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Student views on problem-based learning of 9th grade industrial vocational high school

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Abstract

Mathematics lessons are rather important since the analytical approach is the main issue in engineering. But industrial vocational highschool students perceive maths as a hard lesson with too many equations thus it influence their success and their approach towards maths. In order to change students' perception we need to have educational strategies where the students will be responsible for their learning from real life skills. For this reason, in the last years student centered and learning based constructive educational approaches are being used. Problem-based learning, being one of these approaches, is used in mathematics lesson in 9th grade Industrial Vocational High School. In the end of this study, students conception of problem-based learning is gathered from a survey of 5 open-ended questions asked in student's view or PBL questionnaire form and positive and negative results of problem-based learning is set forth.

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1. Introduction

Mathematics appears from definition of facts or setting of rules, sometimes handling a practical daily problem, sometimes from the inner world of its own necessity (Olkun ve Uçar, 2004). This enables people to think in an analytical way to supply questions and answers towards cases, to progress their ability, and to gather new knowledge joining the data they have with their skills (Baki, 2003).

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This way the need of using mathematics in daily life and understanding gain importance increasingly every day (Altun, 2004). The aim of mathematics lessons in schools is teaching students by means of achieving different behaviours and skills. On the other hand, learning is not achieved by transferring knowledge from one to another. Learning is gained from using one's knowledge and skills, researching, attending and adapting this to his own life (Başaran, 1968). Accordingly, new approach in mathematics learning interprets maths rather than just solving the problem (Olkun, 2002). Therefore, we need to have a new method in which we make maths part of a real life and active methods which students will be held responsible for their learning. For this reason, structural learning approach is being used in mathematics lessons. Structural learning refers to building knowledge and in this, one can manage his own knowledge through experience and interaction.

2. Problem-based learning

Problem-based learning approach is an experience based approach where one solves and makes research by solving complex and real life problems (Torp and Sage, 1998). This is an efficient learning model for students since it gives emphasis on different problem solvings (Ronis, 2001). This learning model, makes students' minds active in lessons and makes students understand why and what they are learning during lessons by forcing them actively take part in lessons. Behaviours and aims about the subject are introduced to students in scenarios (Seyrankaya and friends, 2004). Scenarios being the main tool of problem-based learning have contextual problem sets taken from real life. These scenarios have events which increase students' curiosity, make them think about the reasons and keep the students learning motive on high levels while reaching the said goal. The aim of this is to make the learner think that the learning of the subject is a must and helpful in order to increase his curiosity. With having this learning motive the learner wants to make research, study and apply the knowledge he gained. The scenarios must be prepared according to real life, include tips to reach learning goals, does not give information that diversify from the main subject, includes elements that increases curiosity and willingness, and written in a proper and understandable language. From these scenarios, students asked to solve the problems by gaining new knowledge and combining it with their own knowledge. But the students don't have enough information when they meet the scenarios. Teachers help students by giving problem hints, supplying keywords, or activate students own knowledge by asking questions and correlate them. The teacher also help students to collect learning materials, encourage them to work harder, help to progress students thinking and question asking habits and to gain new knowledge by themselves (Kocaman and friends, 2003). It is important for students to gain the habit of efficient questioning, critical thinking and gaining the new knowledge independently in the problem-based learning environment. Students include activities such as thinking and solving the problem, creativity, gaining knowledge, questioning and agreeing and they spare time both for independent and group work. In the end of each scenario they produce something. Students having adopted the learning behaviour by time they will be eager to learn more and give more effort. In this research, we try to analyse the negative and positive sides of teaching mathematic lessons in PBL environment.

1. Method

The survey took place in Ankara and we surveyed to 22 students in the 9th grade of Industrial Vocational High School representing middle social economic class. 7 scenarios and 3 working sheets on "whole numbers" and "digital" subjects were prepared. PBL methods and how the survey would take place were initially introduced to the students. Groups of 4-5 were formed and each group assigned a speaker. For each scenario groups were asked to recall their knowledge, to determine the need for new knowledge and to research from various sources. The teacher helped the students in reaching sources when they faced difficulties. Lessons mostly took place in classrooms, computer labs and drama rooms were also according what the scenario needed. At the end of the learning period, students were asked their opinion on PBL environment to answer "Students views on PBL" questionnaire form given by the researcher.

2. Finding

There were 5 open-ended questions and unobligatory comments section on the “Students view on PBL questionnaire”. After evaluating students’ views on the questionnaire, the findings gathered under subsections and frequencies were calculated. 18 of the 22 students answering the question “What do you think about PBL approach?”, think PBL is efficient in learning where 4 students do not agree. 20 of the students answering the question “What are the differences between teacher based learning and problem based learning in mathematic lessons?” think PBL is more efficient in learning mathematics, 2 favor teacher based learning. All think PBL has advantages to students answering the question “What do you think about the advantages of PBL to students?”. 15 of the students answering the question “What are the deficiencies of PBL” think that PBL does not have any deficiencies, but 7 students think PBL does have some deficiencies to the question “Do you think PBL method can be used in mathematics lessons?”. 17 of the students answered “Yes”, 3 of the students answered “No”, and 2 of the students said that did not effect what was used as a method in learning maths. Please find below the efficiencies and deficiencies of PBL approach according to the clasified evaluations gathered from students views.

