The Impact of Project - Based Science Instruction(PBSI) on Achievement and Confidence in Academic Study of Educational Sciences Faculty Students/ UNRWA

Dr. Elham A. AL-Shalabi **Dr. Eman R. Abed**

Dr. Ferial M. Abu Awwad

Educational Sciences Faculty UNRWA

H.K.J

ABSTRACT

The study aims at investigating the impact of using Project Based Science Instruction (PBSI) on achievement and confidence in academic study of Educational Sciences Faculty students. A sample of (56) fourth year students studying Biology were divided in two groups; the experimental group taught by using (PBSI) and the control group taught by the traditional method. Achievement test and confidence of academic studying scale were used. Results indicate statistically significant differences as of confidence in academic study between the two groups in favor of the experimental group due to using (PBSI). The study also reveals statistically significant differences between the two groups in achievement. Some recommendations based on such results are cited.

Introduction

In the past two decades, several initiatives have been taken to reform the teaching and learning Process in Jordan schools & universities. Some of these reforms include the implementation of Education Reform for Knowledge Economy (ERFKE), the implementation of national education standards and the increased use of computers and the Internet.

Despite all these reforms, the teaching and learning of science in most Jordanian classrooms is characterized by the chalk-talk-laboratory method. In a study of science and mathematics education, Weiss, Banilower, McMahon and Smith (2001) found that the most common instructional activities in science classrooms were lecture and discussion. The researchers also noted that ''despite the reported emphasis on science process and inquiry skills, classes at all levels are much less likely to stress having students learn to explain ideas in science (21-39 %) or learn to evaluate arguments based on scientific evidence (8-29 %), two skills integral to scientific inquiry'' (p. 61).

The fact that learning to ''explain ideas in science'' as well as to ''evaluate arguments based on scientific evidence'' was given less emphasis at all levels suggesting that students may be learning science without actually understanding it. It could also mean that science teachers are relying on teaching methods or strategies that are ineffective for promoting understanding of science, (National Science Board, 2002).

Kabba and Colley (2005) mention in their paper that the most appropriate instructional approach that science teachers can use to teach science for understanding is project-based science instruction (PBSI). PBSI is the only instructional method that makes science classrooms function like mini experimental stations, research laboratories and scientific agencies. It is an instructional approach that is driven by well-defined student research questions, facilitated by caring and competent teachers. In a project-based science classroom, students pose research questions and conduct extended studies to find answers to their questions within the context of a unit, curriculum or program of study. Teachers in a project-based science classroom, perform more than the role of ''lesson planners,'' ''knowledge providers'' and ''classroom managers.'' Instead, they act as facilitators, mentors, resource persons, advisers, scientists, listeners, learners and leaders in the science classroom. They work with students to identify projects that they are interested in and create learning environments that allow them to gather resources, plan, implement, evaluate and report on their projects. PBSI is the only instructional approach that places full responsibility for learning on the student. This means that students decide what to learn, how to learn, the time required to learn, how to document and report their own learning. When you give students responsibility for their learning and hold them accountable, they are more likely to take it seriously and rise up to the challenge than if they are spoon-fed, feel marginalized or powerless in their own learning.

PBSI, emphasizes on student-directed learning rather than teacher-directed learning, active learning rather than passive learning, collaboration in learning rather than individualized learning, and the integration of content and process rather than separation of content and process. It is a "wholehearted purposeful act" (Kilpatrick, 1918, p. 320). This means that the main goal of PBSI is the pursuit of worthwhile learning activities that are relevant to students' lives and not learning for learning sake. Purposeful learning is emphasized in PBSI because it is believed that it helps students develop not only content, knowledge and process skills, but also provides opportunities to acquire the dispositions required to participate in a democratic society (Kilpatrick, 1951).

There is a wealth of empirical evidence showing that self-efficacy affects academic performance, as part of its general effect on behavior. However, this blanket effect may obscure some more specific differences that could be applicable to educational settings in particular in higher education, where the autonomy and independence of the student are essential to success (witness the key components of the contemporary interest in the concept of 'graduate ness'). In this context, a new construct distinct from its parent concept, self-efficacy, was suggested, a construct that termed "academic confidence".

