Entrepreneurial science thinking approach in project-based learning

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Abstract. This 21st century, research and development related learning strategies have been widely implemented, one of which is the use of project-based learning model. This model has a positive effect on student learning outcomes. However, most of the use of this model focuses more on the appropriateness between the concepts and projects the students are working on. This is considered less hope to compete in the 21st century, especially in aspects of life and career skills. Thus, it is necessary to design a learning strategy that facilitates student to use the concepts that they learn to solve daily problems or even entrepreneurship by applying the Entrepreneurial Science Thinking (ESciT) approach. Therefore, this paper will describe the application of the Entrepreneurial Science Thinking (ESciT) approach in project-based learning as a learning strategy that is expected to provide opportunities for students to further improve their skills not only on the mastery of concept but also on life and career skill.

1. Introduction

The 21st century as today, Indonesian is faced with challenges and opportunities in global competition, included in education. The development and research on learning strategies is mostly done as an effort to adjust to the demands, challenges and opportunities in the era of global competition. The development and research of instructional strategies undertaken by researchers is usually related to the approaches, models, methods, media, teaching materials and instructional techniques. The development and research undertaken not only to conform to the 21st century paradigm but also to find out the efficiency and effectiveness of such learning as a result.

Skills that must be owned by 21st century students are divided into learning and innovation skills: learning to create together, digital literacy: information, media and technology, and life and career skills: work-ready, prepared for life [1]. Project Based Learning (PBL) becomes one of the alternatives that can be used to facilitate students to improve the skills needed. The PBL is defined as a learning model that has five criteria of centering, focusing on questions of problems, constructive of design investigations, learner’ autonomy, and realism [2].

Some of studies that show the effectiveness of PBL implementation are improving learning outcomes of cognitive domains of the mastery of concepts [3, 4, 5] and creative thinking skill [6, 7]. In addition, the implementation of PBL can also assist students for using their creative thinking skill in investigations that lead to the realization of problems in real life [8 - 11]. It showed that PBL has a
positive influence on mastery of concepts and creative thinking skill. However, most of these studies are more focused on assessing the conformity of concepts used with the products they produced. In addition, if it refers back to the 21st century, it only involves learning and innovation skill and digital literacy skill while in the life and career skill aspect less attention is given. Meanwhile, Entrepreneurial Science Thinking (EScIT) is a learning approach that views science from an entrepreneurship point of view [12].

Therefore, the authors are interested to study the approach of Entrepreneurial Science Thinking (EScIT) and its applications in Project-Based Learning (PBL) as the design of learning strategy. With this strategy, students are expected not only have ability to mastery of concepts but also have the skills to use technology and information media (digital literacy), have the skills entrepreneurship thinking (life and career) and skills to develop the knowledge that has been learned to solve the problem creatively (learning and innovation).

2. Method
This research uses descriptive method which includes background research, research question, library research and design of learning strategies. Research design on this time is the library research with seeking information and basic theories that will be used to understand and develop learning strategies. Data obtained from library research will be analysed and considered for designing a strategy.

3. Result and Discussion

3.1. Background research and research question
As we discussed earlier that students need a learning that can facilitate and give more opportunities for them not only to improve the mastery of the concepts but also to improve their skills in an effort to deal with competition in the 21st century. So the research question this time is how the implementing of entrepreneurial science thinking approach in project-based learning as a learning strategy that provide more opportunities for students to improve their life and career skill.

3.2. Library research
Here are steps for implementing Project Based Learning (PBL) [13].
Step 1. Start with the essential question
The question must be a one that will engage the students. It is open ended. It will pose a problem or situation they can tackle. Take a real-world topic and begin an in-depth investigation. Make it relevant for them.
Step 2. Design a plan for the project
Planning contains the rules of the game, the selection of activities that can be supportive in answering essential question by integrating the various possible subjects, as well as knowing the tools and materials that can be accessed to assist in the completion of the project.
Step 3. Create a schedule
Design a timeline for project components.
Step 4. Monitor the students and the progress of the project
To maintain control without preventing students from taking responsibility for their work.
Step 5. Assess of the outcome
Assessing is done to assist the teacher for measuring the achievement of standards, play a role in evaluating the progress of each learner, providing feedback on the level of understanding that has been achieved learner, helping teachers in preparing the next learning strategy.
Step 6. Evaluate the experience
At the end of the learning process, teachers and learner reflect the activities and outcomes of projects that have been implemented.

