INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES

Vol 9, Issue 12, (2019) E-ISSN: 2222-6990

The Effect of Project-Based Learning to Improve the 21st Century Skills among Emirati Secondary Students

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To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v9-i12/6749 DOI:10.6007/IJARBSS/v9-i12/6749

Published Date: 29 December 2019

Abstract

The study aims to discover the effect of project-based learning on the improvement of 21st century skills (4Cs) among Emirati secondary level students. The study sample comprises of twelve male secondary level students from Department of Education and Knowledge-Abu Dhabi who participated in the 'Think Science National Competition 2019'. They were considered as an experimental group, and experimental design was used, where the 21st century skills (4Cs) test was prepared by the researcher and was administered on the group. A pre-test was administrated before the students start the project and a post-test once they finished. The paired sample T-Test was employed to analyze the data. The results shows that there are statistically significant differences of ($\alpha = 0.05$) level in student's 21st century skills (4Cs) test between pre and post-test scores, indicating a better performance in post-test. In other words, the project-based learning approach has significant effect on improvement of 21st century skills (4Cs) among Emirati secondary level students who participated in Think Science National Competition 2019.

Keywords: 21st Century Skills, Communication Skills, Collaboration Skills, Creative Thinking, Critical Thinking; Project-Based Learning.

Introduction

According to the popular Chinese proverb " Tell me and I forget, Show me and I remember, Involve me and I understand" we recognize that we are living in a world that learning is best accomplished by doing through a more level of engagement and inspiration on part of students Railsback (2002). As well as today, achievement lies in having the option to share, communicate, and use information to solve issues, in having the option to adapt and develop in light of new changing circumstances, in having the option to command and to create new knowledge (Pacific Policy Research Center, 2010). Therefore, educational system has to enable our students to be more creative, communicators and problem solvers; they should be more responsible for their learning (Kafi & Motallebzadeh, 2014; Neo, et al., 2017; Bani-Hamad, 2017). However, the great knowledge explosion and 21st century challenges have forced educators to reconstruct and develop the whole teaching and learning process on new basics. This is consistent with the new state in an attempt to provide an interactive educational environment, which resulted in modern teaching strategies based on the use of effective approaches that are used in schools in all educational infrastructure (Noor-ul-Amin, 2013; Barahmeh et al., 2017). In order to encourage students' critical thinking, exploring, discovering, stretching ideas and innovative skills (Sulaiman, 2011; Noel & Liub, 2017). To face these challenges, schools must transform the ways that will empower students to gain the creative thinking skill, problem solving, critical thinking, collaboration and innovative skills that should be fruitful in workplace and life (Alismail & McGuire, 2015).

Trilling & Fadel (2009) and Partnership for 21st Century learning skills, 2009 argue that 21st century Skills (future skills) are necessary for accomplishing the required transformation. Pacific Policy Research Center (2010) suggests the one of the best practices for implementing 21st century skills is project-based learning, to prepare our students for future work and careers. Bell (2010) and Husamah, (2015) emphasized that the project-based learning is a key strategy for creating independent thinkers and learners. The present research aimed at investigating the effects of project-based learning on the development of Emirati secondary students' learning and innovation skills (4Cs) which considered as a part of significant 21st century skills.

Problem Statement

Teaching science nowadays faces a lot of problems, such as teaching and learning activities still teachers-centered and focus on the textbooks and lectures. Moreover, learning in the classroom is concentrates on low order thinking, such as knowledge and understanding of the concepts and facts, that let the students distracts from active engagement in learning. (Freeman et al., 2007; Nguyen, 2010). As well as according to the society's needs for empower individuals with advanced skills to tackle with daily life problems, it is clear that the 21st century skills need to be fully integrated into the classroom and improving teaching methods to produce citizens and employees adequately prepared for further study and the labour market (Partnership for 21st Century Skills, 2009; Pacific Policy Research Center, 2010). Devkota, Giri, & Bagale (2017) and Bellanca & Brandt (2010) emphasized that Project-based learning is one of the best methods to develop the 21st century skills. Consequently, educational institutions in the United Arab Emirates sought to improve the opportunities that presented to the students in the schools and universities based on projects based learning (PBL) in order to developing the knowledge and