Academic confidence is conceptualized as being how students differ in the extent to which they have a 'strong belief, firm trust, or sure expectation' of what university has to offer. As part of its parent concept, self-efficacy, academic confidence may stem from the same four sources: mastery experience, vicarious experience, verbal persuasion and physiological states. It is likely to be subject to change as experience impinges upon expectation. The question becomes to what extent may it predict the nature of that experience? McLean (2001), in a study of medical students found that learning style was clearly associated with academic performance. To what extent How might academic confidence can be influenced by learning styles, and PBSI has a role to play in predicting academic performance and academic confidence. This is what we are trying to investigate in this study. Therefore, academic confidence is proposed as a mediating variable between the individual's inherent abilities, their learning styles and the opportunities afforded by the academic environment of higher education.

Rationale and Hypotheses

"Project-Based Science Instruction (PBSI) is a constructivist method of teaching and learning that has been developed at the Educational Sciences Faculty (ESF) Improved student achievement is a central goal of efforts to improve science education. To promote student achievement, reformers have established what instructional methods should be utilized. Key concepts and principles have been identified as targets for student learning. In addition, reformers recommend student-centered, project-based practices that encourage deep understanding of science embedded in the everyday world and so increase their confidence of academic studying..

The present study focuses on testing the following two hypotheses:

a - There is no statistically significant difference in achievement between experimental & control group due to PBSI.

b - There are no statistically significant difference in confidence of academic studying between experimental & control group due to PBSI.

Project Based Science Instruction (PBSI)

Project-Based Science Instruction (PBSI) is "a teaching and learning model that focuses on the central concepts and principles of a discipline, it gets students involved in problem-solving and other meaningful tasks, allows students to work autonomously to construct their own learning, and culminates in realistic, student-generated products" (Thomas, Mergendoller and Michaelson, 1999).

Literature Review

Druskat and Kayes (2000) proposed and tested hypotheses about the relationship between learning and performance and the team processes that are most predictive of learning and performance in short-term project teams. Results suggest that the needs of short-term project teams differ from those of longer-term teams. They also suggest the potential for tension between learning and performance in short-term project teams.

Schneider, Krajcik, Marx and Soloway (2002) measured the performance of students in project-based science classrooms on a National Measure of Science Achievement. PBS students outscored the national sample on 44% of NAEP test items. This study shows that students participating in a PBS curriculum were prepared for this type of testing.

A Case Study of Project-Based Instruction in the Ninth Grade: A Semester-Long Study of Intertidal Biodiversity was done by Baumgartner, and Zabin (2008). In this descriptive case study, project-based learning is presented as a teaching model that combines elements from other learning strategies. High school students participating in an intertidal monitoring project built around this model increased their content knowledge related to the ecology of the intertidal zone and improved their scientific investigation skills.

ChanLin (2008) reports the findings of a study which observed students' (aged 10-11) use of technology during project-based learning activities in science. As part of the overall process of project-based learning, students used computer technology as a tool for collecting information, organizing it and presenting it to their peers. The results of the study indicate that all of the students achieved their research goals. Students' learning outcomes were observed based on their achievements in relation to developing skills and ability to synthesize and elaborate knowledge, to engage in scientific exploratory tasks, and to use the technology for supporting and reporting their research work.(Teachers' support in relation to providing coaching skills is crucial to students' success in a project-based setting).

Morgil Gungor, Ural and Temel (2008) investigated the effect of web-based project applications on students' attitudes towards chemistry. Using paired-samples t-test has compared pre- and post-test results of attitude scale and a statistical difference has been found. Also a relationship between students' attitudes and performance has been examined by using regression analyze.

Mayhew Wolniak and Pascarella (2008) investigated curricular conditions and educational practices that influenced the development of life-long learning orientations among 405 undergraduate students. Results suggest that growth in life-long learning orientations was facilitated by instruction that included opportunities for reflection, active learning, and perspective-taking and that provided students with opportunities for positively interacting with diverse peers. Negative diverse peer interactions were found to stifle development. PBSI facilitates all these opportunities of life-long learning.

