Project-Based Learning Practices with Secondary School Students

Solmaz AYDIN, Tazegül DEMIR ATALAY, Volkan GOKSU

Kafkas University, Faculty of Education, Kars, Turkey


INTRODUCTION

Recently conducted studies underline that the individual difference of students should be taken into consideration in educational environment. For that purpose, it is suggested that the educational environment should be enriched through education methods that increase students’ ability to link what they have learned with real life, their problem-solving and critical thinking skills. Project-based learning, which is one of these methods, leads students to research and produce and ensures them to build their own learning processes. Through project-based learning (PBL), there will be a contribution to raising individuals who are conscious of their own learning and skills, structure knowledge, and actively participate in the learning process.

Project-based learning is one of the active learning methods where some problems and incidents encountered in real life are investigated and the results are expressed in oral presentations or written reports (Krajcik, Szerniak and Berger, 1999; Thomas, 2000). The occurrence of project-based learning approach has taken a long time. It can be said that John Dewey’s Reorganization and Active Learning, Kilpatrick’s Project Method, and Bruner’s Learning Approach Through Invention are cornerstones of the formation of PBL.
approach (Korkmaz and Kaptan, 2001). By PBL, it is aimed that the students acquire scientific skills and furthermore, increase their academic achievements (Ayaz and Söylemez, 2015).

Demirhan and Demiral (2003) emphasize that project-based learning; develop and enrich the learning skills of the students, provide life-long learning, get them adopt the habit of scientific study, enable students to participate in learning activities based upon teamwork and collaboration, allow the use of different dimensions of intelligence, give significant information to family, teacher, school administration regarding the student’s performance, develop problem-solving skills and problem-based learning skills. In addition to this, Project-based learning provides students various skills. These involve life-sustaining skills, the skill of using technology, cognitive process skills, self-control skills, attitudes, tendencies, and beliefs (Demirhan and Demirel, 2003; Bayraktar, 2015). Project-based learning provides a wide range of benefits. Primarily, this learning approach increases motivation on both sides. Project-based learning collects the interest of the students, motivates them to study and prods them into action (Solomon, 2003). In addition to these, the related literature indicated that PBL might have an effect on student’s perceptions of competence (Aydın and Yel, 2013; Mills, 2009).

Bell (2010) stated that project-based learning provides reading at a higher level, learning more deeply, a better understanding of a subject and increases motivation regarding learning. Thomas (2000) stated that the effect of project-based learning on basic student learning outcomes might be a result of the efforts in school and probably, this situation might be derived from increasing student participation and attention as a result of the motivational effect of project-based learning. As a result of the literature review conducted by Bartscher, Gould and Nutter (1995) in their studies, they stated that the reason for the low motivation of the students in schools is that their psychological needs are not met and for the solution, they proposed that they need to work collaboratively as a motivation tool. In this respect, they emphasized the importance of project studies organized in the form of collaborative groups.

At the end of an eight-month study conducted with 5th and 6th grades, Toci (2000) found that technology-supported project-based learning environment positively impacted on the intrinsic motivation of the students. Schraw, Crippen, and Hartley (2006), state that using research-based learning strategies and students actively taking responsibilities during the learning process will motivate them for success. Therefore, project-based learning enables students both to actively participate in the process and to do research. Additionally, considering the studies conducted on self-efficacy; Mills (2009) determined a significant increase in self-efficacy of the students following the project-based curriculum in a study he conducted with 46 undergraduate students taking French course. In a study Aydın (2012) conducted with 40 undergraduate students taking Cytology Laboratory course, he identified that the biology self-efficacy levels increased following the curriculum based on project-based learning. Similarly, in the study Chen, Hernandez and Dong (2015) conducted with undergraduate students, they studied the impact of collaborative project studies on the self-efficacy of the students. As a result of the study, they ascertained that especially the Spanish students developed a higher self-efficacy in comparison with non-Spanish students. In the study Choi, Kim, Lee and Park (2016) conducted with teachers; teachers were trained regarding project-based learning for a couple of months. Following the study, it was determined that project-based learning was positively and strongly correlated with the self-efficacy of the teachers. In his study, Weber (2010) ascertained that the self-efficacy levels of high school students increased following the program based on project-based education. In the study Amanda, Subagia and Tika (2012) conducted with 8th-grade students, they stated that there was no relationship between project-based learning and self-efficacy of students towards science.

