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G8-OP-01**Using technology to enrich mathematics learning at school-based whole-class level**

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ABSTRACT:

Using technology to engage students in learning is becoming increasingly popular among educators. It not only promoted a more devolved and autonomous learning process, but also allowed learners to access multiple bodies of knowledge. However, the number of studies related to the integration of e-learning into the whole-class gifted education provision was very limited. From 2017, **Jockey Club "Giftedness Into Flourishing Talents" Project** (Project GIFT), organized by the **Program for the Gifted and Talented** at the Chinese University of Hong Kong and funded by The Hong Kong Jockey Club Charities Trust, has collaborated with 20 primary and secondary schools and provided teachers with professional support for implementing school-based talent development and gifted education for their students. Project GIFT also cooperated with these schools to conduct evidence-based research and evaluation to examine the implementation and effectiveness of various forms of school-based gifted education practices. With this opportunity, Project GIFT and Hong Kong and Macau Lutheran Church Primary School, one of the Project Schools, devoted efforts to investigate the effectiveness of integrating elements of e-learning and whole-class gifted enrichment of school-based talent development and gifted education into primary mathematics education.

A total of 123 Grade 4 students in four classes participated in the study and learnt the concept of Tessellation. Four e-platforms were used to facilitate teaching and learning: 1) Onenote: to facilitate students' sharing with one another during pre-course preparation and in-class interaction; 2) Nearpod: with teaching & learning materials conducive to talent development developed by school teachers; 3) Wikipedia: for students' self-learning and reading; and 4) Geogebra: with self-developed teaching & learning materials to facilitate students' hands-on investigative learning. The above technology was used in differentiated curriculum, providing learning materials for high ability/gifted students to extend their learning beyond the regular classroom and school curriculum.

Before the lesson, students were divided into five groups and were required to search for the pattern and objects related to the concept of Tessellation and upload their findings to Onenote so that other classmates and teachers could share, check and give feedback. During the lesson, students were first guided to appreciate a collection of graphics and objects relevant to the notion of Tessellation, and to express their feedback to one another. The teacher then made use of their findings to further illustrate Tessellation through interactive questioning & answering, helping students to better master the concept. As assigned by the teacher, students formed groups of two to study the attributes of Tessellation by reading the related information from Wikipedia and answering teacher's questions. Investigative learning activities were organized for students to construct their knowledge. With the use of Geogebra, students were able to test and find out the shapes that tessellated. They could manipulate different patterns to test their predictions. In the process, students observed, explored and reached their own conclusions through reasoning. Finally, students presented their findings using Nearpod. At the same time, teachers provided comments and feedbacks to students' presentations, and attended to other issues. Differentiated assignments as consolidation task were assigned to students in the light of their diverse abilities. Students were allowed to choose one of the four topics listed below for extended self-

learning using interactive software: 1) to examine which shape could tessellate with graphical illustrations; 2) to demonstrate with graphical illustrations which two shapes could tessellate; 3) to determine whether all triangles can tessellate and provide proof or demonstration with graphical presentation; and 4) to create polygons that tessellate. Differentiated assessment worksheets were designed to facilitate student learning while gauging the effectiveness of e-learning. Interviews with students were also conducted to better understand their learning experience.

Findings from analysis of students' work and the interviews suggested that the use of e-platforms was helpful for students' self-learning, particularly to the highly-able/gifted. Group work in pre-class preparation and in-class collaboration enhanced students' interpersonal and cooperative skills. It was also found that sharing and displaying students' learning outcomes through e-platform was an effective, and intellectually stimulating way to promote cooperation and collaboration. In particular, Onenote helped overcome the physical constraints so mutual exchanges of ideas among students and the teacher could take place spontaneously and conveniently outside school and class, regardless of time and space. To facilitate self-learning during pre-course preparation, students were encouraged to refer to knowledge-based websites such as Wikipedia. To flexibly address their diverse interest during investigative learning, Geogebra with materials developed by teachers was used to facilitate easy and convenient exchanges of ideas, outperforming traditional paper-cut collage methods. Collectively, such arrangements met the learning needs of students with varied abilities and interests and helped make progress in their capacity for high-order thinking and creativity substantially.

This study provided evidence of using technology to enrich students' learning of mathematics to a greater depth in the whole-class level. The use of e-platforms and the Internet allowed students to learn based on their ability and interests. With the use of these platforms, sharing among students became much easier and effective. Teacher's feedbacks and guidance for extended learning can also be delivered to students immediately. However, it is noteworthy of teacher's reflection that the efficiency of this kind of e-learning partly depends on teacher's knowledge and ability to apply the technology in the desired context, the in pre-course preparation as well as in-class interactions and group work.

KEYWORDS:

E-learning; Hong Kong; Jockey Club "Giftedness Into Flourishing Talents" Project; mathematics education; school-based gifted education; whole-class enrichment



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