Sander and Sanders (2003) in a study examined the expectations of two groups of UK university students; one group comprised medical students in a traditional university and the other psychology students in a new university. One aspect of the results was the striking differences in reasons given by students for not liking role-play and student presentations as methods of teaching. Essentially, the medical students were worried that these were not effective methods; whereas the psychology students were worried about their own competence to do them. The possibility of academic confidence as an explanation for this difference arose from an examination of the differing entry profiles of the two groups. The medical students had an average A-level point score of 27.8, in contrast to 15.0 for the psychology students, (using the standard pre 2002 UCAS formula for assigning A level points, where A = 10, B = 8, C = 6, D = 4, E = 2 and AS grades assigned half value points e.g. an A grade AS level = 5).

Literature review shows that PBSI improves content knowledge, investigation skills, and attitudes towards science. It also shows positive relationship between performance and the team processes as most predictive of learning and performance in short-term project teams, but no significant effect on achievement. So, this study tries to add to such trend for better understanding.

Method

Participants

Participants were (56) of (629) Educational Sciences Faculty students; attending small size college of United Nation for Refugees and Work Agency (UNRWA) in Jordan. This college contains one major of educational sciences called Class Teacher. The sample size represented two sections out of (22) section of the student body at the college Participants were selected purposively from those enrolled in biology and health course. The majority of the sample is female (83.0%). All are Palestinians from the same socio-economic back-ground. Experimental group was taught using (PBSI) and control group was taught by the traditional method. Each group consisted of (28) students and were selected randomly assigned to the group.

Tools of the Study

Achievement Test: In this study, Achievement is measured by an achievement test (50 multiple choice items) in (biology& health). The researchers developed an achievement test a multiple- choice test based on central concepts and principles contained in biology& health discipline. A final (50) questions distributed into these domains, as such:

1 - Human Body Systems (32 items)

a - Nutrition and Digestive System (8 items)

b - Respiratory System (2 items)

c - Circulatory System(5 items)

d - Nervous System(4 items)

e - Endocrine System(4 items)

f - Skeletal System(4 items)

g - Excretory System (2 items)

h - Interaction between systems (3 items)

2 - Sensory Organs (3 items)

3 - Health & Disease (3 items)

4 - Biological Kingdoms (7 items)

5 - Environment (5 items)

Content validity was established. Reliability by Cronbach'alpha for the (50) items biology& health test was á = 0.74 using the Spearman-Brown formula (adjusted for 30 items) after applying it to (31) student of the participants but not the sample.

Confidence in Academic Studying Scale: Academic confidence is conceptualized as being how students differ in the extent to which they have a 'strong belief, firm trust, or sure expectation' of what university has to offer. It is proposed as a mediating variable between the individual's inherent abilities, their learning styles and the opportunities afforded by the academic environment of higher education. In this study, it's measured by academic confidence scale constructed by Sander and Sander (2003. with a total of 24 items. The instrument has a response scale of "very confident" (5) and "not at all confident" (1). The maximum score in the scale is 120 and the least is 24. Adeyemo (2007) carried out a test-retest reliability analysis of the scale and inferred that the instrument has a reliability coefficient of $r = 0.88$. For the purposes of this study, the scale was translated into Arabic, revised by 4 members of academic staff for face validity.

Design and Procedure

Course description was distributed to experimental group students at the beginning of the semester to decide what they like to learn and be responsible of their learning in projects. Students were diven time to design their projects, The following steps were taken:

6 - Administering; a pre-test to determine students' knowledge, process skills and dispositions in specific topics chosen by experimental group (Human body systems, Sensory Organs, Health & disease, Biological kingdoms, Environment) and map out how the goals tie into national standards.

7 - Measuring confidence in academic study by applying confidence in academic study scale designed by Sander and Sanders (2003).

8 - Securing Pre treatment equivalence of the two groups (experimental and control groups) in the variables of the study (achievement, and confidence in academic study) by using (t) test for independent groups, (see table 1)

Table 1
T- test for independent groups in achievement and confidence in academic study before applying the experiment

Pre test	Groups	Means	Standard deviations	T value	Significance level
Achievement	Exp.	24.04	3.67	0.32	0.753
	Cont.	23.61	6.15		
Confidence in academic study	Exp.	82.71	13.82	-1.74	0.088
	Cont.	88.39	10.35		

The table showed no statistical significant differences between the overall scores on the achievement test, and confidence in academic study between the two groups at (á =0.05). This means that the two groups are equivalent.