youths' future skills, and encourage a lot of companies to adopt an initiatives to rise up the 21st century skills among students. As a result to that, Emirates Foundation adopted the "Think Science National Competition" which based on projects to enhance youth capacities and encourage them for innovation and creation in scientific projects (Think Science National Competition, 2018). This program employs 21st century skills through scientific projects in schools and universities to develop the students' knowledge and analytical thinking. Therefore, this research comes to examine the impact of the project-based learning in this competition on the 21st century skills especially the 4Cs (Communication, Collaboration, Critical thinking, Creative thinking) among a sample of secondary level students who participate in this competition in Ramah School which belongs to the Department of Education and Knowledge belonging to Ministry of Education (MOE) United Arab Emirates (UAE).

Research Question and Hypothesis

This study attempted to answer the main question: what is the effect of using project-based learning (PBL) in the improvement of 21st century skills (4Cs) among Emirati secondary level students? Of which the following question can be derived:

Q: Are there statistically significant differences at (α =0.05) level in the development of 21st century skills (4Cs) or so-called learning and innovation skills among Emirati secondary level students, due to the project-based learning strategy?

Null Hypothesis

H0: Project-based learning has no significant impact on the improvement of 21st century skills (4Cs) among Emirati secondary level students.

Study Objective

The current study aims at identifying the effect of using project-based learning on the improvement of learning and innovation skills among secondary level students who participate in 'Think science national competition 2019'.

Definition of Terms

Project-based learning

Project-based learning (PBL) is an instructional model centered on the students and engage them in learning knowledge and skills through learning more about problem and investigation to solving this challenging by authentic project required resourcefulness and preparing by the student (Dimmitt, 2017). According to the definitions found in Project -Based Learning, projects are mind boggling tasks dependent on challenging questions or issues that immerse students in design, problem-solving, decision making, or investigative activities; offer students the opportunity to work independently and freely over extended periods of time; and culminate in realistic products or presentations (Thomas, 2000; English & Kitsantas, 2013; Boss & Krauss, 2014). In this study, project-based learning is a strategy that secondary level students used in designing projects that competed in 'Think Science National Competition 2019' from discovering the problem, suggesting a solution, planning, designing, modeling project, testing, and attaining

products to solve the real problems, even to demonstrate the projects in front of evaluating crew and visitors in Emirates Foundation.

21st century skills -4Cs

A set of future skills that represent high-order thinking and social skills which are organized in cognitive skills as well as consider a student-centered skills such as creative thinking, critical thinking, innovation, collaboration, responsibility, and communication(partnership for 21st century learning, 2009; National Research Council, 2013) These are used and enhanced in project-based learning strategy.

Limitations

During the study, a few components were considered as a reason for investigation constraint. Firstly, the sample was twelve Emirati male secondary level students who participated in Think Science National Competition 2019, and hence the results might be confined that could not be generalized. The second constraint was the gender could have affected the results of the study as the investigation was conducted only on male students. The last limitation is the researcher discussed and examined only the 4Cs from all the 21st century skills.

Review of Literature

21st Century Skills and Project Based Learning

Efforts have made to reform educational programs by educators to teach students how to be problem solvers and prepare them to the university study and the labour market. A part from this, schools should help students to gain necessary skills and hence to live and work cooperatively with others by developing innovative teaching strategies that employ 21st century skills in teaching (Progressive education, 2008). The partnership for 21st century skills (PCS21) has been the leading advocacy organization in the United States focusing on implementing 21st century skills into education. As a result of a consensus among educationalists who emphasized the knowledge, skills, and expertise students need to succeed in work and life (Johnson, 2009).
In addition, developed its framework for 21st century learning, which specifically outlines the intended student outcomes and support systems necessary to use the future skills needed by today's students (PCS, 2009b).

