Chapter 10
Computational Thinking and Participatory Teaching as Pathways to Personalized Learning

Eric Hamilton
Pepperdine University, USA

Aileen M. Owens
South Fayette Township School District, USA

ABSTRACT

This chapter discusses personalized learning by briefly outlining historical trends and deficiencies associated with what can be referred to as production style or assembly line approaches to education before contrasting personalized learning definitions. The chapter extends those definitions. It discusses participatory teaching as a personalized learning strategy by which students take on roles of co-teaching, co-designing lessons, or co-designing curriculum with adult teachers. One participatory teaching example involves an international group of students who help one another learn science and mathematics through shared video production. This example involves a US school involved in a larger districtwide effort comprehensively designed to involve each student. Organized around computational thinking, multidisciplinary innovation, arts integration, and collaborative problem-solving, the district may be viewed as a case study in implementing personalized learning. The chapter furnishes several examples that blend participatory teaching and computational thinking.

INTRODUCTION

The technological revolution has opened important new avenues for re-thinking and improving educational practice (Collins & Halverson, 2009). In this chapter, we explore the convergence of three such avenues. They include the *computational thinking* that is at the heart of the technological revolution; the opportunity that new technological tools provide for students to create and share content, and thus

DOI: 10.4018/978-1-5225-3940-7.ch010

to assume teaching roles (referred to in this chapter as *participatory teaching*) more sophisticated than has been possible in the past; and ways that computational thinking and these new teaching roles can make education more humane and tailored for students, enabling more routinely *personalized learning* across systems.

The chapter provides and extends current definitions of personalized learning, but first outlines historical trends and deficiencies associated with what can be referred to as earlier factory or assembly line approaches prevalent in education. The chapter then defines and discusses participatory teaching as one approach to personalized learning, an approach by which students take on roles of co-teaching, co-designing lessons, or co-designing and co-managing the curriculum with adult teachers. One example of participatory teaching involves an international network of students who help one another learn science and mathematics through collaborating on the production of media artifacts, such as videos, digital games, and robot designs. Participants from two sites in Kenya joined students from a school in South Fayette, Pennsylvania, one the state's highest achieving districts. Experience in a "global meetup" videoconferencing session is used to introduce and illustrate a larger systemwide effort in South Fayette, comprehensively designed by the district to enable each of its students to take a unique educational path. Organized around computational thinking, multidisciplinary innovation, arts integration, and collaborative problem-solving, the district's initiative may be viewed as a case study in implementing personalized learning. Student experiences in the initiative span a rich mixture of both digital and non-digital curricula. The chapter furnishes several examples from the initiative that blend participatory teaching and computational thinking as approaches to personalized learning.

This chapter maintains a premise that the formal K12 schooling traditions and practices of Western society since the nineteenth century have resulted simultaneously both in unprecedented success and in dismal failure. Factory production systems, commonly adopting variations of the workflow theories of turn-of-the-twentieth century engineer Frederick Taylor (Waring, 2016), characterized the emergence of western economies in the 20th century. (For purposes of this discussion, we refer to *production systems,* as they are exemplified in assembly line manufacturing, in contrast to the term as it is used in cognitive psychology or cognitive tutoring contexts.) The factory assembly line and Taylor's workflow theories may have accelerated economic growth (perhaps best known through the advent of the automobile industry), but as models mirrored in the development of twentieth century educational practice, they proved woefully inadequate as countless reports, beginning with *A Nation at Risk* (Goldberg & Harvey, 1983), document. As a production system that fosters and rewards certain types of dispositions and competencies in acquiring academic knowledge, formal schooling fosters and rewards certain types of student dispositions and competencies in acquiring academic knowledge; it has served to nurture a sizable fraction of students in it. Yet formal schooling typically stratifies its students (Raudenbush & Eschmann 2015), leaving out or poorly serving those whose dispositions and competencies do not quite align with classroom structures and conventions.

The costs for such stratification and filtering out of students are incalculably high, both in terms of what the system implicitly treats as an "error term" – failed schooling for those who do not quite fit into the production system or who are not served by it, and usually only qualified success for those that do fit. Awareness of the economic, social and moral consequences of failed education in the US, especially since *A Nation at Risk's* 1983 publication and countless studies and US policy initiatives since, has ostensibly climbed dramatically. Yet the overall performance of US education remains stubbornly mediocre (Lee, 2002; National Assessment of Educational Progress (NAEP), 2015).