OVERVIEW OF THE STUDY

As a field, PBL is still in the developmental stage. There is not sufficient research or empirical data to state that PBL is a proven alternative to other forms of instruction. Based on evidence gathered over the past ten years, PBL appears to be an equivalent or slightly better model for producing gains in academic achievement, although results vary with the quality of the project and the level of student engagement. Also, PBL is not appropriate as a method for teaching certain basic skills such as reading or computation; however, it does provide an environment for the application of those skills. More important, evidence shows that PBL enhances the quality of learning and leads to higher-level cognitive and metacognitive development through students’ engagement with complex, novel problems. It is also clear that PBL teaches students complex processes and procedures such as planning and communicating. Accomplishing PBL can help teachers create a high-performing classroom in which they and their students form a powerful learning community focused on achievement, self-mastery, and contribution to the community. The researcher has tried to analyze relation between teaching and learning based on PBL method and development thinking skills, creativity, problem solving and team-collaboration and the difference between genders. The research focuses on science subjects; PBS (project-based science) is the appropriate method to be studied through a comparison between experimental and control group.

DISCUSSION

In this study the effect of PBS (project based science) on student’s thinking skills achievement level and team collaboration skill were investigated. For PBS to be effective, the school must give students change to involve team projects frequently. Placing students in a team and assigning them a task does not guarantee that the students will engage in effective
collaborative learning behavior. When put a group as people that have never worked together, personalities might lead to arguments. the traditional lecture-oriented classrooms do not teach students the social skills they need to interact effectively in a team teaches should give students the skills they need to succeed in teams.

Chapter four gives the conclusions of this research, provides testing of theoretical concepts by concrete data. This chapter helps to discuss the findings and compare them with empirical documents which have been presented in other research.

The following null hypotheses were formulated:

1. There is no significant difference between experimental and a control group in the development of students’ thinking skills.

2. There is no significant difference between experimental and control groups in the development of students’ creativity.

3. There is no significant difference between experimental and control groups in the development of students’ problem solving.

4. There is no significant difference between experimental and control groups in the development of students’ team-collaborating.

5. There is no significant difference in the development of thinking skills among girl & boy students.

6. There is no significant difference in the development of creativity among girl & boy students.

7. There is no significant difference in the development of problem solving among girl & boy students.

8. There is no significant difference in the development of team-collaboration among girl & boy students.
9. There is no significant difference between girls and boys groups in experimental group (pre and post PBL administration) in the development of student’s thinking skills.

10. There is no significant difference between girls and boys groups in experimental group (pre and post PBL administration) in the development of student’s Creativity.

11. There is no significant difference between girls and boys groups in experimental group (pre and post PBL administration) in the development of student’s problem solving.

12. There is no significant difference between girls and boys groups in experimental group (pre and post PBL administration) in the development of student’s team-collaboration.

1. First hypothesis considers the difference between experimental and control groups in thinking skills. In recent two decades many researchers have been done on the relation between project-based learning method and development of thinking skills. (Tretten et al 1995, Horan et al 1996, Shepherd et al 1998, Pea and Leong 2003, Ravitz et al 2011). The findings of the present study are in agreement with previous studies.

A few studies about thinking skills have been done which focus on critical thinking (Tretten et al 1995). In particular, one study of PBL showed a positive effect on low-ability students, who increased their use of critical-thinking skills including synthesizing, evaluating, predicting, and reflecting by 446% while high-ability students improved by 76% (Horan, et al., 1996). Some of researches have considered other dimensions of thinking skills such as creative thinking (Doppelt 2009). Students who participated benefitted PBL, showing from improved critical thinking (Mergendoller, et al., 2006; Shepherd, 1998; Tretten & Zachariou, 1995). Beringer’s (2007) findings indicated that although there were high levels of engagement
with the content, the lack of structure caused some students to focus on technical skills rather than higher level thinking.

