IMPACT OF LONG-TERM PRACTICAL TRAINING ON SCIENCE TEACHERS’ PERFORMANCE AND THEIR ATTITUDE TOWARD CREATING A BETTER SCIENCE EDUCATION ENVIRONMENT

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Abstract

For the past 50 years, studying science has been a fundamental feature of the work of the science education research focusing on investigating students’ attitudes towards basic science. This piece of knowledge represents part of a research project to develop a framework that can integrate practical science activities within the teaching and learning process of school science in Qatar with a special reference to biological sciences. Our goal is to prolong teachers’ knowledge toward understanding main concepts, deep ideas and model alternatives by introducing an effective system for practicing biological science that are designed to be both “hands on” and “mind on”. Our hypothesis was as long as the teachers gained this knowledge; it will be indirectly reflected on positive student performance.

The plan was based on training in the first phase (pilot) a group of 8 grade-11 science teachers from randomly selected 8 independent schools in Qatar over a period of a full academic years for a total of 60-70 hours (3-4 hours training session /week). We also kept other eight science teachers as control without any training courses. In every training session, teachers are trained on a specific topic according to the curriculum, and then they performed the same practical session for their student in their schools. In the subsequent training session, teachers discussed feedbacks with their trainers and colleagues. Evaluation of the program was based on both teachers’ and students’ performances and attitudes before and after training. Evaluation was based on teachers’ general skill test, practical class observation and attitude towards science before and after training of both students and teachers in addition to comparing results with control group.

The results indicated a very significant increase in delivery skills and performance of teachers as well as the attitude toward biological science for both teachers and students. Teachers’ confidence in delivery of practical activities was enhanced among all trainees. A T-test analysis of students’ attitude toward, and interest in science showed a significant increase in five factors related to interest, belief, attitude, self-efficacy and value of science. The research is in progress and in a second phase, the same number of teachers will be selected and evaluated from primary and preparatory schools.

Keywords: Practical Delivery, Biological Science, attitude, curriculum standards, training, inquiry-based.

1 INTRODUCTION

It is well known fact that practical experiments in science at schools is widely accepted as an energetic component of teaching and learning. Several scientists indicated that students prefer practical experiments in science rather than any other learning activities. It is a real way to enhance students’ motivation and broaden their knowledge in understanding theories and ideas about natural world.

Practical work in science helping learners to understand scientific concepts and develop their skills and scientific inquiries in a real word [1]. The practical sessions in schools transfer the theoretical ideas to real and observable objects that end with positive learning outcomes such as identify objects and phenomena in addition to learning facts, concepts, relationships and theory models [2]. According to Shumow and Schmidt [3] “ If given the choice many students will opt for an activity that presents a moderate challenge over one that is mindless, because the challenging one is actually more enjoyable. Challenging activities are not just enjoyable, they also require that students focus their attention and energy in engaging more deeply in the task at hand. Thus practical activities are the best
exciting and challenging tasks in learning science [3]. To achieve excellent outcomes from practical work in science, few requirements should be present, among those: the presence of quality equipment and good laboratory layout, student engagement and good behaviour, time to plan and prepare beforehand and time to carry out the work, support from technicians and teaching assistants and clear purpose for the practical and relevance to the topic or curriculum [4].

In Qatari schools, teacher’s feedback is not always positive toward practical sessions in schools as students do not always learn from a practical task the things their teachers want them to learn. Science curriculum standards for the state of Qatar has recommended to balance between subject contents and scientific enquiry. Some among major aims of science strands stated by the standards [5] are that Students should: • be proficient in the use of a range of scientific methods and techniques and in handling apparatus; • Apply scientific enquiry skills to both familiar and unfamiliar situations and communicate the outcomes of their enquiries in appropriate ways; • Use ICT effectively in the pursuit and communication of science [5]. From the above argument, it is clear that the role of the teacher is paramount for the success of implementing effective delivery of practical science. Without trained, skilled and self-confident teachers, no practical can be implemented successfully and science would be taught in a traditional chalk and talk mode [6]. Consequently, the professional development in subject knowledge of the practical lessons of science teachers is so vital to enhance the whole learning process and scientific literacy.

This research represents a framework that can integrate practical science activities within the teaching and learning process of school science in Qatar with a special emphasis in biological sciences. Our goal is to prolong teachers’ knowledge toward understanding main concepts, deep ideas and model alternatives by introducing an effective system for practicing biological science that are designed to be both “hands on” and “mind on”. Our hypothesis was as long as the teachers gained this knowledge; it will be indirectly reflected on positive student performance.