Table 1: Efficiencies of PBL method

Subject	Sample Student Views
Group Interactivity	<p>“We understand the lesson better. While we are sitting alone sometimes some of us are sleeping.”</p> <p>“Nobody sleeps when we are having a group work. If we sleep we wake up.”</p> <p>“Group work took us to higher levels, made us even diligent, successful and pushed us to higher levels.”</p> <p>“Learning mathematics in daily life is educative. The idea of being a group was nice. Because there was solidarity and exchange of ideas.” “This led us to gain new knowledge from each other.”</p>
Research	<p>“New approach, PBL, relies on more research, is better and makes us work. Even some of our friends who were not fond of studying could work in this environment.”</p> <p>“Each week, everybody made research using sources like internet and books”.</p> <p>“Made us become researchers.”</p> <p>“Anticipation was higher, everybody has learnt something, and different researches were made.”</p> <p>“I want it, we understand better with this approach. Since we made the research we understood clearly. Helped us understand better.”</p>
Gain of Self Confidence	<p>“I hated mathematics in the previous lessons. In this environment, making researches independently sharing own knowledge with others made me gain my confidence”</p> <p>“Our intelligence progressed. Our interest, capacity and performance got better.”</p> <p>“I realized my knowledge level .What I knew what I did not know</p> <p>One had right to think and talk freely.”</p> <p>“I want it because I am gaining my confidence.”</p>
Permanent Learning	<p>“Everybody finds an opportunity to learn through scenarios. Otherwise teacher talks we listen”</p> <p>“The ones who understand are fine, the rest ran after games.”</p> <p>“With these scenarios mathematic lessons are much more understandable, the others are boring and you forget it in a very short time.”</p> <p>“We kept it in mind and we learnt to share with the group. We adopt the problem.”</p> <p>“Since the subjects were taken from real life, we understood clearly, did not forget and we attended the lessons well prepared.”</p> <p>“This environment is better. We learn it even if we do not want to.”</p>
Active Participation	<p>“I understand with PBL, In the other approaches teacher teaches the subject and goes quickly.”</p> <p>“It is nicer in PBL. On the others we only make the descriptions and make some exercise.”</p> <p>“The other approach is class oriented. This is self oriented. In this we can realize the missing parts.”</p> <p>“It is easier to recover the missing parts.”</p> <p>“There are too many differences. We solve the problem with the group in PBL. It is much better.”</p> <p>“We began to like mathematic lessons, time passes so quickly. But normally we thought mathematic lessons were boring, time did not pass so quickly and some slept while some listened who knows.”</p>

Restricted methods of PBL are given 3 heading as a direction of students' opinions and they are presented in Table 2.

Table 2: Deficiencies of PBL Method

Subject	Sample Student Views
Deficient Group Member	<p><i>"When working as a group, some friends did not do their homework and did not attend the lessons."</i></p> <p><i>"Some did not make sufficient research as a result both members of the group and he himself would not understand the lesson."</i></p> <p><i>"Group members do not show interest in lessons. Do not make any research. According to me there is no team spirit."</i></p> <p><i>"This group work is a very good method in learning the subject. But in our group some members did not show any interest so we didn't have enough chance to work too much."</i></p> <p><i>"Will be better next time."</i></p>
Time Consuming	<p><i>"We have long lasting problems. We were always behind."</i></p> <p><i>"It is better when teacher teaches the lesson. So B46 we won't fall behind."</i></p> <p><i>"When teacher teaches we progressed in parallel with other classes. It takes longer in PBL method."</i></p>
Less Problem Solving	<p><i>"It was nice, we could keep it in mind but we solved less problems plus we stayed under our level."</i></p> <p><i>"When teacher teaches we solve more problems. We keep our level."</i></p>

5. Conclusion

The research showed that the students found the efficiencies and the deficiencies of PBL method and increases their motivation to lessons when used in math lessons. According to students, PBL method is a group based, pleasurable method which takes examples from real life, encourages students to research, gives permanent knowledge and increases the interest in lessons. The students listed the efficiencies of PBL as; being part of a real life, gaining permanent knowledge, taking active role in lessons, increasing success and gaining self confidence in themselves. The students stated that the main difference between PBL method and teacher based method is to solve the problems in scenarios with the group and being forced to research. They point out that this difference plays an effective role in learning. Students also stated that working together with the group and researching has some deficiencies for the method. Time consuming point of solving the problems created by the scenario and the members irresponsible behaviours were stated as the deficiencies of the method. Plus they think they solved less amount of problems with this method and pointed out this as the deficiency of the method. It is often stated that using PBL method in maths lessons increases self confidence and their interest in lessons even though it has some deficiencies. This conclusion is parallel to Göl (2000), conclusion which he reached during his studies made with the engineering students using PBL method, increasing theoretical knowledge by practice, students' pleasure and interest in working on the subjects from their own lives. Students think that they won't need maths in real business life, even the most of the professional and technical areas (computer, electric, electronics, machine design etc.) based on mathematics. This idea decreases their interest and success in mathematics lessons. "I liked this study a lot because it helped me understand mathematics now", "I did not like mathematics in the past, but now I started to like it." From the students above statements we understood that mathematics' involvement in daily life through scenarios made mathematics lessons to be liked by the students. As a result, it is stated that in teacher based education mathematics lessons are boring, attention to lessons decreases, knowledge thought to be gained has forgotten quickly. But in PBL based education it is stated that, researching, sharing the knowledge gained in the group and making discussions increases interactivity and with success motive students improve their self confidence.

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