9 - Introducing the experimental group students to the PBSI approach. Explain the expectations of PBSI such as students taking responsibility for their own learning and the teacher serving as facilitator, mentor and resource person. Discuss that the central driving instructional force in PBSI is purposeful learning driven by students' own questions.

10 - Emphasizing that collaboration is a must in PBSI. This is because most scientific investigations require collaboration in tasks such as fieldwork, instrument development and testing, and collection of data. In addition, it is generally believed that having more "heads" working on a question is better than having one "head." Also when scientists collaborate, they complement each other and are able to generate valid and reliable scientific knowledge.

11 - Discussing the advantages as well as the disadvantages of working in groups, while, emphasizing that the advantages of working in groups outweigh its disadvantages.

12 - Observing that as they work in groups, they will have to complement each other's weaknesses with each other's strengths, make constructive criticism as opposed to destructive criticisms, and take collective responsibility as opposed to individual responsibility.

13 - Dividing the class into small manageable groups (6 groups). Groups of four or five balanced in terms of gender, ethnicity, and academic ability. Telling students that they will be working in their groups throughout and as young scientists they will be required to work collaboratively and to divide the responsibility among themselves, and that we each group will be held accountable for its own learning.

14 - Explaining that each group is required to identify a question to investigate within a specific subject of their choice, time frame, resources and context. Explaining that each group is required to design three small projects. They will have to learn as much as possible because at the end of their projects, each one will teach one. Asking each group to submit a research question. Review

each question with the individual groups to make sure that they are well defined and focused. Table 2 shows Projects topics/themes distribution among experimental groups.

Table 2
Projects topics/themes distribution among experimental groups

No	Topics	Group	Date of Presentation
Human Body Systems			
1.	Nutrition and Digestive System	Group(1)	16/3/2008
2.	Respiratory System	Group(2)	18/3/2008
3.	Circulatory System	Group(3)	20//3/2008
4.	Nervous System	Group(4)	23/3/2008
5.	Endocrine System	Group(5)	25/3/2008
6.	Skeletal System	Group(6)	27/3/2008
7.	Excretory System		
Sensory Organs			
8.	The Eye	Group(4)	1/4/2008
9.	The Ear	Group(2)	3/4/2008
10.	The Nose	Group(6)	6/4/2008
11.	The Tongue	Group(6)	6/4/2008
12.	The Skin	Group(3)	8/4/2008

Con/ Table 2
Projects topics/themes distribution among experimental groups

No	Topics	Group	Date of Presentation
Health and Disease			
13.	Health & Disease Concepts	Group(4)	10/4/2008
14.	Infectious and Noninfectious Diseases	Group(3)	13/4/2008
15.	Body Defenses against Disease	Group(5)	15/4/2008
16.	Drugs	Group(1)	17/4/2008
Biological Kingdoms			
17.	Kingdom : Monera		20/4/2008
18.	Kingdom : Prpotista		22/4/2008
19.	Kingdom : Fungi	Group(6)	24/4/2008
20.	Kingdom : Plantae	Group(1)	27/4/2008
21.	Kingdom : Animalia Phylum : Chordata		29/4/2008
22.	Gnathostomata Class : Chondrichthyes Class : Osteichthyes	Group(2)	4/5/2008
23.	Class : Amphibia	Group(5)	6/5/2008
24.	Class : Reptilia	Group(4)	8/5/2008
25.	Class : Aves	Group(3)	11/5/2005

Con/ Table 2
Projects topics/themes distribution among experimental groups

No	Topics	Group	Date of Presentation
26.	Class : Mammalia		13/5/2008
Environment			
27.	Ecology: Environment, Ecosystem		15/5/2008
28.	Ecosystem :A biotic and Physical Factors	Group(5)	18/5/2008
29.	Food Chain, Food Web	Group(2)	20/5/2008
30.	Environmental Problems	Group(1)	22/5/2008

15- Asking each group to present their research question. During the presentation, encouraging them to evaluate each other's research question.

