How does access to modern technologies affect potential pedagogical and learner outcomes?

Abstract

This study is a culmination of an internship with the Flint Hills Discovery Center in which I was charged with the task of implementing programs to use technologies the education department had at their disposal. Throughout this internship I was able to observe several ways in which the use of these technologies exponentially increased the number of pedagogical avenues through which educators could reach their students. With the advantages which these technologies create in mind, this paper argues that technologies such as those I worked with at the Discovery Center are essential to an effective modern education. The absence of such technologies, and the opportunities which they provide perpetuates current inequities in the education system which contribute to statistical gaps in performance such as those based on race and socioeconomic status.

Technology and Learner Outcomes

I learned through this project that having access to different technologies greatly increases the number of resources available to instructors in reaching their students. The most important of these technologies is individual devices such as iPads or laptops; the options made available by individual devices directly contribute to high levels of intrinsic motivation (Jenks & Jasso 2007) and the benefits of individual devices are even increasing as devices are more commonplace in the lives of students. Individual devices also allow for higher levels of student autonomy, and the diversification of methods of instruction and content.

The increased spread of pedagogical options made available through the use of individual devices allows teachers to catch the attention of their students in a whole new way. The use of Augmented Reality (AR) technologies, for example, provide a novel avenue of sensory stimulation to capture the attention of students and engage them in the classroom (Chiang, Yang, & Dwong 2014, Estapa, & Nadolny 2015). The increased levels of interest technologies such as these provide by catering to the individual student cannot be overlooked. In a 2012 study performed by a group of Dutch educators, a strong correlation was found between the stimulation of intrinsic motivation through the introduction of course work that both allows for student autonomy and provides basic scaffolding (Van Loon, Ros, & Martinis 2012). Additionally, the common availability of multimedia tools made possible by individual devices can be used to help introduce students to the practice of creating content as opposed to simply consuming it; the implications of content creation stretch from creating new ways to assess growth and to be used to establish pedagogies that are directly applicable to 21st century job markets.

The use of individual devices allows for educators to increase the volume of information they provide to students in addition to providing novel ways to present said information. Individual devices also allow for new pedagogical methods such as alternative methods of assessment and increased opportunities for collaborative learning. At the collegiate level the use of wiki pages, peer assessment software in which can be easily created and edited, has been tied to positive educational outcomes such as increased collaboration, increased ease of communication for shy or marginalized students, and increased accountability with her educational technology based projects both as methods of assessment and supplemental learning activities. The effectiveness of multimedia in achieving pedagogical goals has been well documented (Powers & Taylor 2010, Ivers & Baron 1998, Okloko & Ferretti 1998, Yuen-kwong 1998).

Technologies such as the y printer also allow for students to exercise autonomy, and cater to the factors contributing to motivation. Factors such as support for self-determination and the value attached to educational endeavors which have been tied to improved educational outcomes (Deci 1991) are equally encouraged by the use of y printer. By encouraging experimentation through allowing students to tweek their creations, y printers prompt critical thinking and problem solving skills.

Benefits Derived from Technology Integration Projects at the Flint Hills Discovery Center

Though the format of the educational process at the Discovery Center differs from that of the conventional classroom, the adaptation of programs I facilitated at the Discovery Center allowed me to examine the potential changes that technology enables an educators to adopt. My work specifically involved finding ways for five y 3D printers, 15 iPads, and a smartboard. I was given time to research the ways in which other facilities and school districts implemented the same technologies. The resources made available at Kansas State University helped me to learn the ideodynamics of the iPad in particular. I was especially lucky to have Cyndi Danner-Kuhn, an instructor specializing in pedagogical uses of technology as a reference in regards to actually teaching the programs needed to bring my plans to fruition; her educational technology based knowledge required to complete most of the tasks requiring technical savvy. The staff at the Discovery Center gave me the agency to pitch ideas to them on how I would use the technologies at hand, and if the idea received a positive reviews I would create or complete a small part of the project for them to see.

When deciding which technologies to focus on, I tried to assess the holistic benefits of the desired outcome in regards to number of students affected and the costs associated with implementing the programs. Due to budgetary restrictions, I attempted to maximize the effectiveness of the programs while minimizing the costs.

