Chapter 5

Implementation of a Personalized Online Learning System Towards Creating Hybrid Learning and Teaching in Chemistry Classes

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ABSTRACT

Recent technological advances have allowed for the use of computerized and online systems to achieve personalized student-centered learning and teaching in the classroom. One such prominent example is the PeTeL system (Personalized Teaching and Learning), developed by the Science Teaching Department of the Weizmann Institute of Science. In the present article, we describe the initial stages of the system’s first implementation in chemistry classes, and show how it facilitates the hybridization of learning by combining online materials and offline activities. The research focuses on different hybridization models applied by chemistry teachers in their teaching, which demonstrate the efficacy of the PeTeL system in hybrid learning. Four case studies of a teaching unit dealing with melting points are discussed, and the considerations of two chemistry teachers using the system who adjust their teaching sequence to the...
personalized needs of their students in four different classes are presented. The results underscore the importance of providing teachers with the capacity and tools to personalize their teaching paths in a way that better supports hybrid teaching matching their pedagogical considerations. A new approach to the construct of hybrid teaching is proposed, considering it as a set of axes instead of one continuum.

INTRODUCTION

Train up a child in the way he should go, and even when he is old, he will not depart from it. –Proverbs 22, 6

In the past few years, the personalization of teaching and learning has been a key feature of education research (Bulger, 2016; Groff, 2017; Tomlinson, 2008). In their wish to tailor the learning experience to the students’ needs (Friend, Patrick, Schneider, & Vander Ark, 2017), researchers, teachers, and curriculum planners have been searching for ways to improve teaching. The incorporation of technology as a learning tool and environment (Baumann & Melle, 2019; Huang, Spector, & Yang, 2019; Molnar, 2017; Kieserling & Melle, 2019) was found to support such personalization. Hybrid teaching methods, which enable teachers to integrate technology into their classroom and benefit from its advantages, could possibly be the key to attaining this purpose (Caulfield, 2011).

The present discussion addresses the personalization of teaching and ways to facilitate and support this task in today’s hybrid environments. We then present an adaptive system for the personalization of learning and teaching, which puts our research in context.

BACKGROUND

Personalized Learning (PL) and Differentiated Instruction (DI)

Tomlinson (2017) addresses the dichotomy between the “one-size-fits-all instruction” in class, and the personalized class, where “students will be able to study what they want to study, whenever they want to study it, and wherever they choose” (p. 1). Although there are numerous definitions for PL, there is common agreement about a number of principles related to it (Groff, 2017): personalized learning centers on the learner’s needs and learning style, which may change across time and in different settings. The learning principles and facilities must therefore be responsive and change accordingly. To complement PL, Tomlinson (2014) outlines key DI characteristics that allow a teacher to create a learning environment where every student can learn according to her or his needs and abilities, across different contexts. Easa and Blonder (2019) developed a model for DI design and evaluation based on Tomlinson’s work (2008; 2014; 2017), where they propose guidelines for planning and assessing DI teaching units, including ways to diversify teaching based on content, process, product and venue. We focus here on three of these elements: (1) the learning environment, actively supporting learners and learning. By acknowledging the difference between students, the learning environment supports the learning needs of different students. It assists in advancing the learning process according to each student’s ability, offering a space where success and failure are merely stages in the learning process, and the teacher is always available for support. (2) The teacher actively attends to students’ differences, playing to their strengths by apply-
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