16- Asking each group to brainstorm and come up with a research plan. Research plans should include research question, procedures, tools and materials required, time required to complete project, roles and responsibilities. Plans should also include how students will assess and provide evidence of their own learning from their projects. Review each group's plan before approval. Keep a copy of each group's research plan as a binding contract.

17- Discussing with the students a collective timetable in which to begin and complete their projects. Identify specific periods and times that products will be due. Identifying periods and times for whole class work and individual group work. Discussing the importance of meeting deadlines and completing their work on time.

18- Ask each group to implement its research plan. This will include identifying and selecting instruments and tools, collecting and recording data. Monitor, mentor, advise, assist and facilitate group activities and keep a mental record of each group's progress. As students implement their projects, remind them of safety issues, sampling procedures, the importance of entering and keeping accurate data. Provide extra help for struggling groups and encourage between groups' interaction, dialogue and sharing of ideas.

19- Discussing the basic methods of analyzing quantitative and qualitative data. Providing students with a simple chart showing types of data and possible ways of analyzing them. Where possible, using computer software to show students how data analysis could be enhanced with technology. Providing students with a template/ format for report writing and discuss rules of scientific writing. Asking students to analyze their data and prepare reports or posters. Student artifacts created during these projects included concepts maps, essays, computer-based dynamic models, reports, experiments, trip field and Web pages.

20- Discussing the protocol of presentation and criteria that will be used for evaluating project reports. Asking students to present their reports for peer review. After the presentations are completed, ask each group to reflect on their research process and product. Asking students to write down what they know prior to and after conducting their project in terms of knowledge, skills and dispositions on the specific subject, theme or topic.

21- As part of the overall process of project-based learning, students used computer technology as a tool for collecting information, organizing it and presenting it to their peers. Students conducted research (through guided research processes), interacted with peers, teachers and the community (through personal interviews and visits), and displayed their understanding of knowledge through the presentation of web-pages and power point. After project presentation each group was interviewed by one of the researchers.

22- Administering the same achievement test and confidence in academic study scale at 23/5/2008 as post tests.

23- One of the researchers attended all groups' presentations and participated in projects evaluation.

Project Sufficiency Form The components of assessment infrastructure during the first quarter of the semester, when students were engaged in learning introductory materials, included a test on the basic concepts and processes in biology science (cell, animal tissues) covered in her lectures worth 20% of the students' grades. The test she gave was meant to both encourage students to take the introductory activities seriously as well as ascertain which students might need further information, practice or support. The work grade was meant to encourage students to be productive during class time set.

The key components of her assessment infrastructure during the other three quarters of the semester were worth 30% for projects and 50% for final exam. The 30% for projects demand a final paper and presentation, and a set of project milestones for each of the three project cycles. The purpose of the final paper, worth 40% of the students' grades depending on the project cycle, was to demonstrate what the students had learned in the course of their investigation and to give them practice writing in the genre of the scientific research article. The presentations, worth 30% of the students' grades for each project cycle to display their understanding of knowledge through the presentation of web-pages or power point, and it were meant to expose students to a wider range of topics in biology& health science (since each of them would only study three in depth) and to develop their ability to critique other students' work. The project milestones portion assessment infrastructure, worth 30% of the students' grades each project. Table 3 lists assessment criteria of projects for groups.

Table 3
Assessment criteria of group projects

Final paper **40%**				Project mile stones **30%**			Presentation **30%**		
Resources 10%	Context 10%	References 5%	-data 5% -tables 5% -figures 5%	use technology 10%	Community valuable 10%	Originality 10%	Clear 10%	Comprehensive 10%	Time restricted 10%

Procedure of Project Gnathostomata

Gnathostomata, Class: Chondrichthyes& Class: Osteichthyes

Members of group (2) are: Hani, Maram, Noora, Amal, and Moosa.

1 - Two weeks before presentation group members met biology teacher to show her scientific material they gather and project plan for their third theme to share ideas and take feedback.

