How do learners discover the topic in team project-based learning?: Analysis of Learners' Creative Activity in the process of selecting the topic*

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Team project learning is a type of Project-Based Learning, which is an effective learning method for developing collaborative competency and interpersonal communication skills, as well as for developing cognitive competency such as critical thinking, creative thinking, and analytical skills. This research, conducted to analyze learning activities, focuses on students' creative thinking and activities in TPBL(Team Project-Based Learning). A qualitative approach including a reflective journal based on the 6 stages of TPBL, was adopted for this purpose. In this study, 69 reflective journals on the three stages (developing a theme, researching, theme-making) of 23 undergraduate students were categorized on the basis of three criteria: divergent thinking factors, convergent thinking factors and affective factors. The results show that the participants' journals demonstrated twenty-eight activities from nine cognitive factors and nine activities from three affective factors were derived from reflect journal. This finding indicates that more appropriate instructional strategies are needed for students to enhance their creative thinking skills and activities

Keywords : Team project-based learning, Creative thinking, Learning activity, Topic selection

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Introduction

Recently, creative thinking skills have become vastly more important in educational settings. Many researchers have attempted to improve those skills through learning (Krulik & Rudnick, 1999). In order to improve these skills, teachers have applied the learning method known as team project learning. Because team projects are effective for improving higher learning abilities such as creative thinking skills, social skills, intrinsic motivation, etc. (Blumenfeld, Soloway, Mark, Krajcik, Guzdial & Palincsar, 1991; Chapman & Freeman, 1996; Moursund, 2003), they are applied for various levels of learners throughout K-12 or other educational settings.

Team project learning is a type of project-based learning wherein questions are generated by learners in order to develop the topic with data search, which are used to predict and reach results (Blumenfeld, et al., 1991; Laffey, Tupper, Musser & Wedman, 1998). Although most literature reports the effectiveness of project-based learning (Chapman & Freeman, 1996; Jung, 2001; Kim, 2007; Kolodner & Guzdial, Liu & Hsiao, 2002; Park, 2007; Thomas, 2000), there are few reports that discuss the learning process. However, this study focuses on the learning process of team project learning, especially the process of topic selection. The learning process of topic selection is more important than any other process, because it would become the design process of the final product, such as architect's design.

When learners seek to discover the topic, they would share their interest and ideas. At this time, learners would experience divergent thinking with their colleagues. In this process of topic selection, creativity makes them be underlied through problem solving and problem. If learners would not try to collect various ideas or interests related to the team project learning, they could not make the creative product of it. So, this study aims to closely analyze learners' activities in the process of selecting their topic of the team project, and then would discover learners' effective creative activities.

Therefore, this study asks the following research question:

What are the learners' creative activities that are used in the process of selecting the topic of team project learning?

Review of the Literature

Team Project Learning

Project based learning is an effective learning method for improving higher learning abilities as well as academic achievement (Thomas, 2000). Learners could especially use this to improve problem solving ability (Liu & Hsiao, 2002; Park, 2007; Park, 1999; Thomas, 2000), self-directed ability (Park, 1999; Liu & Hsiao, 2002), thinking skills (Chapman & Freeman, 1996; Jung, 2001), project management skills (Kim, 2007), intrinsic skills (Blumenfeld, et al., 1991; Moursund, 2003), and social skills (Chapman & Freeman, 1996), such as communication (Liu & Hsiao, 2002) and collaboration (Kim, 2007; Kolodner & Guzdial, 1996; Liu & Hsiao, 2002; ; Park, 2007; Thomas, 2000). Learners could also improve their creative thinking skills by gaining experience with team project learning (Chapman & Freeman, 1996; Roerden, 1999; Song & Shin, 2002).

Team project learning is a type of project-based learning (PBL) which a learner participates in with their colleagues or peers. Project-based learning is a learning method used to generate questions by learners for the purpose of developing the topic with data research, and is used to predict and reach appropriate results (Blumenfeld et al., 1991; Laffey et al., 1998).

Group learning of team project learning facilitates not only the acquisition of knowledge but also several other desirable attributes such as cognitive learning (which includes creative thinking), social abilities (which includes communication and collaboration), and learner's characteristics (which includes self-directed

learning and independent responsibility for learning, sharing information and respect for others) (Awang & Ramly, 2008).