These studies along with the finding of present study reveal that implementing the project-based learning method will develop the higher order thinking.

2. Second hypothesis is related to the difference project-based learning method between experimental and control groups in creativity. The results of the present study show that experimental group where the PBL was applied showed more creativity than control group. Muhammad Yasin et al (2006) pointed out PBL not only focuses on getting solution to interested social issues but also to promote students’ creativity. It is more student-centered approach which does not require students to memories theory or formula; instead they are required to be more analytical and creative in thinking by analyzing information gathered to solve the problem. Pee and Leong (2005) show that besides completing the projects, students also developed other attributes such as creativity. Also Gulbahar and Tinmaz (2006) believe that the curriculum should be evaluated and enhanced with courses emphasizing creativity. Lipson et al (2007) report that slightly over 70 percent student showed improvement after PBL in their creativity. Holubova (2008) in his research on physic topic perceive that Students apply core academic skills and creativity to solve authentic problems in real world situations. To promote creativity of the students, creative teachers are needed as well.

3. The third hypothesis is regarding the difference between experimental and control groups in problem solving skill. The results of this study again show a marked superiority of experimental group over control group in problem solving skills. Garcia et al (2006-2007) reported that, teachers have found in students a higher interest for completing the practical tasks and more effort to solve an open problem. It can be seen as a better attitude
in internal discussions inside student groups in order to solve the different stages of the Project. Mergendoller, et al., (2006) Shepherd, (1998) Tretten & Zachariou, (1995) pointed out that those Students who participated in PBL also benefitted from improved critical thinking and Problem-solving skills. Although one study found that students had difficulty adapting to the PBL structure, which negatively affected their learning of problem-solving skills (Beringer, 2007). Additionally, research on contextual factors has led to the recommendation that, to the extent that it is important for students to be able to apply what they learn to solve problems and make decisions, instruction be carried out in a problem-solving context. Learning that occurs in the context of problem solving is more likely to be retained and applied. Such learning is also seen as being more flexible than the inert knowledge that is acquired as a result of more traditional didactic teaching methods (Boaler, 1998b; Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990). Results from the attitude surveys were similar to those reported by Boaler (1997). Tretten and Zachariou (1995) believe that experience with Project-Based Learning activities had a variety of positive benefits for students including attitudes towards learning, problem-solving capabilities.

According to the present research, it was found that Project-Based Learning experience had a significant impact on students' problem-solving skills. The researcher believes not only were students at the traditional school unable to use their knowledge to solve problems, but "Students taught with a more traditional, formal, didactic model developed an inert knowledge that they claimed was of no use to them in the real world. In contrast, "Students taught with a more progressive, open, project-based model developed more flexible and useful forms of knowledge and were able to use this knowledge in a range of settings such as solve of problem."
4. Fourth hypothesis is based on the difference between experimental group where PBL was used and control groups in team-collaboration. It's obvious that the most important expected result and feedback in implementing PBL method is to achieve team-collaboration skill. The results of the present research are in agreement with most of researchers. Students who participated in PBL also benefitted from improved Collaboration skills (Belland, et al., 2006; ChanLin, 2008). In particular, one study of PBL showed a positive effect on low-ability students that demonstrated initiative, and teamwork, as they worked in groups (Horan, et al., 1996). Also in a study students reported that they enjoyed PBL because it gave them opportunities to interact with their friends and make new friends through cooperative projects (Belland, et al., 2006; Lightner, et al., 2007). In addition, Yiping and MacGregor (2004) reported that between-group mentoring and review facilitated growth in collaboration skills for university students engaged in PBL. Baumgartner and Zabin (2008) also found that collaboration among students contributed to the growth of a “scientific community”.