2 - After three days the teacher read scientific material and wrote notices, figures and suggestion in order to make comparison between Class: Chondrichthyes& Class: Osteichthyes in table.

3 - Four days before presentation team members practiced dissecting and arranged for anatomy activity to dissect skeletal fishes with Amman Training Center (ATC) dean and lab supervisor to show their classmates external features and internal systems.

4 - In the day of presentation all experimental group were available in ATC lab which was in a building near their college.

5 - Biology teacher and one of the researchers attend the presentation to evaluate team work and project milestone.

6 - When the researcher entered the lab, students were divided into groups and scientific material was typed and distributed among them.

7 - The biology teacher started the lecture by introducing the project team and their theme to the class. the project team leaded the class by presenting:

   A - Two minutes clip from National Geographic Channel called: Jewels of the Caribbean, showing different kinds of fishes. Appendix 3

   B - Concept map for kingdom Animalia showing classification of Gnathostomata: Class Chondrichthyes and Class Osteichthyes. Appendix 4

   C - Power point and data show illustrating general features of the two classes and table of comparison between them with clear explanation that displayed full understanding of knowledge. Appendix 4

   D - Dissecting activity for each group to discover external features and internal systems.

E - Brochure for each student summarizing important features and comparison between the two classes.

The researcher revealed that most of the students of that class joyfully involved in all activities and remained adequately motivated throughout.

Results

(HO_1) There is no statistically significant differences in achievement between experimental & control group due to PBSI.

To investigate this hypothesis, means and standard deviations for independent samples were calculated.

Table 4

Means and standard deviation on the posttest scores of the achievement test

Group	number	Means	Standard deviations
Experimental	28	29.54	5.57
Control	28	26.79	7.73

Table 4 shows that there were apparent differences between experimental group, and control group. To identify whether these differences have statistical significance, one-way ANCOVA test was applied.

Table 5 shows these results.

Table 5

One-way ANCOVA results for the effect of PBSI on achievement test

source	Sum of squares	df	Mean square	f	Sig.
intercept	225.42	1	225.42	7.33	0.01
Pretest	821.80	1	821.80	26.72	0.00
Group	81.83	1	81.83	2.66	0.11
Error	1629.88	53	30.75		
total	2557.55	55			

It shows that there weren't statistical significant differences between experimental group, and control group, due to group, since f value was 2.66, and it was not statistically significant at ($\alpha = 0.05$).

The mean of experimental group (29.54) is much higher than control group (26.79) that means achievement of experimental group is better than control group. The f value was 2.66, this indicates that there are no statistical significant differences between the overall scores on the achievement test between the two groups at (α =0.05).

(HO_2) There is no statistically significant difference in the level of confidence in academic studying between experimental & control groups due to PBSI.

Table 6
Means and standard deviation on the posttest scores of the academic confidence scale

group	number	Means	Standard deviations
Experimental	28	95.57	11.12
Control	28	84.46	12.98

To investigate this hypothesis, means and standard deviations for independent groups in confidence in academic studying were found, table 6 shows that. there are apparent differences between experimental group, and control group. To identify whether these differences have statistical significance, one-way ANCOVA test was applied. Table 7 shows these results.

Table 7
One-way ANCOVA results for the effect of PBSI on academic confidence scale

source	Sum of squares	df	Mean square	F	Sig.
intercept	1224.98	1	1224.98	14.76	0.00
Pretest	3488.57	1	3488.57	42.03	0.00
Group	2921.52	1	2921.52	35.20^{*}	0.00
Error	4399.26	53	83.00		
Total	9614.98	55			

It shows statistical significant differences between experimental group, and control group, on the overall score of academic confidence scale in favor of the experimental group at (á =0.05). The f - value of (35.20) indicates that there are statistical significance differences between the overall scores on the scale of confidence in academic study between the two groups at (á =0.05), in favor of the experimental group due to using (PBSI).

