical thinking. Also, with the improved technology, the world is becoming more globalized in which triggers the significance of collaboration skills.

According to Leonard and Swap (2004), moving toward deep smarts framework illustrates the more active learning methods are, the better the learning process and outcomes. It is believed that the learning process can be accelerated with guidance from experts. Active method concerns learning by doing concept that includes guided practice, guided observation, guided problem solving and guided experiment. Experts act as knowledge coaches who mentor novices throughout the learning process.

The research examines the case study of Patai Udom Suksa School who implement PBL in order to promote 21st century skills – 'Project Approach in Patai's Style'. The research focuses on the PBL of lower secondary level section, where PBL is multi-level with curriculum integration. This means that students from Year 7, 8 and 9 participate in the same PBL that integrates various subjects into the learning

activities. With guidance of teachers, students do not only create and transfer knowledge but also necessary skills which can be considered as deep smarts.

There are 8 steps to conduct 'Project Approach in Patai's Style', which can be used as a PBL process guideline for other schools. These steps are can be categorized into 3 periods which are pre-project, during project and post-project. Pre-project period include 1) select theme, 2) design curriculum and 3) prepare resources. Next, during project period includes 4) conduct activities, 5) create product and 6) present project. Step 4, 5 and 6 are repeated weekly until the end of the project's time frame, where a final presentation is organized in exhibition form for the whole school to participate. Then, post-project period includes 7) evaluate and 8) feedback.

A combination of learning methods is used for the project's activities, extending from traditional to more innovative methods. Teachers try to organize as much hands-on learning activities as possible, but sometime it is limited by the context. Unlike the definition of expert given by Ericsson et al. (2007), roles of experts and novices are exchangeable as expertise of teachers and students does not entirely depend on their roles, years of experience or age. There are deep smarts created and transferred multi-directionally between as well as among teachers and students.

Other than learning by doing method, deep smarts can be created through learning by teaching method. This concept is based on the idea that teachers and student are learners in the project but they also have to teach other people. In order for a person to be able to teach someone else, they need have sufficient competencies. When transferring knowledge or skills to another, not only that the receiver move closer to deep smarts but also the sender as well.

The limitation of this research paper is that it is only conducted on one school. Since this research paper uses Patai Udom Suksa School's 'Catch a Star' project as a case study, the finding is limited by the sole source of data collection. The school has unique characteristics in capabilities and resources compared to other schools in Thailand. Characteristics of other schools that have may or may not differ, meaning that their PBL may lead to similar or different results for the research. Also, this research paper focuses on only one of many projects studied by Patai Udom Suksa School, where data collection of other projects may be able to provide more complete information thus finding.

Based on the finding of this research paper, possible further research can investigate the moving toward deep smarts for 21st century skills in other schools within Thailand. PBL may not be the approach used by other schools, because they may have different approaches to create and transfer 21st century skills for students that are more appropriate for their context. Learning methods, including the suggested learning by teaching method, can be examined accordingly to each school's context. Comparisons can then be made between schools in creating and transferring of deep smarts, in order to be guidelines for schools that are interested in implementing innovative learning methods.

In addition, further research can examine the process in building education connection and implementing PBL for schools within the country and overseas. Even though there are already education connection and PBL, but they are usually separated. One school may not be able to have significant impact but unity of school network may be able to push education forward. Also, as mentioned that the world is becoming more globalized, there are many international collaborative projects. However, for basic education schools, most of them concerns mainly about cultures. PBL can stimulate interest in other topics, where knowledge and skills can be created and shared across borders.

Another possible area for further research is post-project follow up, in order to investigate on the development of 21st century skills. Since these skills of each individual cannot be guaranteed to be continuously improved after the PBL activity is over, a follow up research is needed to ensure the on-going development. Instead of only using technology for the learning process, it can be established as a learning system to allow continuity of learning in PBL approach, where students and teachers can participate in the project without time and distance boundaries.

Overall, PBL is an effective method that uses learning by doing techniques to create and transfer deep smarts for 21st century skills. However, for other schools to adopt the same approach, the process of PBL needs adjustment to fit with each school's specific context. This means that the school's resources and competencies have to be taken into account. For instance, multi-level project may be hard to implement due to large number of students so PBL can be done by student within the same level. In order to prepare the nation's future assets to be equipped with important

21st century skills, schools in Thailand have to move away from traditional learning methods that do not develop students to their fullest potential. PBL is a way to stimulates student's learning as well as teacher's capabilities.

REFERENCES

Alavi, M., & Leidner, D. E. (1999). Knowledge Management Systems: Issues, Challenges, and Benefits. *Communications of the Association for Information Systems, 1*(7), 1-37.

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly, 25*(1), 107-136.

Bell, S. (2010). Project-Based Learning for the 21st Century: Skills for the Future. *The Clearing House*, *83*, 39-43.

Brikci, N., & Green, J. (2007). *A Guide to Using Qualitative Research Methodology*. UK: Medecins Sans Frontieres.

Changing Minds. (n.d.). *Socratic Questions*. Retrieved November 30, 2013, from http://changingminds.org/techniques/questio

Ericsson, K. A., Prietula, M. J., & Cokely, E. T. (2007). The Making of an Expert. *Harvard Business Review, July-August 2007*, 1-8.

Gary, L. (2005). Build Your Company's Deep Smarts. *Harvard Management Update, August 2005*, 1-5.

Guta, L. (2013). *Quantitative Versus Qualitative Research in Knowledge Management*. Retrieved from http://ssrn.com/abstract=2218594

Hansen, M. T., Nohria, N., & Tierney, T. (1999). What's Your Strategy for Managing Knowledge?. *Harvard Business Review, March–April 1999*, 1-11.

Leonard, D., & Swap, W. (2004). Deep Smarts. *Harvard Business Review, September 2004*, 1-11.

Leonard, D., & Swap, W. (2005). *Deep Smart*. MA, USA: Harvard Business School Press.

May, G. H. (2011). Education: Time to rethink the Industrial model?. *Journal of Futures Studies*, *16*(1), 101-108.

Nonaka, I. (2007). The Knowledge-Creating Company. *Harvard Business Review, July-August 2007*, 1-11.

Nonaka, I., & Konno, N. (1998). The Concept of "Ba": Building a Foundation for Knowledge Creation. *California Management Review, 40*(3), 40-54.

OECD. (n.d). *Skilled For Life? Key Findings from the Survey of Adult Skills*. Retrieved November 30, 2013, from http://www.oecd.org/site/piaac/SkillsOutlook_2013_ebook.pdf

Rusczyk, R. (n.d.). Learning Through Teaching. *Art of Problem Solving*. Retrieved November 30, 2013, from http://artofproblemsolving.com/Resources/articles.php?page=learning

Saavedra, A. R., & Opfer, V. D. (2012, October 1). Learning 21st-Century Skills Requires 21st-Century Teaching. *Kappan, V94 N2*, 8-13.

The Nation. (2011, January 17). *Cram schools should be taxed and controlled*. Retrieved November 30, 2013, from http://www.nationmultimedia.com/2011/01/17/opinion/Cram-schools-should-be-taxed-and-controlled-30146513.html

Trilling, B., & Fadel, C. (2009). *21st Century Skills: Learning for Life in Our Times*. CA, USA: Jossey-Bass.