The worldwide system which was prepared by the partnership for 21st century learning (P21) consists of four main components: firstly, learning and innovation skills, which incorporate creative thinking, critical thinking and problem solving, communication and working team effort (collaboration) skills. Secondly, information, media and technology skills, which combines information reading and writing ability, and technology literacy.
Third part is life and career skills, which involves ability to change and flexibility, self-direction, social and culturally diversity skills, working well and getting a lot done and responsibility, as well as responsibility for behavior and leadership skills; and the last part is Core Subject and 21st century topics, which incorporates all extremely important subjects, worldwide awareness, financial, business skills, civic literacy, and health literacy (PCS, 2009b). In this article, the

researcher discussed only Learning and innovation skills (4Cs) which consist of creative thinking, critical thinking, communication, and collaboration.

Communication and Collaboration

Partnership for 21st century skills, (2009); Trilling & Fadel (2009) and (National Education Association, NEA) suggest that students nowadays should be able to express thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts; Listen carefully to understand meaning, including: knowledge, values, attitudes and desires. As well as Communicate for multiple purposes, for example to inform, instruct, motivate and persuade; Use many kind of media and technologies and know how to judge their effectiveness a priority, and communicate effectively with many people and environment. Moreover, demonstrate the ability to work effectively and respectfully with diverse teams; exercise flexibility with willingness to help in making necessary compromises to accomplish a common goal; assume shared responsibility for collaborative work and value the individual contributions made by each team member. Partnership for 21st Century learning (2009) emphasize that the students can learn communication and collaboration skills through an assortment of strategies, such as project-based learning, problem-based learning, and problem solving. The project- based learning allow students to learn in-depth instead of using methods that direct students down order thinking and to have integrative thinking that can be adapted and success in their lifestyle (Dimmitt, 2017; Romli, Othman, Abdullah, & Hamat, 2018; Ijeoma, Ezeamama, Ebisi, 2018)

Social Learning through Projects Enhances Collaboration Skills

Project – based learning advances social learning as learners practice and become capable with the 21st century skills of communication, negotiation, and collaboration. As learners work at these activities, they should conceptualize thoughts and act as good listeners inside their groups. Teaching students active listening skills improves community collaboration skills just as creativity. Students become familiar with the essential skills of productive communication, regard for other people, and cooperation while creating thoughts together. Negotiating how to collectively solve and take care of an issue is additionally part of project-based learning.

Afterward the finish of the project, students complete a self-assessment. They assess not only their learning, but also the success of their social communications. They reflect their communication abilities, regardless of whether they believed they listened well to other students' thoughts, and whether they accepted their own assessments were heard. Reliable work and practice of these skills will fortify them over time and lead to capability and mastery. These skills are basic to future success in the structures of our worldwide economy (Bell, 2010; Noel& Liub, 2017).

Critical Thinking

Critical thinking skills include the ability of individuals to reason effectively, analyze, interpret, summarize and evaluate alternative perspectives, and think critically about choices and procedures. The P21 initiative concentrated around the ability of students to: reason adequately,

use frameworks thinking; make judgments and decisions (Partnership for 21st century skills, 2009; Trilling & Fadel, 2009; & Pacific policy Research Center, 2010).

Creativity and Innovation

Partnership for 21st century skills (2009) defines creativity as learners think creatively by using and creating a wide range of ideas; expound, refine, investigate, and assess unique ideas to improve and expand creative endeavors. In addition, implement innovation through acting on creative ideas to make a tangible and valuable contribution to the field in which the innovation will happen.

