

EDITORIAL

The Potential of Action Research for Improving Science Teaching – An Experience from Georgia

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Action Research is an intense strategy of connecting practice and research. New teaching approaches and materials in Physics were developed during a master course at Ilia State University in Georgia. Pre-service teachers conducted Action Research using observations, interviews, and questionnaires to test and evaluate these innovative approaches in the classroom. The current paper describes how Georgian pre-service teachers have been working to improve physics teaching in the 7th grade. After implementing the inquiry-oriented lessons modules, the pre-service teachers noted a positive tendency in terms of students' involvement and motivation toward physics.

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Need for Innovation

Georgia is still struggling to overcome the purely academic, subject matter structured, and teacher-centered paradigm in science education that is rooted in the Soviet time, as it is the case also in other post-Soviet countries (Kapanadze & Eilks, 2014). Instead of focusing on process-oriented skills and capabilities that promote successful, responsible life in society-at-large, a strong focus on theoretical learning is still dominant in science teaching at secondary schools and universities in Georgia. Teacher cooperation with the students is limited to short periods that employ guided questions and short answers. This learning process does not correspond to that which educational theory suggests as proper. Students are not motivated to learn physics and the other science subjects. In the end, Georgian students gained poor results in international studies such as PISA and TIMSS.

Action Research in Science Education

Action research is described as a cyclical process of planning, implementation, observation and reflection (Gilbert & Newberry, 2004). These cycles allow teachers to evaluate their own classroom practices for improvement (Townes, Kreke & Fields, 2000). Action research is an effective tool for helping teachers to reflect on their own teaching practices. As such, action research is part of professional development and university courses in many countries (Mamluk-Naaman & Eilks, 2012). Through reflection, teachers and student teachers better understand students' learning difficulties and also critically look at their own teaching practices.

Action research used in Georgia is now aimed to increase students' motivation and to improve teaching methods in science. Instead of traditional approaches, which were very common for the students, they explored various types of topics via experiments and discoveries.

Pre-service teachers from Ilia State University in Georgia started to conduct action research. They used different instruments – observation, interviews, and pre-post questionnaires. In total, 37 students from the 7th grade participated in one of the studies – 18 of them were in an experimental class and 19 in a control group. Students for the experimental class were chosen randomly. Interventions and data collection were done during one semester.

From the interview with the physics teacher, it was clear that he conducted lessons based on a traditional, teacher-centered approach using mathematical calculations for physics phenomena. Having studied the positive effects of inquiry-based learning during the university course at the laboratory (Panasan & Nuangchalerm, 2010), the pre-service teachers prepared teaching modules based on inquiry. Pre-interviews were done with the students before the implementation of inquiry based modules. The topic of the first teaching module was Archimedes' Law. The module consisted of four lessons. Archimedes' Law was investigated and studied experimentally. Students from the 7th grade found out the relation between the buoyant force, volume of the subject and density of the fluid based on the experiments. The pre-service teachers collected data – they used diaries and observation list. They realized that only 30% of the class was actively involved in conducting experiments.

Based on the observations and data analysis, the pre-service teachers planned the second cycle of the teaching module. The topic of it was Pressure and it consisted of three lessons. The pre-service teachers planned the lessons with motivational activities including videos and experiments with visible results (less calculations and more visible effects). Post group interviews were done with the students after the implementation of both teaching modules.

The pre-service teachers compared pre-post interviews and they found that students enjoyed the lessons when they were conducting different experiments and became more interested in the subject.

For a quantitative study, the pre-service teachers used motivational questionnaire (Pintrich, & De Groot, 1990). After analysis of quantitative and qualitative data, it was clear that in the experimental classes students became interested to study physics and expressed positive attitudes towards the subject in general. For the control class, the results for the pre-post studies were the same.

Conclusion

Conducting action research helped to pre-service teachers to analyze the situation and improve the learning process in the classroom. It helped the students to get more interest to study Physics.

At the stage of implementation, it was revealed that research-based teaching practice necessitates proper preparedness from the teacher as well as from the students. We believe, that the idea and

importance of the methodology mentioned here should be precisely understood by the teacher so that it is correctly implemented during the learning process. At the stage of intervention, a positive tendency in terms of students' involvement was noted. They constantly asked questions and tried to connect materials covered during the lesson to everyday life.

On the basis of action research, we can assume that a learning process oriented on students' interests and needs leads to students' fascination and involvement in the lesson, both of which are indicators of enhancing student's motivation.

I hope that more studies like this are implemented in science teaching in the different countries and that teacher educators, student teachers, and teachers start reporting corresponding activities and findings in the journal *ARISE – Action Research and Innovation in Science Education*.

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