Chapter 11
Caught Short During COVID-19: Transferring Lessons Learned to the Science Classroom

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ABSTRACT

With the sudden shift to emergency remote teaching at the start of the COVID-19 pandemic, some educators were more prepared than others having previously utilized digital tools and practices in their classroom. These educators may be considered early adopters, who research has shown tend to be more prevalent among science educators due to the fact that the science and engineering practices often incorporate digital tools as part of the sense-making process. Understanding the crossover between the science and engineering practices, sense-making, and use of digital tools, the author puts forth key lessons learned that should not be abandoned with the return to the classroom but rather transferred to and utilized within a blended learning environment which should become standard for science education.

INTRODUCTION

The shift to blended and eventually remote online instruction at the onset of a pandemic was swift. The message came in the form of an administrative email and with the CDC's announcement to distance socially, nearly every basic and higher educational entity moved to a virtual, remote, or online format with the flip of a switch. Moving to one of these formats undoubtedly sent education and educators into uncharted territory, which created new dilemmas and many unanswered questions. One of these questions that science educators focused on was *how do we engage students with online lessons and digital tools that create interaction and assist them in sense-making?*

Educators recognize that face-to-face instruction provides certain benefits that meet various instructional, social, and developmental needs beyond the curriculum. It also needs to be recognized that the lessons learned during the COVID-19 pandemic can be transitioned to the blended learning environment. As science educators, we realize the importance of providing students with the opportunity to engage

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in investigations conducted in person; we recognize the level of increased discourse that occurs when students interact synchronously. We recognize the importance of the social interaction that contributes to sense-making. However, we should also acknowledge that we are fortunate in some respects that technology is often a part of those investigations, discourse, and sense-making. All science educators may have a new appreciation that science lends itself to engaging students anywhere and anyplace, whether online or face-to-face.

This chapter examines what those lessons learned are and what are instructional best practices which can be transferred and incorporated into the blended science classroom environment.

SCIENCE INSTRUCTION

It needs to be acknowledged that the manner in which the move to remote or online learning occurred was not ideal, welcomed, or purposefully done from an educational perspective. It happened during a crisis. It created challenges and difficulties. However, there is no doubt that the shift demonstrated the resilience of educators who became resourceful as they transitioned their instruction and student learning. For example, one of the most challenging areas within science education during this shift was having students engage in actual laboratory investigations that had been recognized many years ago (Kassner, 2013). More current research indicates K-8 science teachers struggled to incorporate a phenomenon into remote lessons (Sarna et al., 2020).

Additionally, there has been a growing consensus since the start of fully remote teaching that it wasn't necessarily consistent with any of the prior approaches, whether instruction was blended, online, or hybrid. Rather, the move has been dubbed "emergency remote teaching" (Bozkurt & Sharma, 2020; Carrillo & Flores, 2020; Quezada et al., 2020), which created some obstacles that would not usually be present when an informed decision and planned move to blended or online learning was decided upon (Carrillo & Flores, 2020). Emergency remote teaching is defined by Hodges et al. (2020, para 14) as a "temporary shift of instructional delivery to an alternative delivery model due to crisis circumstances." As with any approach to instruction, it is necessary to recognize and acknowledge the limitations that are paired with the benefits.

Science Education – Pre-Pandemic

Throughout the last half-century, science education has had many different shifts in the approach to learning including everything from the "back to the basics" movement in the 1980s (Nelson, 1999) to inquiry-based instruction (National Research Council, 1996) at the start of the standards movement to the current approach of utilizing three-dimensional instruction.

Throughout all of these approaches, science educators have historically utilized a variety of different instructional strategies and tools in the classroom. Broadly speaking, example instructional strategies that have been utilized in the science classroom include the 5E model (Bybee, 1997; Bybee & Landes, 1988), problem or project-based learning, case studies, inquiry-based learning, laboratory experiments, and even the use of lectures among others. Although the use of lecture alone within the sciences is ineffective in promoting meaningful learning that provides transfer of the experiences (Freeman, et al. 2014). Additionally, science educators have utilized components of blended learning such as flipped learning and station rotations even if they have not adopted blended learning.