In project-based learning, students voluntarily select the research topic based on questions, share opinions and ideas among team members through conversation, and manage the effective process to solve problems (Krajcik, Czerniak, & Berger, 1999). Especially, when learners seek to discover the topic, they would share their interest and ideas. At this time, learners would listen and be careful of various views or fields of team members. So, they would experience divergent thinking with their colleagues. In this process of topic selection, creativity makes them be underlied through problem solving and problem (Runco, 2004).

Creative Thinking Skills

Creativity

Creativity can be defined in numerous different ways (Meusburger, 2009). Over the course of the last decade, a general agreement has been reached that creativity involves making novel and useful products (Mumford, 2003). Project learning is a model that requires thoughtful inquiry to learn from and create something new. This implies that creative thinking is required throughout project learning. Creativity is poorly understood and difficult to teach. Moreover, the factors affecting creativity are not agreed upon; researchers suggest that diverse factors concern creative thinking.

Factors of Creative Activity

Cognitive and affective factors are involved at each level of creative learning (Fasko, 2000-2001). About cognitive factors, Guilford (1956, 1959, 1960, 1986) considered creative thinking as involving divergent thinking, which emphasizes fluency, flexibility, originality, and elaboration(Kim, 2006). In this regards, Guilford suggested SI model (Guilford, 1975) and that creative act requires convergent and

divergent thinking (Fasko, 2000-2001). Torrance Tests of Creative Thinking (TTCT) (Torrance, 1990) is a widely used test of creativity and identifies defining factors of creative activity. Three of the creative abilities measured by these tests are originality, fluency, and flexibility. These abilities are defined as follows: originality: the ability to produce uncommon or unique responses; fluency: the ability to produce a large number of ideas; and flexibility: the ability to produce a variety of ideational themes or categories. Buakanok(2012) suggested creative thinking process include sensitivity, fluency, flexibility, originality, elaboration, and imagination.

About affective factors, Sternberg & Lubart(1991) suggested that there are several personality attributes that have been shown to be traits of persons considered to be creative:(a) tolerance for ambiguity, (b) willingness to surmount obstacles and persevere, (c) willingness to grow, (d) willingness to take risks, and (e) courage of one's convictions and belief in oneself(Awang & Ramly, 2008).

There were several researchers proposed that creativity include both cognitive and affective factors.

Individual differences in creativity are modulated by certain cognitive skills and personality traits such as fluency, flexibility, visualization, imagination, expressiveness, openness to experience and increased schizotypal traits (Folley & Park, 2006). Buakanok(2012) suggested that the abilities required in the creative thinking process and characteristics. Creative thinking process includes sensitivity, fluency, flexibility, originality, elaboration, and imagination. Characteristics related to creative behavior are curiosity, run-a-risk, independence, task commitment, humour, and motivation, which are related to the cognitive process for accomplishment. Cho, Ho, and Jeon (2005) categorized cognitive and affective factors on creativity and classified cognitive factors into the categories divergent thinking and convergent thinking. Divergent thinking involves the generation of many ideas. In contrast, convergent thinking tends to move toward a single solution to a problem (Guilford, 1956; Mayer, 1992; as quoted in Goncalo, Staw, 2006).

Divergent thinking is divided into the following categories: fluency, flexibility, imagination, elaboration, and originality. The authors sub-categorize convergent thinking and divide it into the sub-categories: critical thinking, analytic thinking, and comprehensive thinking. They then classify affective factors into the following categories: openness, concentration, curiosity, and spontaneity. Cho et al.'s framework was applied in this study, because various factors are required to reveal more meaningful creative activity.

Table 1. Cognitive and affective factors on creativity (Cho et al., 2005)

Category	Sub-Category	Description
Divergent Factors	Fluency	Fluency is the ability to generate a wide number of relevant ideas.
	Flexibility	Flexibility is the ability to find various solutions and generate a large number of ideas from which to choose.
	Imagination	Imagination is the ability to create new ideas based on past experiences.
	Elaboration	Elaboration is the ability to refine proposed ideas, review a given problem, clarify the meaning contained in the problem, find the missing piece, and complement ideas.
	Originality	Originality is the ability to produce ideas that are uncommon, novel, and unique.
Convergent Factors	Critical Thinking	Critical thinking is the process of understanding a given problem and judging the authenticity of any facts or circumstances.
	Logical Thinking	Logical thinking is the ability to develop ideas based on empirical evidence or reasonable discussion with reasonable accuracy.
	Analytic Thinking	Analytic thinking is the ability to decompose a concept or an object into separate properties and elements and then compare the similarities and differences by dividing out by case and result.