Entrepreneurial Science Thinking (EScIT) is a concepts of teaching and learning science to give birth to students who have entrepreneurship thinking. Here are steps for EScIT [12].
Step 1. Observe
Take initiatives to observe purposely, deliberately and continuously.
Step 2. New idea
Keep thinking to find uniqueness or “different” of the observed phenomena in the form of new ideas/system/product/model/technology/design.

Step 3. Innovation
Select a few ideas from the above that might be successful for innovation and evaluate them.

Step 4. Creativity
Purposeful enhancement and improvement of ideas (design and redesign).

Step 5. Value (Society)
To create value added to the ideas/products in term of value creation to the society/community.

Based on the above points show the implementing of ESciT in PBL has potential to improve the skills needed in the 21st century.

### Table 1. Design of the implementing of ESciT on PBL.

<table>
<thead>
<tr>
<th>PBL</th>
<th>ESciT</th>
<th>21st Century skills</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Learning and innovation</td>
<td>Information, media and technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Life and career</td>
</tr>
<tr>
<td></td>
<td>CP¹</td>
<td>CC²</td>
</tr>
<tr>
<td>Start with the essential question</td>
<td>Observe</td>
<td>v</td>
</tr>
<tr>
<td>Design a plan for the project</td>
<td></td>
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<td>Create a schedule</td>
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<tr>
<td>Monitor the students and the progress of the project</td>
<td>New idea Innovation Creativity</td>
<td>v</td>
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<tr>
<td>Assess the outcome</td>
<td></td>
<td></td>
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<tr>
<td>Evaluate the experience (society)</td>
<td>Value</td>
<td>v</td>
</tr>
</tbody>
</table>

| a Critical thinking and problem solving |
| b Collaboration and communication    |
| c Creativity and innovation         |
| d Information literacy              |
| e Media literacy                    |
| f Information and communication technology |
| g Flexibility and adaptability      |
| h Initiative and self-direction     |
| i Social and cross-cultural interaction |
| j Productivity and accountability   |
| k Leadership and responsibility     |

### 3.3. Design of learning strategy
Table 1 shows the implementing of Entrepreneurial Science Thinking (ESciT) on project-based learning (PBL) as a learning strategy. The “v” sign at that step, students have opportunities to improve their 21st century skills according to the learning objectives. Step 1 on PBL is open ended and it is not explained.
that the question come from the teacher or from the students so that there is a possibility that learning objectives will not be optimally achieved. Thus, with the “observe” on ESciT will reduce the probability of it happening and further increase the opportunity to improve their skills in “initiative and self-direction” aspects. This aspects has an opportunity to boost almost every step of the learning. This also happens to “information, media and technology” skills.

Step 2,3,4 and 5 on PBL with “new idea”, “innovation” and “creativity” will provide more opportunities to train students’ creativity in project. In addition, students can improve their life and career skill on “flexibility and adaptability” aspects because with ESciT students are directed to think flexibly in adapting some ideas to generate completely new ideas. Furthermore, in these step, it can also increase the chance for students to improve their life and career skills in “social and cross-cultural interaction”, “productivity and accountability, “leadership and responsibility” aspects. But, it can be improved in step 6 also.

Step “value/society” on the ESciT approach, students are directed to interact with communities outside the school so that students not only interact with friends or teachers in the school environment but also students interact with the community with various professions outside the school, this will be in accordance with efforts to improve their skills on “social and cross-cultural interaction” aspects. In this step, the students are also directed to know how people view the product they have created both in the school and outside the school so that students not only in the school environment will reduce the probability of it happening and further increase the opportunity to improve their skills in “initiative and self-direction” aspects. In accordance with improvement of their skills on productivity and accountability, “leadership and responsibility” aspects.

4. Conclusion
In general, PBL can improve the mastery of concepts and 21st century skills especially on learning and innovation skill, information media and technology as in previous studies. But in particular, PBL with ESciT provides a greater opportunity to improve 21st century skills especially learning and innovation and life and career skills. Thus, implementing of ESciT in PBL will provide students with more opportunities not just to improve their conceptual mastery but also for learning and innovation skills, information, media and technology skills and life and career skills in the process of solving daily life problems at future.

5. References
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