INNOVATIVE ONLINE EXPERIMENTS FOR STEM EDUCATION IN CHINA: DESIGN AND DEVELOPMENT AND EVALUATION OF STUDENTS’ LEARNING

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Abstract

Even though China has world in recent decades become the largest manufacturing country around the world and has the biggest number of university graduates in various STEM disciplines, yet secondary school students are often deprived of the opportunity to conduct science experiments in schools. This prevalent phenomenon occurs not only in those schools lacking of the necessary resources and facilities (especially in the rural regions) but also in those resource-rich schools in the eastern coastal regions due to the exam-oriented school education which largely omits the laboratory practices and hands-on activities. On the other hand, mobile phones, computers and Internet access are nowadays commonly available in most homes in China which plans to launch 5G in 2019. Hence, this paper reports some innovative and new online experiments which are specifically developed for the Chinese children and scheduled for implementation in a few secondary schools in the cities such as an experimental school in Shenzhen (a highly developed city at the southern coastal region of China and adjacent to Hong Kong), a middle school in Xinxiang of Henan province (an inland city located at the central region), two middle schools in the Benxi city of Liaoning province (northern region) and a key secondary high school in Ningbo of Zhejiang province (at Eastern coastal region), it was accepted as one of the provincial key secondary high schools.

Two new online experiments are being developed by separately by two master of education students as part of their research projects. The first one is on the exothermic crystallization from super saturated sodium acetate solutions and it aims to develop middle school students’ in-depth understanding of the peculiar crystallization process (the solution suddenly turns into crystals with huge release of heat energy). By observing the crystallization phenomenon and analyzing the corresponding temperature data, the students will find the connection between the crystallization and the energy involved. The students save the time of setting up the experiment and drawing the graph. The online experiment also reduces the wastage of the experimental materials which are reusable in our design.

The second set of online experiments is to investigate the effect of light on the rate of photosynthesis. In traditional laboratory practice, students may just set up the experimental and then observe the final results a few days later without any ideas on the details of the processes undergone. The specific plant of this experiment is Fittonia verschaffeltii which has three different colors, green, red and pink for students’ scientific investigation. Besides, students can select different colors of light (red, green, blue, white or a combination of them) to shine on the plants. The system will record the concentration of carbon dioxide and the light intensity automatically over a long period of time. Students need to think about their design of the scientific investigation activities before actually carrying out the experiments to verify or discard their original hypotheses.

In this conference, we will present the detailed design and development work of the abovementioned two experiments and findings on Chinese students’ performance, perception and attitudes towards online experiments. The education implications and long-term on students’ STEM education will also be discussed.

Keywords: Online experiments, China, STEM education, Science education.