	Comprehensive Thinking	Comprehensive thinking is the tendency to establish a unified concept of listed or opposed ideas.
Affective Factors	Openness	Openness is the tendency to explore new possibilities without being tied to an existing framework.
	Task Commitment	Task commitment is the tendency to focus on a specific theme or situation in order to collect a variety of information and to persist until the problem is resolved.
	Curiosity	Curiosity is the tendency to be doubtful of ideas and to pose continuous questions.
	Spontaneity	Spontaneity is the tendency to react to the problem situation and to produce ideas according to their intrinsic motivation and not coercion.

Method

Participants

The participants of this study were 23 undergraduate students who all majored in Special Physical Education. They were grouped into six teams in an "educational technology and methods" course. A cooperative activity was performed on the basis of the project learning model.

Data Collection

The topic of the project was to design coursework to be used in the near future at their school. Participants can select the scope of the future learning environment, such as a school classroom, and they could decide the teaching and learning methods.

The final products of the six teams included six visualized maps, the presentation

of a 150-minute video file, and the creation and collection of 138 reflection journals of six stages of development. For this study, reflection journals of three stages (developing a theme, researching, theme-making) of development were analyzed.

Research Process and Analysis

This study aims to explore creative activities in topic selection stage. A qualitative approach including 69 reflective journals about topic selection and project planning was conducted. Forms of reflective journal were adopted for this study from study of team project based learning (Kim, 2011).

For the study, first, data was coded for activity units according to the Cho et al.(2005)'s framework. Researchers reviewed same journals each. After researchers' reviewing, new meaningful coding statements which are not correspond with Cho et al.(2005)'s framework were emerged during coding. Therefore, framework was modified and 101 statements are extracted. Second, they are summarized in activity statements. After discussion, researchers made 90 agreements (89%) of 101 statements. Third, summarized statements are restated in general statements. At the same time, all 90 activity statements in first stage are reexamined. Fourth, creative activity coding scheme was developed. And levels of activity were elaborated because activity levels were different even though same categorization. Fifth, data was coded for classified activity units according to developed coding scheme. Repeated activity statements are counted in the frequency and deleted in the activity list.

For confirming the validity, one PhD candidate and one PhD in Educational Technology as external experts reviewed all categorizations for verification. Agreement among the external coders, based on Cohen's Kappa Coefficient, was .91. The entire process was followed by the researchers' consensus.

Results

Message analysis of learners' topic selection activity focused on creativity

According to cognitive and affective factors on creativity, learners' creative activities in team project learning based on topic selection are shown in Table 2.

Table 2. Number of learning activity messages focused on the creativity

Category		Number of activity messages	
Cognitive Factor	Divergent Thinking	Fluency	3	
		Flexibility	7	10
		Imagination	4	
		Elaboration	2	
		Originality	4	
	Convergent Thinking	Critical Thinking	6	
		Logical Thinking	3	18
		Analytic Thinking	3	
		Comprehensive Thinking	6	
Affective Factors		Openness	5	
		Task Commitment	1	9
		Spontaneity	3	
Total			37	

In this study, learners' creative activities in the topic selection of team project are 37, 3 fluency activities, 7 flexibility activities, 4 imagination activities, 2 elaborative activities, 4 originality activities, 6 critical thinking activities, 3 logical thinking

activities, 3 analytic thinking activities, 6 comprehensive thinking activities, 5 openness activities, 1 task commitment activities, 3 spontaneity activities.

Their concrete activities of selecting the topic are following Table 3.