These studies reviewed in the literature show that the effect of project-based learning in many different school and grade levels on self-efficacy were examined, especially focusing on undergraduate students and finding the studies conducted with middle school students insufficient. As some of these studies found that self-efficacy of the students increased (Dunlap, 2005; Hatipoğlu and Rambo-Hernandez, 2016; Mills, 2009; Schaffer, Chen, Zhu and Oakes, 2012), some of them could not determine a significant effect (Amanda, Subagia, and Tika, 2014). Accordingly, the fact that the studies conducted with middle school students being insufficient and the study results differing from each other mean more studies should be conducted regarding this subject.
In addition, considering all these outlined studies, it is understood that for the learning process, student motivation and academic self-efficacy is an important aspect and should be developed. At this stage, the optimal thing to do would be contributing to the studies conducted regarding examining the effect of PBL on motivation and self-efficacy of the students and finding and applying the teaching implementations that can increase the self-efficacy of students (Gerlach, 2008; Meyer, Turner and Spencer, 1997; Mills, 2009; Wang, 2010).

Aiming to identify academic self-efficacy and academic motivations to middle school students by providing them opportunities to conduct and present their own projects in accordance with their interests and skills, this study covers the consequence assessment obtained from the second term of the TÜBİTAK-supported research project “Kafkasın Mucitleri Bilimlle Buluşüyor (Caucasian Inventors Meet with Science)”, and the comparison of this assessment with the results attained from the first term of the project. The first term of the Project was completed in 2015-2016 academic year with a different study group (Aydın, Demir Atalay and Göksu, 2017).

This project study shows that besides enabling students to do their own project studies, project studies can be done not just only in the field of science but also in the fields of such as Turkish and social sciences, and also contribute to the literature in terms of determining the effect of PBL on student academic self-efficacy and motivation.

Method

Research Model

In this research, the one group pre-test-post-test experimental design was used. Earlier on this research process, pre-tests were applied to the students, project studies were carried out in the fields of Science, Turkish and Social Sciences during the two academic years (fall and spring, 2016-2017) and at the end of the spring semester, a science festival was held and following the post-test applications, the process was finalized.

Study Group

The study group of the research consists of 7th-grade middle school students. In the process of determining the study group, this TÜBİTAK-supported project study was introduced to the students and the project introduction brochure was distributed to the students by primarily going to the middle schools in Kars province center which were included to the target population of the study. By collaborating with teachers at schools, the students who were interested in this study and wanted to participate were asked to leave their names and contact information to their teachers. Following the process, the list of the students who wanted to participate in the research was taken from the teachers, the students were reached out by using their contact numbers that they had left and the first project meeting was held. During this first meeting, students were acquainted with and students were given a seminar in the areas of "What is project study? Why is it important? What should we pay attention when choosing a project topic? How should the project study process be?" Additionally, examples were given from previous project studies. After this seminar, students who positively wanted to participate in the project studies were determined. Accordingly, it was started to work with 40 students and continued with 39 students in the oncoming process. The students started on project studies in groups of 3 and 4 people (trios and quartets).

Data Collection Tools

Data collection tools that were used in the study are the Academic Self-Efficacy Scale and the Academic Motivation Scale.

Academic Self-Efficacy Scale

The "Academic Self-Efficacy Scale" which the adaptation into Turkish, along with reliability and validity studies conducted by Önçü (2012), was used in this study. The scale is a four-point Likert-type scale and consists of 21 items. The sub-dimensions of the scale are "ability", "environment" and "quality of education". In the first period of this study, the project team performed "Confirmatory Factor Analysis" before using the scale. As a result of this analysis, it was decided that "quality of education" sub-dimension would not be used and was determined that the two-factor and 16-item structure of the scale could be used. Adhesion coefficients
of the scale showed that the model fit the data ($\chi^2(103) = 237.01$, $p < .01$, $\chi^2/df=2.3$, RMSEA=0.073, CFI=.94, NFI=.90, AGFI=.86, GFI=.89) (Aydın, Demir Atalay and Göksu, 2017).

