

Although the classic design of a classroom setting has a recurring theme for many schools, technology has change rapidly in the past century. It has gotten to a point where it is difficult to give a lecture without technology including televisions, music speakers, cameras, and computers. Students from two centuries ago could be shocked to see what is expected from an average American student. Teachers and instructors have made attempts to integrate technology with their lectures and school activities. Since the late 1980's, the use of the Internet has increased and had become relevant to class lessons and research papers. Technology that used to be available to business persons, smart users, and the wealthy, are currently used by more than a million users in 2019. It has gotten to the point where is more convenient for employees such as Nurses to be familiar with computer coding in their workspaces (Flitton 2018). With challenging motivation to encourage children into the field of Science, Technology, Engineering and Math (STEM), there were questions if students are cognitively learning with the aid of technology. There were suggestions that children could be more motivated to learn in the field of STEM with technology and in some case video games. Some teachers are using technology to help make learning experiences more meaningful to children and students.

With the increase use of technology in recent years, some instructors lean more towards shared learning. With available technology, an instructor can be open to teach students with more than one learning method. Students could talk to the teacher in person as well as share documents and exchange material electronically. A method of teaching could be adapted to fulfill an instructor's needs as much as a student. However, some questioned if a student gets electronic feedback in a delay as opposed to getting feedback during a learning activity.

Different theories were brought up in regards to intelligent tutoring systems (ITSs), Anderson's development of adaptive control of thought (ACT), and adaptive hypermedia systems (AHSs), and affective artificial intelligence in education (AIED). ITSs and other systems were implemented through Web based systems to adapt goals, interest and knowledge for the learners. Some question if a launch like this was "Unintelligent" tutoring. But from another point of view, computers tools could play a role to support mindful process in students (Lowyck 2014).

There a consideration with direct facts and perception. Technology could be helpful for "knowing that" but does not always define "how" something works or "knowing how."

Lowyck's article, *Bridging learning theories and technology-enhanced environments: A critical appraisal of its history*, implied that many learning theories have limits, including theories involving technology (Lowyck 2014). Technology is rather useful for information exchange and delivery. Metacognition instructional knowledge and motivation is still necessary for tuning behaviors to learning for instructors and learners. Some classes in the past and some in the present, include the classic pencil and paper. Written during the early 1990's, a chapter from *Distributed cognitions Psychological and educational considerations*, mentions how children in elementary schools have to learn and memorize basic mathematics with papers and pencils (Pea 1993). When children grow up into teenagers, they could be granted permission (or deeply encouraged) to use

calculators to complete assignments. Some calculators (or maybe the models released a few years later), could artificially build and display information including graphs. Roy D. Pea's book was published when the Internet was very new and each school had a certain availability of computers. Even during that decade, the designers could be sensitive to how a design or presentation of something could affect someone's daily and "mental" activities (Pea 1993).

Technology could also help with student activities and understanding nature. The article, *Socio-technical dimensions of an outdoor mobile learning environment: a three-phase design-based research investigation*, had forest and nature investigations held with the help of instructors and mobile technology. Exploring the local arboretum and within the Penn State area, children in three different groups had the help of mobile technology to identify items in nature such as leaves, trees, needles, fruit elements and different types of bark (Land 2015).

Although some people immerse themselves in accessible mobile devices, they become useful for activities that require people to leave their homes. The activities featured in the article had children using mobile devices for museums and identifying items in the woods. Other museums could have a plaque with a description of an artifact. A high tech museum could have an interactive touch screen with a visual history lesson or audio; an even more advanced museum would have the information presented in multiple languages. There are recent mobile applications that do not cost money that are able to give information to visitors at a museum. However, some applications require available space for downloading the application and maybe give personal information or make a "user's agreement."

Google and select search engines could not only search words, but also make attempts to match images or try to identify what the image is. If the image were highly recognizable (or a famous image), the search engine would identify the image immediately (Google 2011). Exploring outside there is a lot to identify. Books can provide reasonable information but the photographs can be selective and it takes some time to search for a certain piece of information; it depends on the type of book, as well. Children or anyone learning simple letters, it is convenient to have a short list of information to give them information or identify items.

The information the children gathered seemed easier to understand when a grown up (i.e. mother, camp leader) helped clarify their findings, or reminded the children what they each have learned during the investigations. The chance for children to learn about nature while using mobile devices can be fun and meaningful when the activity is done with friends or family. Parents whom are available or not busy with conflicts (i.e. work) could spend time with their children both teaching and learning during explorations.