Project based Learning and Real Problem Solving Skills

The underlying foundations of project – based learning reach out back over a hundred years, to design by educator and thinker John Dewey (1959) at the University of Chicago, based on the inquiry. Dewey contended that students would create individuals' interests in the material in case that they engage in real, meaningful tasks and issues that emulate what specialists do in real situations. Over the two most recent decades, learning sciences researchers have refined and expounded Dewey's unique insight that activate inquiry brings about more profound comprehension. New discoveries in the learning have prompted better approaches for seeing how students learn (Bransford & Cocking, 1999; Krajcik & Blumenfeld, 2006).

According to Constructivism theory, the meaning is formed when students engaged in real world experience. Thus, educators, who are depending on course materials, furnish students with only one side of the complex truth (Brooks, 1999; Kafi & Motallebzadeh, 2014). Incorporating project-based learning into educational programs furnishes students with real world problem-solving investigation, enables students to work freely, and reveals realistic reasonable outcomes (Wiek et al. 2014; Noel& Liub, 2017; Dimmitt, 2017). The learners who engage in this strategy will have the option to make an association between the gathered information and what occurs in their environment, attempting to be progressively self-directed, gain higher-order skills such as: analysis, synthesis and assessment skills. Therefore, a student's success in the 21st century to a great extend relies upon how many critical thinkers exist, and the amount they can solve problems when they face them in their life (Kafi & Motallebzadeh, 2014; Dimmitt, 2017).

Ohlsson (2012) in his article suggests some probable practical methods for growing real problem solving skills. Inquiry- based learning is fundamentally the same as real problem solving, through which the information is exhibited to students in a sort of scaffolded way. As well as this, a few points must be represented when utilizing real problem solving: the issue must be exhibited in a real manner, students must work cooperatively, students must have the option to apply their insight to the present problem and assess their own learning (Hung, 2002). Problem-based learning and project –based learning are other forms of inquiry-based learning, both firmly rooted in constructivism (Duffy, 2004; Noel& Liub, 2017). What is worth mentioning here is that project-based learning involves self-evaluation, self-learning and reflection between students. Learners learn from their process. They think about how well they functioned in a cooperative group and how well they contributed, negotiated, listened, and welcomed other group member's thoughts. The students, likewise, self-evaluate their projects, endeavors, motivations, and productivity levels. By implementing project-based learning, we are preparing our students to

meet the 21st century with preparedness and a repertoire of skills they can use successfully (Bell, 2010).

Methodology

Participants

A Sample population was selected from Emirati secondary school level studying at Ramah School in Department of Education and Knowledge under Ministry of Education, United Arab Emirates, who participated in 'Think Science National Competition 2019'. Twelve male participants were intentionally assigned to do four various projects in order to participate and compete of these projects in Emirates Foundation in Think Science Competition. These students took part in the competition as an experimental group. In addition, all the participants were Emirati with Arabic as native language yet they spoke English very well, and their age extended from 16-18. Furthermore, taking their overall ability and the homogeneity into consideration where they had all scores above 90% in academic achievement in all subjects, and they have good social skills. This was the reason for selecting the participants in Think Science Competition to make projects and demonstrate their working in the competition. Consequently, they were all homogenized in science process skills by taking part in the same placement test to identify these skills among this sample as well as they were all at similar degree of language -according the interview examination, social skills, science process skills, and academic achievement. After that, the study began with the students by 21st century skills (4Cs) pre-test followed by making projects in school, there were total four projects working three students each in one group.

Instrumentation

In order to attain the results based on the research question that prior aforementioned which was related to probable important impacts of project-based learning on the development of 21st century skills (4Cs) among Emirati secondary level students. Hence, the researcher prepared a modified 21st century skills test based on al-Baz (2016), Torrance Creative Thinking Test as well as Appraisal Watson Glaser Critical Thinking Test to be applicable for the present study and appropriate for Emirati students. The modified 21st century skills test consisted of 20 items, which aimed to elicit the aforementioned skills. The researcher administered the test at 10 Emirati Secondary Level Students as a pilot study; and its reliability was examined, which hit a high significant point 0.91. Furthermore, education science and psychological experts from Abu Dhabi University United Arab Emirates checked the test validation. The 21st century skills test were administrated and about 60 minutes allocated for answering the pre-test, and about 60 minutes for post-test in class after the participants had finished the projects.