Disadvantages Incurred by Students Without Access

Unfortunately, these benefits are not shared equally across the public education system; the beneficial nature of these technologies creates a situation in which those students who have access to such technologies are given a more enriching education for the aforementioned reasons. Often, schools that fall under the low SES umbrella have limited funds to provide the necessary technologies. In the past, I have attended a school district that was not able to buy the necessary tools for the students who were in poverty. This inequality means that poor students do not profit from the necessary technology as their peers do. The gap between those who have access to these technologies and those who do not is widening, which may cause the future generations of students to be more disadvantaged. Just as inequality is perpetuated in the job market, similar inequities in the educational system perpetuate inequality at all levels of society.

In attempting to provide a fair and equitable education, actors in the education system must look at the severity of needs for different groupings of students. Individual devices make tools such as instructor created websites more effective as students can use these tools and archives of content to access classroom materials where ever they are. As previously discussed, the publication of course materials enable students who may in the classroom to stay in contact with the information essential to classroom success. This access is arguably more beneficial to lower SES students as these students are more likely to miss class, be tardy, or experience illnesses (Jensen 2008). Furthermore, it follows to reason that students who have fewer opportunities to access technologies at home are likely to be left behind in the field of digital literacy. To properly equip lower SES students for life in would heavily permeated by information flowing from digital sources, adding opportunities for lower SES students to experience aspects of the internet increases the likelihood that these students develop digital literacies. These students may benefit more from the scaffolding educators can provide in this regard than students who have been exposed to similar concepts at home.

The benefits offered by these technologies are relatively larger for lower SES districts, the costs are smaller. Aside from the inherent issue of budgetary problems between high and lower wealth districts, the additional costs of these technologies are relatively larger for lower SES districts. A few examples might include subsequent costs presented by maintaining the functionality of individual devices, which may be placed in a large number of classrooms and may need to be replaced frequently. Additionally, to maintain the benefits of these devices as they become outdated, educators will need to replace them. The issue of students in lower SES districts is limited by the availability of technological advances.

Relevant Terms:

SMART Board

Finding an educationally valuable use for the SMART board technology in an informal learning setting was a challenging task. As touchscreens do not hold novel value to children, who are inherently Pavlovian in their learning, the benefit of the SMART Board is the ability to interact with the students as a whole.

3D Printers

The main constraint on the use of 3D printers is tied to the functionality of the printers themselves. It take about half an hour to print an object the size of a chess piece. My favorite idea for the 3D printers was to have the Discovery Center buy STEM Kits which allowed students to design the shell of an object and then build the object around the kit materials. The Discovery Center did not have the funding for this project, but teachers can circumvent this issue through the use of grants and other funds which allow for them to work with individual devices as there are many free computer aided design (CAD) programs.

Costs Associated With Implementing Technologies Into Formal Public Education Systems

To consider universally spreading the benefits of these technologies, one must assess the multiplicity of costs that these technologies require. In addition to the costs associated with each individual devices, another cost can be added to the equation. In this process. It is pivotal educators are also taught in the use of new technologies to ensure a smooth technological transition. In particular, individual devices necessitate the presence of infrastructure such as strong wireless networks. Though these factors increase the cost of providing these tools, many costs can be offset by potential savings districts could enjoy by transitioning to a system of 3D printers, or converting traditional text books and large-scale printing (C. Danner-Kuhn, personal communication, October 19, 2017).

Implementation Projects:

- Quiver, an AR program that makes student drawings 3D
  - Aurora, a social media platform which allows instructors to overlay additional media on top of any image.
  - Kiikulu, a program for creating scavenger hunts which integrates with additional content.

Overall Advantages Presented:

- iPads allow for many learners to perform their own activities simultaneously.
- Gaming feature increases motivation and allows for the integration of additional content.
- Only costs associated are initial purchase of device and one-time purchase of app.

Individual Devices

Costs related to the use of individual devices will vary, but the cost will increase with the number of devices needed. The costs associated with maintaining these devices will vary, as well as the cost associated with maintaining the software required to run the devices. The cost associated with these devices will vary, but the cost will increase with the number of devices needed. The cost associated with maintaining these devices will vary, as well as the cost associated with maintaining the software required to run the devices.