Technology may have to be adjusted to work appropriately with the learning group. In the article, *Integrating physical activity data technologies into elementary school classrooms*, the students in two fifth grade classes got involved in projects involving the integration of physical activities and technology with physical activity data (PAD) (Lee & Thomas 2011). Children with the guidance of their teachers (and researchers) had to keep track of walking and heart rates. With persuasion and motivation, the children observed and maintain observations made throughout the day the PAD. With a little bit at a time, other subjects were incorporated into the PAD activities. Schools lessons involving math, graphing, writing, and interviewing were also integrated

into the project. The project had participants used self-contained units that had to be worn on one's body to measure his or her heart rate, such as a specialized wristwatch or a device with a strap wrapped around the chest (Lee & Thomas 2011).

Although there are benefits of thinking of solutions without getting every answer from a computer, using some technology can be helpful. In the article, *Supports for deeper learning of inquiry-based ecosystem science in virtual environments-Comparing virtual and physical concept mapping*, two groups of children did research with fish and ecosystem.

Along with the environment, the students look over the observations in different categories, such as human factors, measurements, and organisms. The students overtime observe evidence to decide what could contribute to the "death" of fish in an environment. The way the students displayed their findings was similar to laying out notes and evidence to solve an ecologic mystery involving the death of a fish (Metcalf 2018).

The students mapped out the ecological relationships with the different parts of the environment and the nodes. When creating the names of the nodes, some students gave unique code-names, such as "sun" for "sun light," and "sun rays." The code names were probably quick to read and easy to understand over time. The students determined several contributions to the death to some of the fish. Some factors involved the fertilizer washed by rain into the pond, growth of algae affects the dissolved oxygen, the oxygen affecting the fish and bacteria, and so forth. Some of causes of the death to the fish were either connected, or one issue creating a new issue in a domino effect (Metcalf 2018).

There were concerns of learning in video game settings or cognitive thinking with video game in general. Although there are education games, usually the big commercial video games are popular and the most played (Squire 2006). The article, *Videogames as designed experience*, discussed cognitive thinking and players learning about a digital environment.

Popular video games with tons of actions and beautiful imagery attract a lot of customers. The escapism can sometimes get the players immersed after a long day (or one that just started). Some video games have a mission or story with characters, while others let players do what they want. The article mentions the *Grand Theft Auto* franchise, which featured a sandbox micro world for the players (Squire 2006). It could be an immersion to a retro city setting, but one could say that it was created with an *artistic license* or activities not everyone agrees with. Some actions can only be done in the game. Some actions in games can provoke cognitive learning. Mention in the article, "Viewtiful Joe" had task involving signs and player must understand the meaning of the sign to progress in the game (Squire 2006). The article also mentions knowledge through performance. Sandbox games allow the players to learn the protagonist ability by wandering around trying things out.

Decades ago there were television programs with specific educational goals such as *Bill Nye the Science Guy* (1993-1998), *Beakman's World* (1992-1998), *The Magic School Bus* (1994-1997), *Square One* (1987-1992), and *Science Court* (1997-2000). Television shows with a bit of humor, fun, and home activities sparked interest with the fans. *Where in the World is Carmen Sandiego?* computer games and various television adaptations provided educational facts to fans about geology and history while everyone is attempting to capture the title character.

Along with PBS television programs, video games from PBS can be very educational (including “free” available on the Internet). The Sesame Street games provide games with familiar characters involved in activities that encourage learning and a value of knowledge. Some of the PBS games were made child friendly so a child does get not too discourage when “losing” (PBS Kids 2019).

Role Playing Games (RPG) may require players to strategize in the moment of a battle. The player has to be careful with money spending in an RPG. *The King's Request: Physiology and Anatomy Revision Game* uses medical terms in the battle arena to help the player win battles. For example, the fighter has to attack the monster in the part of the brain that affects eyesight (Steam 2018).