Procedure

After the pre-test administrated to participants who participate in think science national competition, the researcher began the treatment by project-based learning strategy. To this end, the researcher suggested abundant authentic problems with students as well as the students beginning to bring real problems that encounter their society by themselves from the desert and community environments which are considered full of challenges, the students settled at four real problems. The researcher placed students in four groups, each group consisting of three

students, and chose a leader for each one. Each group selected a real life problem and started to make a solution for this problem based on projects that may be a solution for that problem, so, there were four projects (beehive gear, emergency car water tank, electricity from plants, and spilled petroleum sensor). As the researcher started the pre-project organizing, the groups had discussed to answer a set of general rules such as when the task begins. To what extend it keeps going, when it ends, what students should do in groups, what the necessary materials and equipment are for every project, how they should work together, how they could bring the material, and when they will finish every stage of project to submit evidences for the Think Science Competition Team. Thereafter, participants in each group imparted their insights. They were asked to prepare the Power Point slides regarding the stages of projects they had chosen, and prepare photos and a video for every stage they had finished to send them to the Think Science Competition in order to evaluate every stage. Concerning the on-project stage, the researcher acted as a facilitator during the sessions and answered any questions related to find the required equipment or information, materials, how to make any part of projects, and the like. Better to say, at the end of each session the researcher had a small talk in each group with participants to evaluate how the process was developing. Reaching to the post projects stages, participants in each group had to illustrate what they did at the end of each stage in front of their peers within 2 minutes. At the end, each group provided the researcher with a CD that contained the information they had gathered. What is worth mentioning here is that, the projects started in the middle of October 2018, and the students finished the projects within four months. When the projects were completed, the participants took the same 21st century skills test used as the pre-test previously in the study but functioning here as the post-test with 60 minutes to find out whether their 21st century skills (4Cs) had significantly changed after the projects or not. Later on, the obtained quantitative information was used in the analysis of results. Finally, the data had analyzed by SPSS software and more specifically paired sample T-Test to hook up the results.

Study Design

The researcher's concentration was on finding the possible significant impacts of project-based learning on improvement of 21st century skills (4Cs) for a sample of Emirati secondary level students before and after project based learning strategy. Therefore, the intended design of the study was experimental design.

Result and Discussions

Based upon the research question, which was mentioned previously i.e. whether or not project-based learning strategy can significantly develop the 21st century skills (4Cs) among Emirati secondary level students, paired sample T-Test was used in order to determine if there are significant differences in mean scores before and after treatment. To this end, the 21st century skills test which was administrated to the participants as the pre and post-tests in experimental group that was in the form of twenty questions divided over five questions each in creative thinking, critical thinking, communication skills, and collaboration skills. Thus, in order to determine the sum score for each student in the overall test; the questions in the instrument were given five marks for each skill then multiplied by five to be twenty five marks for each skill,

and overall test (21st century skills-4Cs) had a score of one hundred. The results of the pre and post-tests of each skill are illustrated in Table 1.

Table 1: Means and Standard deviations of the study sample performance on 21st century skills (4Cs) tests

21st century skills (4Cs)	N	Pre-test	post- test
Criterion		MEAN (S.D)	MEAN (S.D)
Creative thinking	12	14.83 (3.97)	19.16 (3.58)
Critical thinking	12	14.16 (5.15)	18.92 (3.96)
Communication skill	12	18.33 (4.44)	21.93 (3.77)
Collaboration skill	12	18.46 (5.57)	22.08 (3.96)
Overall (4Cs) 21st century skills	12	65.70 (10.73)	80.80 (9.04)

The findings according to the table 1 shows that communication and collaboration skills have the highest mean score in post-test which was on communication (21.93) with standard deviation (3.77) and collaboration (22.08) with standard deviation (3.96). This shows that students are more capable in communication and collaboration skills between their peers and teachers. The creative and critical thinking skills was the low score in the post-tests where, creative thinking (19.16) with standard deviation (3.58) and critical thinking (18.92) with standard deviation (3.96). This shows that students are less capable in creative and critical thinking than communication and collaboration skills in this study. The researcher attributes the fact that students in groups were more active by communication and collaboration once they attempted; planed; and designed projects.