Discussion

The study aims at investigating the impact of using project based science instruction (PBSI) on achievement and confidence in academic study of Educational Sciences Faculty students. Results show that there are statistically significant differences in confidence of academic studying between the two groups in favor of the experimental group due to using (PBSI). The study also reveals that there are differences between the groups in achievement in favor of the experimental group due to using (PBSI) but these differences are not statistically significant. This means that:

1 - (PBSI) has no effect on achievement of the students, and this is may be because each team in the experimental group concentrated only on three topics through their projects or because in the achievement test 50% of items concentrate on knowledge. This study shows that educators need not concerned that students in inquiry-based science courses will be disadvantaged on achievement tests. PBS students performed as well or better on almost all of the items used to make comparisons with similar students. PBS incorporates the recommendations based on extensive research made by ESF. Educators should be encouraged to use inquiry-based approaches such as PBS to implement reform in their colleges and schools.

2 - (PBSI) improves confidence in academic study. This result refers to the importance of the (PBSI) in enhancing students' ability to take responsibility for their own work and progress. In doing so, they gain confidence in themselves, their product, and their process as learners. While working on a project, teachers provide them with on-going, meaningful, and personalized feedback. So, all of them outlined a personal growth in self-esteem, self-reliance and confidence in engaging in academic study.

An interview was conducted with members of group (2): Hani, Maram, Noora, Amal, and Moosa directly after the class of project *Gnathostomata,* (Class: Chondrichthyes& Class: Osteichthyes) in order to ask them about advantages, disadvantages and difficulties in PBSI:

Hani: "The advantage of PBSI was in cooperative work; Noora and Amal collected scientific material from books and journals, Moosa and me collected scientific material from electronic resources, Maram was responsible for the concept map and anatomy part. The final coordination of scientific material was done by all of us".

Maram: "Enrichment of ideas for project; I suggest concept map for classification and dissecting skeletal fish. Hani has high computer skills so brought clip from National Geographic Channel showing life in the Caribbean. Amal and Moosa, suggested power point and data show for general features and compression between the two classes while Noora suggested the brochure".

Noora: "More confidence in ourselves; each one was responsible for presenting one of the activities or working together in dissecting activity".

Amal: "We felt more confidence in our academic study because we constructed our knowledge and gained scientific processes and skills so that knowledge is not forgettable".

Moosa: "Every one of us worked what she/he was good at so, we lived the joy of accomplishment".

Hani: "One of the great advantages was working with society especially with ATC".

Moosa: "The most of the disadvantage was the time; most of our time was occupied working on the projects a lot of work was needed, but working in groups makes the work manageable".

Amal: "One of the difficulties was collecting the scientific material.we couldn't easily decide what was important and not".

Maram: "Lock of facilities (no scientific Lab) was one of the most apparant difficulties we faced".

Reflection

Students conducted research (through guided research processes), interacted with peers, teachers and the community (through personal interviews and visits), and displayed their understanding of knowledge through the presentation of web-pages and power point. The results of the study indicate that all of the students achieved their research goals. Students' learning outcomes were observed based on their achievements in relation to developing skills and ability to synthesize and elaborate knowledge, to engage in scientific exploratory tasks, and to use the technology for supporting and reporting their research work. Increased their content knowledge related to the biology and health and improved their scientific investigation skills through real world application. Student in teamwork face problems and put plan to solve them, each choose task suitable to his/her ability PBSI builds a scientific community and makes the work more manageable. PBSI facilitated opportunities for reflection, active learning, and perspective-taking and that provided students with opportunities for positively interacting with diverse peers, so the development of life-long learning.

The following questions: maybe raised: Is it likely to have the same results using PBSI in different fields and for different samples? Does it have the same effect on other learning outcomes, such as attitudes, values, scientific thinking, investigation skills, problem solving, decisions making, and epistemological beliefs about science?

Recommendations

We recommend:

- More studies using PBSI in different units in science and for different studying levels.
- Training teacher for PBSI and evaluation, and including it in teacher qualification programs.
- Impeding PBSI in curriculum through real life problems that are important to students.
- Applying PBSI in schools by asking students to accomplish at least one project each year.