Marx et al. (1991) believe that one of challenges grew out of difficulties teachers had in accepting the ideas that effective collaboration among students requires more than involvement, it requires exchanging ideas and negotiating meaning. Asan and Haliloghlu (2005) indicated when students work together in teams to create projects, they maximize their computer skills. They also indicated that PBL improves students’ collaboration skills. PBL accommodates and promotes collaboration among students, between students and the teacher. Harrison (1999) and Dooling’s (2000) studies support this conclusion as well. Frank et al (2003) state that in order to PBL to be an effective learning’s environment, students should be trained in teamwork either before or during the process. This preparation will help them to cope with in-team conflicts, to make team decisions, to allot tasks to team-members, and to take the necessary organizational steps. Abdallah et al (2007)
suggest a metamodel to help the teachers to choose a platform of e-learning and deploy their lessons according to the objectives of a Project-Based Collaborative Learning (PBCL) framework.

In the present study the researcher observed that most of the students respected each other’s opinion in the group and they learned to share tasks and take responsibility for accomplishing them. But some responses presented a more complex situation than researcher anticipated. Approximately 20 percent of students indicated that there was a disagreement within the group members. Also some responses emerged to confirm the presence of a strong individualistic culture in the groups. Most students rated their own team work abilities highly. 90 per cent indicated that their success is entirely due to their efforts. In other words, students had confidence in their own skills to effectively complete team projects. Students also believed that their fellow students contributed to the best of their ability to satisfactorily complete the team project. From all of these responses we can conclude that the students felt very positive about their collaboration. The way they talked about arguing seems to suggest that there was a battle of wills over different people's opinions rather than a sharing of ideas. At the end of the project, they seemed to appreciate that the final outcome was a combined effort and they enjoyed working with the other team members, learned about the importance of teamwork and learned to be more patient with others and to be more open-minded.

Few students complained about group size and time management. This is because this class were not used to group work, they wasted a lot of time and worked slowly.

5. Fifth hypotheses related to differences in the development of thinking skills among girl & boy students. Munns et al (2004-2005) considered ways to motivate and engage boys in thinking critically and creatively about their own and their peers’ schooling, their worldview, their future employment and what they want to make of their lives. They suggest
that traditional curricular, pedagogical and assessment practices have failed for some - perhaps many - of these boys. Curricula that connect with boys’ interests and experiences can provide rich material through which their existing knowledge is not only acknowledged, but can be extended, deepened and subjected to critical reflection.

Chadwell (2007) suggested use of project-based learning as a strategy for working with girls. Embedded units and lessons with connections to the real world, show relationship between content/skill and the lives of real people. He emphasized that teachers must recognize the energy that boys bring to the classroom as a learning opportunity instead of behavior that needs to be controlled, so offer use of problem-based learning as a strategy for working with boys, start units or lessons with an essential question involving decisions or choices. Present study shows that boy’s groups score is higher than girl’s groups score in the development of student’s thinking skills. The researcher believes that there is no different between gender to learn thinking skills on project-based learning method and both of genders indicate great abilities meanwhile implementing of method. It may be this difference due to number of boys that less than girls, and or cause boys were from school in prosperity region. In order to present exact viewpoint about should implement vast amount research between genders.

6. Sixth hypothesis is related to difference in the development of creativity among girl & boy students. Muhammad Yasin et al (2006) point out that creativity is considered as a critical skill in lifelong learning, as well as a skill needed in scientific problem solving and entrepreneurship. One way of promoting creativity is through the approach of Problem Oriented Project Based Learning. McGrath (2004) found no gender differences between girls and boys at any level, and the students attained significantly higher grades than the students at the more procedural school.
Mioduser and Betzer (2007) demonstrate that Students in both groups showed poor creativity knowledge of the curricular concepts in the pre-test, as expected. After the learning process both groups performed significantly better, but the gain for the experimental group was impressive with an increase of 84% compared with 52% by the control group. The mean increase for the girls of the experimental group was even higher, above 90%. Analysis of variance test considering the variables ‘‘group’’ (experimental, control), ‘‘testing-time’’ (pre, post) and gender showed significant difference for the gain in creativity in both groups, and between groups but not for gender.

