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Introduction

In a world where information is at one's fingertips, it is more important than ever that society keeps education up to speed with all the technological advancements being made. Educational systems must evolve for the benefit of the next generations to meet the needs of a STEM-focused world. Students use technology both as a means of learning as well as a tool and resource in projects. The goal of this paper is to compare how the techniques and the degree to which technology is used in education vary based on the teacher's individual style and based on whether it is a formal or informal learning setting.

Literature Review

Not everyone has the same attitudes or aptitude with technology usage in education, but its use can be very effective for learning. Research studies have consistently found that "the usage of educational technology motivates students; gains their attention; … concretizes abstract concepts; simplifies complicated concepts; facilitates understanding by presenting information in a concrete manner; and illustrates the relationships between concepts (Karamustafaoğlu, 2015, p. 2). Turkish researchers investigated what science teachers' attitudes were towards technology usage and tested whether there was a relationship between their attitudes and their age, gender, experience, or teaching styles.

Karamustafaoğlu (2015) discovered that while there was no statistically significant difference in technology attitudes of teachers in terms of gender, age and experience was a good indicator of what the teacher's attitude would be. Furthermore, they found that there was a "positive correlation between the attitudes towards technology" and five teaching styles of "expert, formal authority, personal model, facilitator and delegator" (Karamustafaoğlu, 2015, p. 9). They recommended that teachers should be given the necessary access and training for using technology in the classroom, particularly computers, projectors, and video (Karamustafaoğlu, 2015, p. 6).

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Another group of Turkish researchers investigated the different ways that science teachers use technology in the classroom. Savasci (2014) found that the predominant use of technology was through PowerPoint slides, followed by textbooks and blackboards (p. 2). Videos and animations were least likely to be used compared to other technologies, despite animations having great potential to help students understand difficult concepts such as the atomic and molecule level in chemistry (Savasci, 2014, p. 2). They conclude that there is a need for teacher education programs to develop their knowledge and attitudes about information and communication technologies (Savasci, 2014, p. 4).

Even when science teachers in the US have technology available to them in the classroom, they often aren't using it according to what the state and national standards recommend (Hakverdi-Can, 2012). Researchers studied various ways in which science teachers and their students use technology, specifically computers in the classroom and found that the level of student use was highly correlated with the level of teacher use (Hakverdi-Can, 2012, p. 14). They also compared technology use based on classroom management styles through a teacher's "pupil control ideology." Pupil control ideology was how the teacher viewed the roles of themselves and the students, ranging from the "custodial" ideology based in a traditional controlled environment, to the "humanistic" ideology based in a cooperative, experiential learning environment (Hakverdi-Can, 2012, p. 3). Although computer self-efficacy had a stronger positive association than classroom management style with student technology use, both were related to the teacher's use (Hakverdi-Can, 2012, p. 14).

Methodology

The degree to which students use technology themselves in the classroom may also vary based on the learning setting that they are in. The author observed four different learning environments and compared how often students were using technology themselves. All students were enrolled at Buffalo Public School 59 (PS 59), at which the author observed Ms. LaRusch's eighth grade Living Environment class and Mrs. Finn's Arbor Club, Solar Car Club, and 4-H Marine Engineering after school programs (Brown, 2016). The author additionally collaborated in organizing a field trip for PS 59 fifth graders that featured hands-on engineering activities (Brown 2016).

Results

Although Ms. LaRusch's class was closer to a traditional classroom setting compared to the other three learning environments, her class still involved a lot of student participation with limited student use of technology. "The textbook that the seventh and eighth graders used was focused on hands-on activities and labs, so each lesson was usually taught in the form of a lab instead of a lecture" (Brown, 2016, p. 2). In some classes however, the extent of technology usage was vocabulary words and definitions being projected onto the smartboard for the students

to silently copy into their notes (Brown, 2016, p. 6). Based on the author's observations, Ms. LaRusch's classroom management style may align with the formal authority style while her pupil control ideology may be slightly custodial (Brown, 2016). Besides lab equipment such as microscopes, student use of technology was very limited compared to the other learning environments.