Sometimes video games are used to help aid for medical training. In 2007, research has done with testing the benefits of young surgeons using a laparoscopic surgery controller with for the Wii U (or a similar video game system) to practice “key hole” surgery (Rosser 2007). Rosser’s article, *The impact of video games on training surgeons in the 21st century*, acknowledges the negative correlations with video games from critics. Although other outside factor can contribute, some have accused video games for lowering school grades, increasing aggressive emotions, or creating obesity (Rosser 2007). However, some there chances of increased performance of eye-hand coordination task and reaction time (Rosser 2007). There might be benefits for medical students to practice with video games in with surgical theme without cutting a real body or cadaver. In the past, it used to be “see one, do one, teach one” for medical students (Rosser 2007). But the human body can be irreplaceable and students need more than observational training to become surgeons. For many people, it is helpful to try a procedure with their own hands. Meticulous detail in recent video games can be helpful for delicate procedures such as surgery.

The casual fun game “Underground” for the Wii U was meant to be compatible with the Surgical Laparoscopic Controller (Nintendo Life 2015). *GoogleTechTalk* reveals a prototype of one Surgical Laparoscopic Controller, which is said to be smaller than the “Wii Fit” exercise device for the Wii (GoogleTechTalks 2012).

Rosser’s study included 18 women and 15 men with the goals to build skill sets that enable surgeons to function effectively in the video endoscopic surgical environment (Rosser 2007). Because of the three titles selected were from a list of 100 popular video games, *Super Monkey Ball 2*, *Star Wars Racer Revenge*, and *Silent Scope* shooting game as opposed to a surgery themed game (Rosser 2007). Perhaps puzzles, time management, and hidden object games must have not been as popular for game consoles at this time period. The Nintendo DS games with the touch screens were also pretty new after 2004, after removing the words “Game Boy” from the name and enlarging the audience (2019NDS-GEAR). Because it was the early 2000’s, there was a possibility that men had more experience playing video games than the women (Rosser 2007). Surgeons that not play games made errors in gaming sessions than those who play more frequently, cause mixed results (Rosser 2007). Along with the article was an “Invited Critique” from Dr. Myriam J. Curet, MD. Although the idea of video games improving laparoscopic skills sounded appealing, the study did not support much evidence that the method decreases death in patients. Dr. Curet felt that people with those surgeons with gaming experience reacted quick with the laparoscopic skills and surgeons with less experience should use other learning modalities to become competent laparoscopic surgeons (Rosser 2007).

Vietnamese Graduate School, Duy Tan University was in the process of creating a few bilingual applications to help medical students study the human body (Duy Tan University 2019). One application that could be visible on the laptop or a 3D projector, while the other application could be used on a touch device (possibly an iPad). In English or Vietnamese, the user could examine and point at the different organs and parts of each body system while learning the terms and functions. Between May and July of the year 2018, exchange students from SUNY Oswego examined the functionality and designed the applications. “Anatomy Now” application prototypes displayed the male body, but there were plans for a possible female prototype in the future. As of early 2019, the applications may not be widely available for purchase yet, and is most likely still under construction (AppAdvice 2019).

There were concerns still about the welfare of children using video games. *Pokémon GO* really grabbed a lot of attention for many reasons. The Augmented Reality (AR) where players can see fantasy pocket monsters appearing on their phone in a world that looks like theirs. There were news reports about the games, including infamous ones. There were reports and some criticism when users played the game near the resting place of Rosa Parks, Holocaust museums, and other notable places (TMZ 2016). Others may have joked that the new phone game was encouraging players to step outside and socialize. Games with online social activity like *World of Warcraft* (WoW) were usually played while sitting down or inside a building. Games like *Minecraft* could be played anywhere, but does not require most people to step outside. Players using *Pokémon GO* in general got interested with curiosity and some made social relationships when playing the game.

The video game franchise *Pokémon* for the Nintendo was celebrating its 20th anniversary around the year *Pokémon GO* became popular (Bulbapedia 2019). What started out as a simple Gameboy Color title about Ash the pocket monster trainer had grown into a bigger franchise with more characters and Pokémon monsters to catch. Like in the Nintendo games, players can train obtained creatures to become strong enough to win battles. The player can give each of their Pokémon names. Some Pokémon in the smart phone games can evolve into new and stronger fighters (RaZzi 2017).

In the article, *Collaborative Scientizing in Pokémon GO Online Communities*, Pokémon GO became a potential learning opportunity. For Jason Yip’s research and his team, activities with *Pokémon GO* involved mapping, egg hatching, and determining statistics (2017 Yip). Other activities can include monitoring catches and making strategies. Playing select video games could also encourage thinking or working with an environment to achieve goals (Squire 2006). The goal to catch them all has encouraged players to visit specified environments to catch as many Pokémon as they can (Yip 2017).