**Academic Motivation Scale**

In the study, the “Academic Motivation Scale” which the adaptation into Turkish, along with reliability and validity studies conducted by Kara (2008), was used. The scale that is a three-point Likert-type scale and consists of 12 items including four sub-dimensions such as "Identified Extrinsic Motivation", "Amotivation", "Introjected Extrinsic Motivation" and "Intrinsic Motivation". In the first period of this study, the project team performed “Confirmatory Factor Analysis” before using the scale. As a result of this analysis, adhesion coefficients of the scale showed that the model fit the data ($\chi^2(48) = 78.72$, $p < .01$, $\chi^2/df=1.64$, RMSEA=0.052, CFI=.95, NFI=.90, AGFI=.92, GFI=.95) (Aydın, Demir Atalay and Göksu, 2017).

**PBL Study Process**

The student projects were formed in accordance with the phases transferred by Korkmaz and Kaptan (2001) in their studies as the implementation steps of project-based learning approach. The process took place in the form of six phases.

**Phase One: Identifying the subject and subtopics, organizing the groups in itself**

During the fall semester when the education period started, following the process of the project introduction seminar given to the students and determining the groups, the students were asked to review the literature in order to determine their project topics, make research and write down the project topics they chose. Students were informed on how to make a literature review and where to make use of. Moreover, teacher candidates were chosen in order for them to coordinate the project studies and help the students. These teacher candidates helped students in science, social and Turkish projects. The students worked on the projects at the weekends and sometimes came together with their coordinator teacher candidates on weekdays and worked together in the process of both topic identification and maintaining the projects.

Following the student researches, by convening teacher candidates from their own fields and student project groups, the faculty members (researchers) who worked on the project in the fields of Turkish, Science and Social Sciences had interviews separately with every group and addressed the project ideas written by the students on a discussion platform. During the spring semester, the process of topic identification was completed and project studies have started. The students formed 14 groups (39 people). Some groups wanted to do two projects and in this manner, a total of 17 project studies were conducted. Eight of these projects were Science, seven were Turkish and two were Social Sciences projects.

**Phase Two: Groups developing project plans**

After the project groups identified their topics, they were asked to develop a project plan. Each group developed a plan for their projects. This plan had the headings of “project group, project name, objective, structure, distribution of roles and work schedule”.

**Phase Three: Implementing the project**

At this stage, students started working on the project topic they selected. In accordance with the project plan they developed, each student fulfilled their duties. They frequently came together and worked with the coordinator teacher candidates, and these researchers responsible for each project department attended these meeting, exchanged opinions with them and guided them concerning solving their problems.

During the project study process, the students were encouraged to conduct research, identify their own problems, their own study process, briefly stated that their autonomy were supported.

**Phase Four: Planning the presentation**

In April, the construction phase of the projects was completed and together with the students, the preparations were started for the science festival which was decided to be held with the intent of promoting the projects. For the promotion of their projects, students prepared posters, pictures, brochures that they can use during the presentation. They wrote the final reports of their projects. Furthermore, t-shirts, hats and name
rags were prepared for the students and other staff working on the project with the intent of them wearing during the science festival.

Phase Five: Giving the presentation

The students gave their introductory presentations during in the science festival. In the festival, tables reserved for each project were set up reciprocatively, posters prepared for the promotion of their projects were put up and on some projects, brochures were distributed. Middle schools, families, university staff and students were invited to the science festival that was held in May.

Phase Six: Evaluation

Academic Self-Efficacy Scale and Academic Motivation Scale implemented as pre-test, were implemented again as post-test following the science festival.