2 METHODOLOGY

The presented plan is part of a research project on developing a framework for effective delivery of practical in science with emphasis on biology in alignment with K-12 curriculum standards of science subjects of independent schools in Qatar. The main research question relevant to this part of the project were: How will secondary school science teachers develop their skills, to make practical lessons more effective, via participation in “hands-on” and “minds-on” training programs linked to science curriculum standards? In addition, how will students benefit from their teachers’ after being participated in these training programs?

2.1 Sample selection

8 grade-11 biology teachers were randomly selected from eight schools based on certain criteria regarding the teachers and schools. These are mainly based on academic ranking from Ministry of Education and High Education as poor performance or average performance in previous years in science subjects in addition to commitments from both schools and teachers. Teachers were interviewed and visits from research team to teachers in their practical science classes during the semester prior to training, were carried out to find out the nature of training needed for these teachers.

2.2 Program organization and implementation

In the week prior to training, the teachers attended a two-day workshop that focused on inquiry based teaching strategy, practical alignment with curriculum and assessment of practical activities. The first training workshop started two weeks after the start of the academic year (October 2015) and continued with an average of one 3-4 hour session / week for 19 weeks during which breaks were given during mid-term and final term exams and mid-year holiday. The training concluded at early May 2016. In every training session, teachers were trained on a specific topic from the curriculum, and then they perform the same activities at their schools. In the subsequent training session, teachers reflect and discuss feedbacks with their trainers and colleagues. Evaluation of the program was based on both teachers’ performance and students’ attitudes before and after training.

2.3 Program evaluation

To evaluate the impact of the training program on teachers’ professional development in instructing practical sessions of biology classes, teachers were subjected to a comprehensive written exam. The
eight teachers were set up for an exam, along with other 8-teachers, randomly selected to serve as control group from 8 different schools. The exam covered all aspects of practical activities performed during the program. T-test was used to differentiate between experimental and control group of teachers at $P \leq 0.05$.

A 5-point Likert score survey that contained 38 items grouped into six subset factors, was administered to 544 students from classes taught by trainee teachers and 228 control students from students taught by the control teachers were surveyed before and after the long training course in order to evaluate any change that could have happened in students’ attitude toward, and interest in, science over the period of the training course (October 2015-April 2017). The six studied parameters are: Attitude towards and interest in science, value of science, science, self-efficacy, teacher support, attitude toward practical and support from family.

3 RESULTS

The results of the comprehensive exam conducted to explore the gain of knowledge and skills of the 16 teachers (8 control plus 8 experimental) after the training sessions are presented in Figure-1. A very clear improvement has been achieved for teachers who did the training sessions compared to the control group. The average rate of improvement was 44% (calculated as ((Experimental value-control value)/control value) X 100%). The differences between experimental and control group is significant ($P \leq 0.05$) according to T-test.

![Figure 1. The mean average results of the post training obtained for experimental group compared with control group. The error bars represent the standard deviations (N=8).](image)

The results of the 5-point Likert score survey is presented in Figure 2. The survey contained 38 items grouped into six subset criteria (Figure 2). 544 students from different classes taught by trainee teachers along with 228 control students from classes taught by the control teachers were subjected to the above-mentioned survey. The purpose of the survey was to evaluate the change that could have happened in students’ attitude toward, and interest in, science after their teachers have been exposed to a well-designed training program. Results showed that all measured criteria were significantly ($P \leq 0.05$) improved after comparing the value of each post-training with pre-training student response using T-test (Figure 2).
Figure 2. Results of the 5-point Likert score survey conducted on students before and after their teachers being subjected to the training program. The survey include 544 students from different classes taught by trainee teachers along with 228 control students from classes taught by the control teachers. All the six measured criteria showed significant improvement after compared with pre-training period.

4 CONCLUSIONS

Qatari schools suffer from the same challenges that hinder science teachers from undertaken practical work in effective manner such as curriculum pressure, poor learner behaviour, lack of time to research suitable ideas for practical work and health and safety [1-7]. Professional development of science teachers toward practical work in addition to professional development in classroom management and assessment of outcomes are effective enough to overcome most of the above-mentioned challenges [7]. The latter conclusion was the main objective of the research project on developing a framework for effective delivery of practical in science in Qatari school. The results obtained from this research highlighted that the practical work when effectively delivered could significantly improve teachers’ skills and knowledge and promote students’ interest in, and enhance their attitude toward, science [6, 8].

Results from this study coincides with the above conclusions as significant improvement occurred for teachers skills and knowledge and the rate of improvement is about is 44%. In addition to that, our results indicated a significant promotion of students’ interest in, and enhance their attitude toward, science in all measured criteria particularly the attitude of students toward practical work in sciences. Since practical work is an essential component of science teaching and learning particularly if its described by content focus, active learning, alignment with curriculum standards and collective participation. Our recommendation is to make these training programs available in periodic and regular basis and to include lab technicians in any future program. These programs should also be available for science teachers in primary and preparatory schools.

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