In addition, in order to answer the study question which enquired: Is there statistically significant differences at (α =0.05) level in the development of 21st century skills (4Cs) among Emirati secondary level students, attributed to the project-based learning strategy? And to accept or reject the null hypotheses which stated: the project-based learning has no significant effect on the improvement of 21st century skills (4Cs) among Emirati secondary level students; Paired sample T Test was run for pre and post-tests. Table 2 below illustrates the results

Table 2: report of paired sample T-Test for 21st century skills (4Cs) pre and post-tests.

	paired sample T Test (pre-test and post-tests)						
21st century skills (4Cs) Overall	N	MEAN	S.D	Std. Error mean	t-test	df	Sig.(2-tailed)
	12	15.1	5.61	1.621	8.326	11	0.00

According to the findings presents in Table 2, there are significant differences between the mean scores of participants in 21st century skills (4Cs) pre and post-tests, where the participants could perform more significantly in post-test than pre-test i.e. (Sig. = 0.00 **<** 0.05) in 21st century skills (4Cs) tests. From the findings, a significant difference was observed concerning the participants' mean scores as the post-test which was done after the treatment showed that participants did perform better than in pre-test before treatment. Consequently, project-based learning

strategy had a significant effect on the improvement 21st century skills among Emirati secondary level students who participated in think science national competition 2019. Therefore, this aligned with Bell's (2010) study in terms of significant effect of project-based learning for the 21st century skills or skills for the future. and with Kafi & Motallebzadeh's (2014) previous study in terms of an effect of project- based instruction on 21st century skills, where the results in these previous studies showed that students did better in post-test than in pre-test. This results in the students improving their 21st century skills by project-based learning.

Conclusion

The 21st century skills are important for students to prepare them for university future jobs and study. Therefore, the United Arab Emirates government is focusing future skills through the Ministry of Education and encourages the youth to be innovative and creative by participating in national exhibitions through projects which they have designed. 'Think Science National Competition 2019' is one of the exhibitions, which was created by Emirates Foundation to thrive students' future skills in schools and universities by designing projects as solutions to real life problems in order to acquire the students' future skills that help them to be more capable to face 21st century challenges. The researcher as a supervisor in the competitions conducted a study to examine the effect of projects based learning strategy on improvement of 21st century skills especially , (learning and innovation skills)- 4Cs with twelve secondary level students in Ramah school who participated in 'Think Science National Competition 2019' through designing projects. The study results showed that students' scores on 21st century skills (4Cs) test analysis after implementing project-based learning had a significant effect on the improvement of 21st century skills among Emirati secondary level students. As well as the result yields that communication and collaboration skills placed high mean scores while creative and critical thinking placed low mean scores comparing with communication and collaboration skills. The findings have supported the hypothesis and objective of the study and also attempted to determine the effect of implementation the project based learning strategy with secondary level students through Think Science National Competition 2019. As well as gives the stakeholders in Ministry of Education in UAE and Emirates foundation the implications regarding how the Think Science National Competition 2019 developed the 21st century skills among students. In addition, this study recommends including the study result in the teachers' training. Moreover, this PBL approach will influence in students' performance daily life and future careers especially the participated students in the competition. In addition to this, the researcher recommends expanded uses of project-based learning with all students in schools and universities in order to equip them with the future skills that they need in life and future work. As well as the future researches will benefit from methodology and results for this study.

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