Findings

The pre-test and post-test scores obtained from academic self-efficacy and academic motivation scales of the students were compared according to the data obtained from the study. The data obtained from the scales do not show a normal distribution. Therefore, Wilcoxon Signed Rank Test was used in the SPSS packaged software as one of the non-parametric tests.

Data obtained from academic self-efficacy scale

The data obtained from Academic Self-Efficacy Scale consisting of two sub-dimensions in the form of “Ability” and “Environment”.

Table 1. Pre-test-post-test analysis results for the sub-dimensions of the Academic Self-Efficacy Scale

<table>
<thead>
<tr>
<th></th>
<th>Mean rank</th>
<th>Sum of ranks</th>
<th>Z</th>
<th>Eta squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability</td>
<td>Negative ranks</td>
<td>14,68</td>
<td>249,50</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Positive ranks</td>
<td>16,58</td>
<td>215,50</td>
<td>.507</td>
</tr>
<tr>
<td></td>
<td>Ties</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Environment</td>
<td>Negative ranks</td>
<td>20,26</td>
<td>385,00</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Positive ranks</td>
<td>17,67</td>
<td>318,50</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Ties</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Based on positive ranks

When Table 1 is examined, no change was observed in self-efficacy levels of the students towards the school environment they were present and confidence in their own abilities.

Data collected from academic motivation scale:

The data collected from four sub-dimensions of the Academic Motivation Scale in the form of “identified extrinsic motivation”, “introjected extrinsic motivation”, “intrinsic motivation” and “amotivation” are presented in Table 2.
Table 2. Pre-test-post-test analysis results for the sub-dimensions of the Academic Motivation Scale

<table>
<thead>
<tr>
<th>Identified Extrinsic Motivation</th>
<th>Posttest- pretest Mean rank</th>
<th>Sum of ranks</th>
<th>Z</th>
<th>p</th>
<th>Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative ranks</td>
<td>3,90</td>
<td>19,50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive ranks</td>
<td>4,25</td>
<td>8,50</td>
<td>54</td>
<td>.3</td>
<td>.108</td>
</tr>
<tr>
<td>Ties</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amotivation</th>
<th>Posttest- pretest Mean rank</th>
<th>Sum of ranks</th>
<th>Z</th>
<th>p</th>
<th>Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative ranks</td>
<td>12,50</td>
<td>175,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive ranks</td>
<td>11,22</td>
<td>101,00</td>
<td>13</td>
<td>.2</td>
<td>.128</td>
</tr>
<tr>
<td>Ties</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Introjected Extrinsic Motivation</th>
<th>Posttest- pretest Mean rank</th>
<th>Sum of ranks</th>
<th>Z</th>
<th>p</th>
<th>Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative ranks</td>
<td>6,00</td>
<td>6,00</td>
<td></td>
<td>.0</td>
<td></td>
</tr>
<tr>
<td>Positive ranks</td>
<td>19,86</td>
<td>735,00</td>
<td>36</td>
<td>**</td>
<td>.606</td>
</tr>
<tr>
<td>Ties</td>
<td>-</td>
<td>-</td>
<td></td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intrinsic Motivation</th>
<th>Posttest- pretest Mean rank</th>
<th>Sum of ranks</th>
<th>Z</th>
<th>p</th>
<th>Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative ranks</td>
<td>7,10</td>
<td>35,50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive ranks</td>
<td>8,45</td>
<td>84,50</td>
<td>42</td>
<td>.1</td>
<td>.165</td>
</tr>
<tr>
<td>Ties</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Based on negative ranks
**Based on positive ranks
***p≤0.05

When Table 2 is examined, no change was observed in identified extrinsic motivation, amotivation, and intrinsic motivation of students who participated in the project study because they identified the behavior with themselves by considering it significant.

Additionally, there was a significant difference in introjected extrinsic motivations of the students who participated in the study. Considering the mean rank of the scores, it is understood that the observed difference is in favor of positive ranks, in other words, the post-test. Considering the eta squared influence quantity value, according to the criteria stated by Cohen (1998), the influence quantity of mean differences in intrinsic motivation has a high level of significance. All in all, at this stage of the study, it is understood that project studies motivated the students in the form of introjected extrinsic motivation, in other words, students internalized studying as they consider it necessary.