7. Seventh hypothesis is related to difference in the development of problem solving among girls & boy students. Project-based learning requires students to understand a problem, with all of the fundamental science, societal, ethical and other constraints, prior to assessing and implementing a solution. Powers et al (2003) reports that there was no real difference between boys and girls in their perceptions of the types of problems science and technology can solve. Both recognized that these disciplines could fix many specific problems but had less confidence that engineers could solve social problems. Westheider and Brown (2010) indicate that the girls paid more attention to details, did more thorough testing and retesting, and did more extensive work in the planning phase.

They kept working at solving the programming and equipment problems longer than the two boys’ teams. They tried more solutions out, and collaborated more on how well each new facet of the solution worked. The researchers deducted that the boys did their programs more by trial and error, with less pre-planning than their female counterparts. The most obvious difference between the girls’ group and the other two groups of boys was the level of attention to detail shown by the girls.

8. Eighth hypotheses state difference in the development of team-collaboration
among girl & boy students. Westheider and Brown (2010) indicate that the boys’ groups were willing to give up sooner and to accept a robot that could not do exactly what they had in mind for it to do and against the girls urge done another to continue, and collaborated more in dividing the labor to get the robot to do the target actions. Sarvar (2002) believes it’s very difficult for girls to work together in a group especially if two of them want to be ‘the boss.’ This problem was also voiced in the group interview. One interviewee said ‘there should be rules of behavior in projects like these. A revealing reflection is given by another learner of the same group. Zastavker et al (2006) state our results indicate that:

a. On average, both men and women find in-class group work helpful in their learning.

b. Found a positive correlation between student participation in small group work (both in and outside of the classroom) and the extent to which students report that group work positively impacts their own engagement.

c. Women experience PBL with higher levels of anxiety than men and report that their coursework is very challenging and time-consuming. Powers et al (2003) believe that the girls tended to rate group work activities higher and are more confident in this area than the boys.

McGrath (2004) states the researchers looked at how girls and boys worked in teams over a 10-week project. They anticipated that these mixed groups would be a problem for girls at first but that these problems would gradually go away.

Working collaboratively has also been seen as especially beneficial for girls. Reasons given are that most girls prefer collaboration to competition; girls generally have good communication skills and benefit from and enjoy discussion; small collaborative groups facilitate “connected” learning and support and encourage risk taking; and collaboration helps to create a more egalitarian environment (Cordeau, 1995; Jacobs, 1994; Morrow &
Morrow, 1996; Solar, 1995). In a comparative study of two schools, Jo Boaler (1997a, 1997b, 1997c) found that girls in a school that used an approach based on collaboration and open-ended inquiry reported increased confidence and enjoyment of mathematics. Girls in a school with a similar population that used a traditional textbook-based approach reported widespread disaffection, lack of confidence, and the feeling that they were not being given a chance to understand.

For people concerned with gender equity, another potential benefit of the collaborative approach is that boys may play a less dominant role in small-group discussions than they do in whole-class teaching. Studies of the latter have consistently found that a disproportionate number of teacher-student interactions are with boys (Howe, 1997; Koehler, 1990; Leder, 1990). Collaborative work in small groups may allow more students the opportunity to articulate their ideas than would be possible in whole-class teaching, and so may have the effect of counteracting the tendency for a few males to dominate classroom interactions.

Although many studies of gender and classroom interaction, such as those cited earlier, have looked at the context of whole-class instruction, relatively few have investigated the influence of gender on interaction in a collaborative inquiry context.

In present study, the collaboration allowed team members to share and critique ideas, of course, difference between genders is natural according to psychological studies but there was no difference in collaboration or no collaboration but difference was observed in interactions quality between them. The girls showed more patience in team working and the boys could be taking risk and manage the interactions.

The cases of learning differences between girls and boys were discussed above (hypotheses 9-12).