

MESSY PROBLEMS CHALLENGE TO DISCOVER THE UNKNOWN USING THE KNOWN

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Introduction

One of the main purposes of education should be to equip the students with the knowledge and skills to face the challenges in life successfully. Unfortunately, current education system in Sri Lanka has not been successful in this due to the high competitive examination system which promotes students for rote learning. Consequently, learning science is identified as an area where students have to memorize lot of equations and facts in order to obtain higher grades. Therefore, students do not see science as a familiar discipline which they should appreciate as it explains the world around us. In addition, promoting the students to use education to deal with the unclear problems in life is becoming increasingly important due to the growing complexity of the world around us. Problem-based learning (PBL) which is a novel instructional strategy is identified as an effective method to cater to these needs. PBL is a student-centered instructional strategy in which students collaboratively solve problems and reflect on their experiences. In this approach learning is driven by challenging, open-ended, ill-defined and ill-structured, practical problems and students generally work in collaborative groups while teachers take on the role as "facilitators" of learning. (Torp and Sage, 2002).

This research was carried out to find the successfulness of this method in Sri Lankan context. In fact, the objective was to find the effectiveness of PBL on 8th grade students understanding of the concepts related to force, pressure, work and energy.

Methodology

After a deep analysis of recent literature (Karunaratne et. al. 2009) related to PBL and analysis of science curriculum, teacher guide and science text books a questionnaire was prepared to get views of 75 science teachers. The results of these were used in selecting a difficult unit. Two government schools (girls' and boys') were selected, considering accessibility. With the consent of the principals a diagnostic test was conducted to identify two parallel classes of equal level from each school. Ill-structured problems were crafted considering the difficulties and common interests of students. Two teachers were guided by coaching them through lengthy discussions and video clips on PBL. Same teacher taught both PBL class and non-PBL class. Data were collected through data collecting tools such as participant observation and videotaping lessons on their teaching. Assessment data and student work were also collected. At the end of the unit an achievement test was

conducted. Student comments and teacher comments were also gathered. Data collected from multiple sources were triangulated to analyze data qualitatively and t-tests were used to analyze the data quantitatively.

Results and Discussion

First lesson in both the PBL classes were less successful than the rest as students were not familiar with the novel approach. However, it was clearly visible that the student involvement, motivation and enthusiasm increased continuously once they were familiar with the method. Boys were more excited than girls of the PBL classes at the beginning and they took less time to get adjusted to the new method. In both PBL groups students managed to do more effective group work day-by-day as they were keen to share the work and knowledge in order to face the challenges managing the given time. They continued to try more creative methods to present their solutions and learnt more communication skills through whole class discussions. Each day they were waiting to be given the challenge assigned for the day and the students who were labeled as trouble makers according to their previous behavior seemed to take the lead along with the high achievers in the class. Students were more engaged and more involved and was looking forward to ask questions from the teacher when they were confused and also were keen to use the resources to face the challenge of finding a solution to the given ill-structured problem. Moreover, PBL class students were given more opportunity to develop their social skills and to pay attention

on time management in PBL lessons (both the PBL classes managed to cover the unit within 12 periods whereas non-PBL classes took more time). Also students were highly enthusiastic and more interested in discovering knowledge in PBL class compared to the non-PBL group. Furthermore, the comments given by the students of the PBL class were mostly positive, while 96% was totally positive about the effectiveness and the successfulness of the method 4% had doubts about the involvement of the less active students while they liked the method themselves. Students of both genders of the non-PBL groups were less active. They did more writing and listening and did not get the opportunity to improve their social skills or time management skills as they were just following the orders given by the teacher.

In addition, the two-sample t-tests conducted on the diagnostic test results gave p values > 0.05 , showing that the null hypothesis which stated that there is no significant difference between the two groups to be true for both genders. However, the results of the final tests gave p values < 0.05 , showing that the alternative hypothesis which stated that the achievement test marks of the PBL group was greater than that of non-PBL group to be true for both genders.

Overall, these results show PBL approach produced far better results than that of the conventional method hence it was clear that the students of the PBL class had a far better conceptual understanding of the concepts taught than the students of the non-PBL class.

Conclusion

The results of the study made it apparent that PBL learning approach was successful in making students gain conceptual understanding of the unit force, pressure, work and energy. Moreover, it was clear that PBL was successful in increasing student motivation by enhancing the ability to work as a team and also by promoting social skills and time management skills of students. Hence, PBL could be used in many different contexts to enhance student understanding in subjects other than science.

References

- Karunaratne, S., Parker, J., Lundeberg, M., Eberhardt, J., & Koehler, M. (2009). Multiple Paths Chosen by Teachers in a Professional Development (PD) Project Based on Problem-Based Learning (PBL) and Teacher Research. Proceedings of the Intercultural Education (IAIE): Paideia, Polity, Demoi conference held in Athens, Greece. (ISBN 978-90-814411-1-7).
- Torp, L., and Sage, S. (2002). Problems as possibilities problem-based learning for K-16 education (2nd Ed.) Alexandria, Virginia, ASCD.