Table 3. Content of learning activity messages focused on the creativity

Category			Activities
Cognitive factor	Divergent Thinking	Fluency	Questioning team members continuously and producing a large amount of possible ideas
			Sharing own ideas on the subject with team members
			Providing opinions based on collected information and creation of ideas through brainstorming
		Flexibility	Finding solutions through internet search, by collecting and reviewing relevant data
			Seeking ideas for transforming the present situation through discussions with team members
			Investigating comments and materials about the present situation to acquaintances (parents, teachers or friends for example)
			Exploring ideas through a variety of resources, such as internet research, books, and inquiring to acquaintances
			Investigating the current situation as it relates to the theme of the project from different angles
			Investigating users' experiences and opinions about the projects theme
			Visiting and observing the methods of similar institutions and collecting materials through internet research, books, or other places.
		Imagination	Envisioning specifics related to the project
			Thinking about a future need based on past experience
			Imagining what the available technology, tools, and

		environment in future
		Producing specific ideas while envisioning possible solutions of the project
	Elaboration	Selecting sub-themes to be included in the final result
		Thinking of details about the sub-theme
	Originality	Visualizing a unique environment that does not originate from currently used technology
		Breaking the stereotype
		Producing creative thoughts for improvement by collecting a variety of materials related the topic
		Creating topics that are outside the scope of topics which the other teams might choose
Convergent Thinking	Critical Thinking	Discussing insufficient or inconvenient aspects of the project in relation to specific topics
		Thinking about the topics by taking into account current situation, problem, and methods of improvement
		Considering the benefits and negative aspects of ideas during discussion
		Thinking critically about the advantages and disadvantages of every topic
		Questioning preconceived notions concerning the topic
		Presenting opinions for and against the ideas of team members
	Logical Thinking	Discussing the most appropriate among various topics
		Reminding oneself of the goal of the project continually and remaining fixated on the correct topic
		Keep in mind the prerequisite goal of the project
	Analytic Thinking	Setting priorities and their hierarchal importance and selecting appropriate sub-topics
		Subdividing topics by establishing criteria to determine the

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		contents of the project
		Classifying content by category to create a specific design
	Comprehensive Thinking	Determining a valid sub-topic through discussion
		Synthesizing team members' opinions
		Envisioning the entire design of the topic's discussion
		Selecting a topic by discussing the issue
		Determining the project's vision by exploring a variety of information
		Setting the goal of the project by synthesizing team members' opinions
Affective factor	Openness	Paying attention to others and writing team members' comments down
		Organizing ideas after listening to team members' opinions
		Maneuvering through the topic by coordinating with and talking freely to team members to share thoughts
		Questioning team members about their opinions for topic selection
		Selecting the appropriate topics for use after considering how to develop the project
	Task Commitment	Inviting acquaintances to express opinions on available topics
	Spontaneity	Team members showing leadership and presenting opinions in discussion
		Thinking about the topics before the team meeting
		Reviewing other team members' work and sharing materials

Most of all, learners have a tendency of focusing on cognitive thinking strategies as well as affective strategies, especially flexibility, critical thinking, comprehensive thinking for selecting the project topic.

Content analysis of learners' topic selection activity focused on creativity

Content of the learners' creative activities in team project learning focused on topic selection are as follows.

Cognitive Aspects

We analyzed the learning activities in cognitive aspects of fluency, flexibility, imagination, elaboration, originality, critical thinking, logical thinking, analytic thinking and comprehensive thinking. In cognitive aspects, learners' activities are characterized by sharing ideas and resources, analyzing the improvements and conceiving the final product.

Activity 1. Sharing Ideas and Resources to Find out Their Topic

Learners tried to share ideas and resources to generate a wide number of relevant ideas and find various solutions for their project topic. Firstly, learners created diverse ideas by sharing their opinions and questioning each other. They questioned to team members continuously and producing a large amount of possible ideas.

> *"We tried to investigate the extant context of the topic through various thesis, social issues and literatures, so would try to discover our topic."(interviewee J)*

Also, they would share own ideas on the subject with team members, providing opinions based on collected information and creation of ideas through brainstorming. Secondly, learners collected information by various resources and acquaintances to find out solutions as much as possible. They found solutions through internet search, by collecting and reviewing relevant data, and they explore ideas through a variety of resources, such as internet research, books, and inquiring to acquaintances. They investigated the current situation as it relates to the theme of the project from different angles, seeking ideas for transforming the present situation through discussions with team members. Also, they used to visit and

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observe the similar institutions, investigating comments and materials about the present situation to acquaintances (parents, teachers or friends for example). Throughout observing and investigating, they focused on learners' experiences and opinions about the projects topic.

