

Chapter 10

Behavioral Innovations in Computer Science and Computational Thinking in P-16 Education

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ABSTRACT

This chapter is based on the behavioral innovations of students and teachers in P-16 education with regards to computer science (CS) and computational thinking (CT). Beyond racial and gender bias, the behavior of students and teachers towards new ideas has been noted to have a substantial effect on accessing of CS and CT. When students and teachers are presented with new ideas, a series of complex mental processes are always carried out in order to reinforce their acceptance or disregard of such ideas. With deep insights into concepts such as technological pedagogical content knowledge framework (TPACK), computer-mediated classroom, computer-oriented teachers, and computer-oriented students, this chapter will further anticipate the equity of computer science in P-16 education.

INTRODUCTION

Education has continued to thrive in the human society over the course of time. It has been regarded as a priceless asset which serves a unique beneficial purpose to both individuals and societies. A number of policies and prolific measures have been continuously established in the quest of enhancing and improving educational standards. Aggarwal (1996) posit that the improvements in educational standards have a major part to play in the process of teaching and learning. Over the years, the improvement in educational standards has been essentially based on the adoption of Information Communication Tech-

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nologies (ICTs). According to Yamamoto and Yamaguchi (2016), the use of computers in the educational sphere has exponentially enhanced the process of accessing, organizing and sharing of academic contents between teachers and students. As a result, both teachers and students are gradually acknowledging the essence of computer science (CS) in their curriculum. Naidu (2016) purport that the process of teaching and learning can be further expedited with the aid of CS. More so, CS has the capability of enabling students with computational thinking (CT), such that students are enabled to think independently and explore beyond their areas of specialization. Makewa, Magaletta and Role (2017) assert that with the aid of CT, students will be equipped with the ability to expand their scope of learning beyond the classroom. Furthermore, students will be motivated to be more engaged in collaborative research, thus accelerating the rate at which they solve problems collectively. According to Basri, Alandejani and Almadani (2018), research and development in pedagogical practices with the aid of CS has proven to be effective in all facet and purview of both teachers and students. However, Mugo, Njagi, Chemwei and Motanya (2017) opine that the adoption of CS and CT usually involves some behavioral innovations which deals with the ability of teachers and students to adjust their cognitive schema into accommodating new ideas, knowledge and patterns in their various operations in the classroom. The process of adopting CS and CT requires teachers and students to move from the tradition mode of operation into more advanced mode of operation. Thus, teachers and students would be necessitated to pass through some developmental stages in order to reinforce their acceptance or disregard of CS and CT. Once they have passed through these developmental stages, they would be equipped with the ability to naturally discover their inherent capabilities of adopting CS and CT in their various operations in the academic sphere.

COMPUTER SCIENCE

The human race has witnessed more technological advancements in the past 50 years than in the entire 10,000 years of human history. Over the years, computers have served major purposes of bridging communication gaps and increasing access to information. Computers are increasingly becoming prevalent in the contemporary society, in which numerous global advancements with regards to the immense capabilities of computers have gained significant recognitions in several discipline and field of specialization. Bourke (2018) assert that computers have the capability of providing an unprecedented quality of multi-dimensional information and knowledge exploitation which will further enable teachers and students with absolute unrestricted access to information resources. Thus, it is imperative that teachers and students acknowledge the essentiality of computer science (CS) in their curriculum.

According to Denning (1988), CS is a discipline that involves the understanding and design of computers and computational processes. In its most general form, CS is concerned with the understanding of information transfer and transformation. CS ranges from theoretical studies of algorithms to practical problems of implementation in terms of computational hardware and software. Jones and Stephenson (2006) purport that CS is the study of computers and their operations, including their principles, their hardware and software, their applications and their impact on society. Rapaport (2017) in his own view perceives CS to be the systematic study of the feasibility, structure, expression and algorithms that underlie the acquisition, representation, processing and storage of information. Victoria (2019) assert that CS is the systematic study of algorithmic processes that describes and transform information into theory, analysis, design, efficiency, implementation and application.

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