Computational Thinking in Junior High School

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In the Philippines, there are opportunities for students' computational thinking to be developed. An example is through the Information and Communications Technology (ICT), one of the four areas covered under the subject Technology and Livelihood Education in the curriculum in which for grades 7 and 8, students take up exploratory subjects while for grades 9 to 12, they have specialization subjects such as computer programming (Java, Oracle Database). The ICT subject offerings depend on the capability of the schools. Another is through school initiatives such as the organization of a Robotics Club in a certain science high school where interested students learn robot programming and as a result, they participate in robotics competitions.

In order to intentionally develop computational thinking among students, it is important to have a clear understanding of what it is and what its elements are. According to computer scientist Jeanette Wing[1] (in Araya et al 2019), "computational thinking is the thought processes involved in formulating a problem and expressing its solution(s) in such a way that a computer – human or machine – can effectively carry it out." In short, computational thinking is thinking like a computer scientist. Since it involves problem solving and the goal of the Philippine K to 12 mathematics curriculum is the development of learners' problem solving and critical thinking skills, developing learners' computational thinking supports the attainment of this goal. Moreover, teaching/learning of mathematics can be a rich context for developing computational thinking.

How this can be done requires familiarization with the elements of computational thinking which according to Grover and Pea[2] (2017) consist of concepts and practices. If teachers are aware of and fully understand these, they can systematically and deliberately develop students' computational thinking through lessons that naturally lend themselves to this development. The concepts include logic and logical thinking, algorithms and algorithmic thinking, patterns and pattern recognition, abstraction and generalization, and evaluation and automation. The practices include problem decomposition, creating computational artifacts, testing and debugging, iterative refinement (incremental development), evaluation and automation, and collaboration and creativity. Mathematical content (such as those in algebra, geometry, and statistics to name a few), and mathematical processes (such as in problem solving, reasoning, communication, representation, and connection) that exemplify these concepts and practices abound.

[1] Araya, R., Isoda, M., Gonzalez, O, and Inprasitha, M. (2019). Discussion Paper: A Framework for Computational Thinking for the Transition to a Super Smart Society. Presented at the 2019 APEC-Tsukuba International Conference in Tokyo, Japan.

[2] Grover, S. and Pea, R. (2017). Computational Thinking: A Competency whose Time Has Come. https://www.researchgate.net/publication/322104135