**Discussion and Conclusion**

In this study, where project studies conducted in order to identify the contribution of project studies on academic self-efficacy and academic motivations of middle school students; no change was observed in self-efficacy levels of the students who participated in the project studies toward their own abilities and the school environment that they were present. This situation was also determined in the first period of the project study (Aydın, Demir Atalay and Göksu, 2017). Additionally, similar to the result obtained from this study, Amanda, Subagia and Tika (2014) identified that project-based learning had no effect on self-efficacy of students in a study they conducted with middle school students. When examining the conducted studies on this subject; it was observed that the studies done with university students showed that project-based learning increased student self-efficacy (Aydin and Yel, 2013; Brennan, Hugo and Gu, 2013; Chen, Hernandez and Dong, 2015; Mills, 2009). On the other hand, when examining younger age groups, studies showed that project-based
learning might not affect self-efficacy at young ages and might increase with their grade levels (Amanda, Subagia and Tika, 2014; Shell, Colvin and Bruning, 1995; Zimmerman and Martinez-Pons, 1990). The reason of this situation might have arisen from students who participated in the study being at middle school level. Hence, Bandura (1977) also stated that repeated success situations increase the sense of competence. In other words, self-efficacy is also expected to increase with their age, grade and experience levels. Additionally, Pleiss, Perry and Zastavker (2012) stated in their studies that in the project-based learning environment student autonomy is important for self-efficacy and self-efficacy might be increased by creating a more dynamic course structure. This suggests that in order to increase self-efficacy of the students, alongside of their autonomies should be supported, they need more support and coordinating.

When examining academic motivation levels of the students, it has been observed that there was no significant difference in the levels of identified extrinsic motivation, amotivation and intrinsic motivation. It has been determined that there was only a difference in the level of introjected extrinsic motivations of the students. Introjected regulatory behaviors are a kind of internal motivation, arise due to internal pressures, and partially internalization comes into question (Akt. Kara, 2008). Considering this, it can be said that students who participated in the project study partially internalized the study and thought that they should do it. In fact, according to the self-determination theory, the individual internalized the causes of the act in order to avoid anxiety and comfort himself (Deci and Ryan, 1985; 2000, Ryan and Deci, 2000). Individuals with introjected self-determination behaviors might think: “I study the night before exams because that’s what good students are supposed to do” (Vallerand, et al., 1992).

Considering the result obtained from the first period of the project study, there was a difference in intrinsic motivation levels of the students. This shows that students studied only because they wanted to study, in other words, they were motivated internally (Aydın, Demir Atalay and Göksu, 2017). The results of both studies coincide with the literature and show that project studies motivated the student (Bradford, 2005, Kempler, 2006; Seloni, 2005; Toci, 2000). In the first study, students were motivated internally, whereas in the second study, they were motivated externally. This shows that students who participated in the first study participated with interest and aspiration, as for students who participated in the second study participated because they thought they should. Fairchild, Horst, Finney and Barron (2005) stated that introjected self-determination behaviors are partially controlled by environmental factors, while at the same time they are internal rewards such as fulfilling an obligation and avoiding guilt. Besides, conducted studies express that intrinsic motivation and introjected extrinsic motivation are highly correlated with one another (Cokley, 2000; Vallerand, et al., 1993). Hence, this suggests that the results of the first and second studies are in fact close; however environmental factors impact the individual effectively and this affects the academic motivation of the individual. Ocak and Uluyol (2010) stated that students had some problems in project-based education such as not be able to work cooperatively and arising problems during topic distribution; and these problems might affect the intrinsic motivation of the students negatively.

It has been a gratifying consequence that project studies, both internal and extrinsic, positively affected academic motivations of the students. The fact that students have academic motivation during the education process will positively affect their academic performance and learning (Fortier, Vallerand and Guay, 1995; Gottfried, 1985, 1990; Singh, Granville and Dika, 2002; Noels, Clement, and Pelletier, 2001; Wentzel and Wigfield, 1998). According to Legault, Green-Demers and Pelletier (2006), lack of academic motivation might lead to disappointment and dissatisfaction and hinder productivity and happiness.