Mrs. Finn's Arbor Club worked on an after school project that a group of sixth graders presented at the Interdisciplinary Science and Engineering Partnership (ISEP) Science Summit (Brown, 2016). The project evolved from them mapping trees in a nearby park to observing the park's wildlife and investigating the wildlife's use of habitats in the park (Brown, 2016, p. 1). With the assistance of Mrs. Finn, the sixth graders used ArcGIS and Google Earth to map the trees in the park and also independently used the internet to research information about bird species (Brown, 2016, p. 5). The students' usage of technology in their project was likely related to Mrs. Finn's self-efficacy in using mapping technology, an association supported by the independent findings of Hakverdi-Can and Thomas M. Dana (2012).

In Mrs. Finn's other after school programs also involved a high level of student technology use. In the Solar Car Club, students worked in teams to build toy cars that would be powered with a small solar panel (Brown, 2016, p. 8). The Buffalo Science Museum gave them access to a workshop room that had engineering tools and equipment for them to use (Brown, 2016, p. 8). Mrs. Finn and the museum worker served primarily as guides and facilitators for the students to use equipment such as hot glue guns, Styrofoam cutters, and 3D printers to build their cars (Brown, 2016, p. 9). In both the Solar Car Club as well as the 4-H Marine Engineering project, the teachers gave a demo with safety instructions on using a soldering iron before the students all got a chance to solder parts of their project themselves (Brown, 2016, p. 10). Mrs. Finn's teaching style likely aligns with the facilitator style and her pupil control ideology is likely humanistic.

The PS 59 fifth grade field trip to the University at Buffalo presented an opportunity for the students to engage in hands-on informal learning. The fifth graders were split into five groups of six and rotated through five different hands-on engineering activities (Brown, 2016, p. 12). The author collaborated with Anna Smith, who organized the field trip, by leading an activity to introduce the students to computer science and spark their interest in the field (Brown, 2016, p. 12). The fifth graders were given access to an online coding tutorial program called Scratch which "used a simple, user-friendly graphical user interface that used drag-and-drop to build code as if [individual code lines] were puzzle pieces" (Brown, 2016, p. 13). The activity began with a short discussion "about what computers are and how a computer knows what to do," during which the students learned that computers require very specific instructions (Brown,

2016, p. 13). When they used Scratch themselves, they understood how if the computer wasn't doing what they wanted, then they did not give the computer instructions that were clear enough (Brown, 2016, p. 13).

Discussion

The field trip environment gave the students an opportunity for informal learning or "informal science education" in which they "experience excitement, interest, and motivation to learn" about computer science (Sacco, 2014, p. 1). The author and other volunteers acted as facilitators for the students by helping out when they weren't sure why their code wasn't working. Although they weren't formal instructors, their pupil control ideology was actually relatively custodial due to the activity's controlled environment within the field trip.

Comparing each case, the usage of technology varied based on the educational and learning setting. Ms. LaRusch's classroom with approximately twenty-five students had a limited technology use while Mrs. Finn's after school programs ranging from six to ten students had a high level of technology use. Even though Mrs. Finn's after school programs sometimes physically took place in part within classrooms, they may still be qualified as an informal learning environment. Ms. LaRusch's class was more in line with formal science learning. While the difference between those two cases may be explained by teacher style and pupil control ideology, the third case of the computer science field trip activity also had high technology usage despite a relatively custodial pupil control environment.

Conclusions

The variations of technology usage within the author's observations may be attributed in part to the learning setting, particularly when the setting is an environment for informal learning. Based on the observations, informal learning settings are more likely than formal learning settings to have students engage with technology and equipment themselves. While formal learning is not necessarily bad, there may be more effective opportunities through informal settings for students to learn more about their increasingly complex world and spark an interest that they may pursue.

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