Activity 2. Analyzing the Improvements to Make more Practical Topic

Learners tried to analyze the improvements to create new ideas and think the authenticity of any facts or circumstance for their project topic. Firstly, learners envisioned the solutions by past experience and future need, especially envisioning specifics related to the project, thinking about a future need based on past experience, imagining what the available technology, tools, and environment in future, producing specific ideas while envisioning possible solutions of the project. Secondly, they created topics from stereotype to improvements to make the perfect product. They would try to visualize a unique environment that does not originate from currently used technology, breaking the stereotype, producing creative thoughts for improvement by collecting a variety of materials related the topic and creating topics that are outside the scope of topics which the other teams might choose.

> *"We tried to analyze the problem of the music class, and consider the improvement of this class."(interviewee H)*

Thirdly, they would analyze the benefit and negative aspects, discussing insufficient or inconvenient aspects of the project in relation to specific topics, thinking about the topics by taking into account current situation, problem, and methods of improvement. Also, they tried to consider the benefits and negative aspects of ideas during discussion, thinking critically about the advantages and disadvantages of every topic, questioning preconceived notions concerning the topic and presenting opinions for and against the ideas of team members.

Activity 3. Conceiving the Final Product Systematically

Learners tried to clarify the meaning contained in the topic, develop ideas with reasonable accuracy, decompose a topic into separate elements, and as establish a unified concept for their project topic. Firstly, learners would conceive the structure and details of the final product, selecting sub-themes to be included in the final result, and thinking of details about the sub-theme.

> *"We tried to make the outline of the final product with selecting the most appropriate issues or resources."(interviewee K)*

Secondly, they tried to keep the consistency of goal and product, discussing the most appropriate among various topics, reminding oneself of the goal of the project continually and remaining fixated on the correct topic, and keeping in mind the prerequisite goal of the project. Thirdly, they subdivide topics by hierarchal content, setting priorities and their hierarchal importance and selecting appropriate sub-topics, subdividing topics by establishing criteria to determine the contents of the project, and classifying content by category to create a specific design. Fourth, they would envision the final product by synthesizing the ideas, determining a valid sub-topic through discussion, synthesizing team members' opinions, envisioning the entire design of the topic's discussion, selecting a topic by discussing the issue, determining the project's vision by exploring a variety of information, and setting the goal of the project by synthesizing team members' opinions.

Affective Aspects

We analyzed the learning activities in affective aspect of openness, task commitment, curiosity and spontaneity. In affective aspects, learners' activities are characterized by learners' openness, especially paying attention to listen and question about other's opinions and spontaneity for team performance.

Activity 1. Paying Attention to Other's Opinions to Select the Persuasive topic

Learners would pay attention to others and write team members' comments down during discussing them. They used to organize ideas after listening to team members' opinions, maneuvering through the topic by coordinating with and talking freely to team members to share thoughts, questioning team members about their opinions for topic selection, and then they selected the appropriate topics for use after considering how to develop the project.

> *"I tried to listen carefully to her ideas, and then I gave a feedback on it. So, I tried to persuade her to our topic."(interviewee P)*

Activity 2. Reacting to Produce the Team Performance

Learners tried to prepare the works and lead the idea sharing, especially team members showing leadership and presenting opinions in discussion, thinking about the topics before the team meeting, and reviewing other team members' work and sharing materials.

> *"I used to check our club notice, and then I would think about what our topic is appropriate."(interviewee J)*

Conclusion

This study analyzed the learners' activities in the process of selecting their topic focused on creative strategies. As a result, thirty-seven activities from nine cognitive factors and nine activities from three affective factors were derived from reflection journals. In cognitive aspects, learners' activities are performed as sharing ideas and resources, analyzing the improvements and conceiving the final product. In affective aspects, learners' activities are performed as learners' openness, especially

paying attention to listen and question about other's opinions and spontaneity for team performance. However, it doesn't show the activities focused on the curiosity of affective factor noticeably in the process of topic selection.

Topic selection activity cannot be too highly important of any other steps of team project learning, because it would become the design of making their product. As this study is shown, learners would try to investigate and explore their topic by searching the information from various resources and sharing ideas with peers. Through this process of searching their topic, learners would get the various resources and ideas, and then experience the creative thinking with their peers.

This study does concern on the creative activity of designing their team project. So, this finding would contribute to the instructional design of the topic selection of team project learning focused on creative thinking.

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