Being a game that one can play on a smart phone, players can interact with other players in a social community. Around 2016 some social media groups (i.e. Facebook, Reddit) had between 500 and 15,000 members (Yip 2017). Some social groups might have been a comfort space, an area for showing off, or a place to discover different locations for catching more Pokémon and achieving goals in their video game. Knowledge was shared with other players and some provided “nest” locations; about 293 nests were reported within Las Vegas, NV (Yip 2017).

In the article *Collaborative Scientizing in Pokémon GO Online Communities*, some testing and information was gathered. Participants got to play the game and attempted to see how people can engage in science practices. Participants traveled to variety of American cities for the research. There had been suggestions that select Pokémon could only be obtained in certain continents like Tauros in North America and Mr. Mime in Europe (Yip 2017). For Pokémon that laid eggs, there were players attempting to hatch region-locked Pokémon in other continents; some in the research played around with egg hatching (Yip 2017).

Aside from *Pokémon GO*, Google Pixel or other applications could provide AR where someone can see her real dog and an “animated” dog in her phone or touch screen device (Haru the Shiba Inu 2019). AR is a rather new source of Mixed Reality and has become easily accessible.

Pokémon GO provided opportunities for friends and families to step outside and engage in activities with the use of AR. The game could be bridging people into a “third space” to socialize, whether it is online interaction or friends with phones standing alongside each other. Social media tools (SM) recently seems to becoming more ubiquitous in children’s lives (Yip 2013; Zickuhr 2011).

Jason Yip has done other research with electronics, learning, and mobile technology. *ScienceKit* was a mobile application that supported learners’ engagement in scientific inquiry (Yip 2013). There were plans and concerns for child computer interaction and life-relevant learning (LRL). References were to Tamara Clegg’s previous research in regards to LRL and Kitchen Chemistry when integrating structure and flexibility in *ScienceKit*. The researchers wanted make the learning environment engaging to activities. They wanted the experience with learning to also be memorable.

Although some children are lightly interest in science, more people are motivated to use science and math when in it integrated with everyday life and easy to access activities. In 21st century article *Technology for promoting scientific practice and personal meaning in life-relevant learning*, science was almost accused of being a “boring” and abstract subject for children (Clegg 2012). Select staff members from University of Maryland (HCI Lab), Helene Gelderblom from University of South Africa, and Alex Kuhn from University of Michigan worked together in a new protect. They have developed Life-relevant Learning (LRL) environment to help learners understand the relevance that scientific thinking, processes, and experimentation can have in their lives (Clegg 2012). LRL environments are programs in which youth come in the STEM fields in the context of their interest and goals (Clegg 2012).

While working with LRL, children used tools and resources that they familiar. The staff in the project wanted to support science learning in children’s everyday lives. Mobile devices and social media technology was in reach of the most of children involved. *Zydeco* and *StoryKit* were used in the research with the children. *Zydeco* was originally effective for museums with links to exhibit websites.

StoryKit inspired storytelling to get users engaged into a subject and create another meaningful experience. Some children could also emphasize with an origin story of scientific research when learning about the famous scientists involved (Clegg 2012). Children can also relate to familiar stories. The researchers took some inspiration from articles and experiments involving cooking and Kitchen Chemistry (KC). Some of the activities were physically demanding activities

to get the children involved. Cooking activities can be fun for children that enjoy food and cooking, Water can boil and evaporate into air. Temperatures can be measured. Math and measures were required when the children gathered ingredients. They tasted ingredients like vinegar (and different reactions). The children could use *Zydeco* to help investigate what types of cookies and food that they were cooking. They also recorder sound and took pictures for electronic storybooks. If being a chef is a student's interest, it is helpful to realize the science portion of cooking. Scientific meanings could be found in experiences with Cooking Chemistry. There were at least two Kitchen Chemistry sessions (Clegg 2012).

During the research, children were encouraged to ask questions and reflect on their experiences. They also were asked to captured evidence and support their scientific claims in their experiments (Clegg 2012).

Technology can be helpful or distracting depending on the approach. In the past and present, there are different methods to teaching, usually with the aid of technology. Cognitive learning can happen in the classroom for educational purposes or it can be something used in home for stress relief and entertainment. Technology can provide information in research or help record an educational event. Whether exploring in the woods, checking one's heartrate, playing a game, or watching cookies bake in an oven, technology can help people when learn something productive and new when properly.

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