In the light of the data obtained from this study, the following can be said: Project studies can be used as motivation-enhancing activities, a course structure with a high student participation that supports student self-efficacy should be created in project-based lessons, project-based learning process should be well-planned and attention should be paid to student autonomy.
GENİŞLETilmiş ÖZET

Problem Durumu ve Çalışmanın Amacı


Bu hususlu ilgili çalışmalar dikkate alındığında öğrenci motivasyonunun ve akademik öz-yeterliğinin öğrenme süreci için önemli ve geliştirilmesi gerekir bir husus olduğu anlaşmaktadır. Bu durumda yapılması en uygun olan şey PTÖ’nün öğrencilerinin motivasyonlarını ve akademik öz-yeterlikleri üzerine etkisinin incelenmesi konusunda yapılan çalışmalarla katkı sağlayarak ve akademik öz-yeterlikleri artırmak ve uygulamaları belirlemek ve uygulamaları yapılabileceği öngörülmektedir (Meyer, Turner ve Spencer, 1997; Gerlach, 2008; Mills, 2009; Wang, 2010).


Yapılan bu proje çalışması öğrencilere kendi proje çalışmalarını yapabilme imkanı tanımanının yanında, proje çalışmalarının sadece fen alanında değil Türkçe ve sosyal bilgiler gibi alanlarda da yapılabilme etkinliği göstermekle, PTÖ’nün öğrenci akademik öz-yeterliği ve motivasyonu üzerinde etkisini belirlemek amacıyla gerçekleştirilmektedir.

Yöntem


Araştırmanın çalışma grubu ortaokul 7. sınıf öğrencilere kendi proje çalışmalarını yapabilme imkanı tanımanının yanında, proje çalışmalarının sadece fen alanında değil Türkçe ve sosyal bilgiler gibi alanlarda da yapılabilme etkinliği göstermekle, PTÖ’nün öğrenci akademik öz-yeterliği ve motivasyonu üzerinde etkisini belirlemek amacıyla gerçekleştirilmiştir. Bu doğrultuda 40 öğrenci ile çalışmaya başlanmıştır, ilerleyen süreçte 39 öğrenci ileride devam edilmiştir. Öğrenciler 3 ya da 4'er kişilik gruplar hâlinde proje çalışmalarına başlamışlardır.

Bulgular

Çalışmadan elde edilen verilere göre öğrencilerin akademik öz-yeterlik ve akademik motivasyon ölcklerinden elde edilen ön test ve son test puanları karşılaştırılmıştır. Bu amaçla Wilcoxon Eşleştirilmiş Çiftler Testi kullanılmıştır.

"Yetenek" ve “Ortam” şeklinde iki alt boyuttan oluşan Akademik Öz-Yeterlik Ölçeğinden elde edilen verilere bakıldığında proje çalışmasına katılan öğrencilerin kendi yeteneklerine ve bulundukları okul ortamlarına yönelik olan değerlere bir değişme meydana gelmediği görülmektedir. Akademik Motivasyon Ölçeği alt boyuttan oluşan "özeşleşmiş dışsal motivasyon", "motivasyonsuzluk", "içe yansıtılmış dışsal motivasyon", "içsel motivasyon" şeklinde dört alt boyutta mümkün olduğu için bu boyutlar incelenmemiştir. İşte verilerin içinde proje çalışmalarında katılan öğrencilerin yaptıkları davranışın önemli olduğunu düşündüğü için yapmalarına yönelik olan özdeşleşmiş dışsal motivasyonlarda, içsel motivasyonlarda ve motivasyonsuzluk düzeylerinde bir değişime meydana gelmediği görülmektedir.


Sonuç ve Tartışma


REFERENCES


Pleiss, G., Perry, M., Zastavker, Y. V. (2012). *Student self-efficacy in introductory project-based learning courses*. 2012 Frontiers in Education Conference (FIE), (pp. 1-6)