أثر تدريس العلوم القائم على المشروع على تحصيل طلبة كلية العلوم التربوية الجامعية/ الأونروا وثقتهم بالدراسة الأكاديمية

د. إلهام علي الشلبي د. إيمان رسمي عابد
د. فريال محمد أبو عواد
كلية العلوم التربوية - الأونروا
المملكة الأردنية الهاشمية

الملخص

هدفت الدراسة إلى استقصاء أثر تدريس العلوم القائم على المشروع على تحصيل طلبة كلية العلوم التربوية وثقتهم بالدراسة الأكاديمية. تكونت عينة الدراسة من طلبة السنة الرابعة بلغ عددهم (٥٦) طالباً وطالبة يدرسون مادة الأحياء موزعين في شعبتين تجريبية درست بطريقة التعلم القائم على المشروع، وضابطة درست بالطريقة التقليدية. تم تطبيق اختبار تحصيلي في مادة الأحياء ومقياس الثقة بالذات الأكاديمية. أظهرت نتائج الدراسة وجود فروق دالة إحصائياً عند ($\alpha \leqslant$ ٠,٠٥) في الثقة بالذات الأكاديمية لصالح المجموعة التجريبية التي درست باستخدام المشروعات مقارنة مع المجموعة التي تلقت تعليماً تقليدياً، وعدم وجود فروق دالة إحصائياً في التحصيل.

REFERENCES

1 - Baumgartner, E. & Zabin, C. (2008). A Case Study of Project-Based Instruction in the Ninth Grade: A Semester-Long Study of Intertidal Biodiversity. (Electronic version). **Environmental Education Research**, 14 (2), 97-114.

2 - ChanLin, Lih-Juan, (2008). Technology Integration Applied to Project-Based Learning in Science. (Electronic version). **Innovations in Education and Teaching**, 45, 55-65.

3 - Druskat, V. U. & Kayes, D. C. (2000). Learning versus Performance in Short-Term Project Teams. **Small Group Research**, 31(3), 328-353. <http://sgr.sagepub.com/cgi/content/abstract/31/3/328>.

4 - Kabba, E. & Colley, Ed.D. (2005). "Project-Based Science Instruction: Teaching Science for Understanding". ISSN: 1524-6345. Retrieved December 12, 2007, from: <http://radicalpedagogy.icaap.org/content/issue7_2/colley.html>.

5 - Kilpatrick, W. H. (1951). **Philosophy of Education**. New York, NY: Macmillan.

6 - Kilpatrick, W. H. (1918). **The Project Method**. New York: Teachers College Press.

7 - Mayhew, M. J. & Wolniak, G. C. (2008). How Educational Practices Affect the Development of Life-Long Learning Orientations in Traditionally-Aged Undergraduate Students. (Electronic version). **Research in Higher Education**, 49(4), 337-356.

8 - McLean, M. (2001). Can we Relate Conceptions of Learning to Student Academic Achievement? **Teaching in Higher Education**, 6(15), 399-413.

9 - Morgil, I.; Gungor, H.; Ural, E. & Temel, S. (2008). "The Effect of Web-Based Project Applications on Students' Attitudes towards Chemistry". Retrieved May, 2, 2008 From: ERIC.

10 - National Science Board (2002). **Science and Engineering Indicators**, Volume I. Arlington, Virginia: National Science Foundation.

11 - Sander, P. & Sanders, L. (2003). Measuring confidence in academic study: A summary report. **Journal of Research in Educational Psychology and Psycho pedagogy**, 1 (1), 1-17.

12 - Schneider R. M., Krajcik J., Marx R. W., & Soloway E. (2002). Performance of Students in Project-Based Science Classrooms on a National Measure of Science Achievement. **Journal of Research in Science Teaching**, 39(5), 410-422.

13 - Standards-based reform and its unintended consequences: Implications for science education within America's urban schools. **Journal of Research in Science Teaching**, 39(2), 114-127.

14 - Thomas, J.W., Mergendoller, J.R., &Michaelson, A. (1999). **Project-Based Learning**: A Handbook for Middle and High School Teachers. Buck Institute for Education. (<http://www.bie.org>.

15 - Weiss, I., Banilower, E. R., McMahon, K. C., & Smith, P. S. (2001). **Report of the 2000 Survey of Science and Mathematics Education**. Chapel Hill, NC: Horizon Research Inc.