FDLA Journal

Volume 2 Article 4

1-1-2015

Peek Into the Future of Education Using Glass

Allison Berger
Florida Atlantic University, allison.berger.1@gmail.com

Victoria Brown
Florida Atlantic University, vbrown22@fau.edu

Peek Into the Future of Education Using Glass

Cover Page Footnote

Portions of this paper were presented at the Society of Informational Technology and Teacher Education 24th Annual International Conference in New Orleans and published in the 2013 proceedings for that conference.

Running head: PEEK INTO THE FUTURE WITH GLASS

PEEK INTO THE FUTURE OF EDUCATION USING GLASS

Alison Berger
Allison.berger.1@gmail.com
Florida Atlantic University

Victoria Brown
Vbrown22@fau.edu
Florida Atlantic University

Author Notes

Portions of this paper were presented at the Society of Informational Technology and Teacher Education 24th Annual International Conference in New Orleans and published in the 2013 proceedings for that conference.

Abstract

Glass, an everyday material found in every home and school, now finds new life as part of some of the most cutting-edge technology available. Through their invention of Gorilla Glass®, Corning Glass Works has introduced a new type of glass that is both stronger and thinner. The enhanced glass finds new life in interactive glass walls, collaborative worktables, and even augmented reality glasses. As glass technology moves from the stuff of futuristic fantasy into actuality, the possibilities for its use in the world of education are numerous.

Key words: Glass technology, future education, educational technology

Peek into the Future of Education Using Glass

Introduction

Glass is a material that has been in existence for thousands of years. In ancient Egypt and Mesopotamia, as early as approximately 2500 B.C., ancient glassmakers worked with the medium, exploring its decorative uses. Antonio Neri, an Italian priest and glassmaker, devoted much of his work in the 17th century to developing the clarity of glass, while throughout the Middle Ages, glassmakers attempted to create brightly colored glass to decorate the windows of churches. Later in the century, scientists such as Galileo and Kepler explored the telescopic properties of glass. In the late 1800s, scientists Abbe and Schott devoted their studies to improving the strength of glass by adding other elements to it. In the early twentieth century, after Corning had developed its durable borosilicate Nonex® glass for use in railroad lanterns, the company formulated Pyrex®, a lead-free borosilicate used in ovenware and laboratory equipment (Kurkjian & Prindle, 1998).

In 1952, Don Stookey, a chemist at Corning Glass Works, accidentally overheated a sample of glass by more than 300 degrees. Unbeknownst to Stookey, he had created the first synthetic glass-ceramic, known to the industry as Pyroceram, and to the public as Corningware®. The new material was significantly stronger than traditional glass, and thus the invention marked the beginning of Corning's work in research and development, an endeavor known as Project Muscle. The initiative's goal was to find other ways in which to fortify glass. After several failed attempts, the project was stalled in 1971. Almost three decades later, in 2007, Apple's Chief Executive Officer Steve Jobs asked Corning to develop a large quantity of a new type of glass that was revolutionary in both its thinness and its strength. Corning's Chief Executive Officer Wendell Weeks reformulated an existing automotive glass known as Chemcor® using a new fusion technique, and thus, Gorilla Glass® was born.

Gorilla Glass can be found in most handheld electronic devices today, and the potential for its use will only continue to grow. Corning has continued its research and development of the material, releasing both Gorilla Glass 2® and Willow Glass®, an ultra-thin, flexible glass (Gardiner, 2012). Right now the full potential of this glass has yet to be realized, due to the fact that the electronic components required for handheld devices must remain hidden behind the glass. What if the electronic components were to be made so small that entire devices were clear, enabling the user to seamlessly interact with the environment around them? With the invention of new types of glass, the possibilities for their use in the world of technology have only just begun to be explored.

Description of Technology

Glass technology combines a common material that has been around for millennia with the latest and greatest in technology. As consumers become increasingly dependent on their technology, from smartphones and tablets to televisions, they expect displays that are sharper and clearer with touch technology. However, at the same time, they want devices that are more durable in order to resist breaking. According to Corning (2012c), Gorilla Glass® revolutionizes any display-based technology, such as smartphones, tablets, televisions, personal computers, modern design, and touch panels. The new glass is thinner and lighter, but boasts an increased sensitivity to touch applications, while maintaining its durability. Gorilla Glass is created by immersing the glass in a hot salt solution of 400 degrees. Potassium ions replace the smaller sodium ions in the glass, which produces a more compressed outer layer, dramatically increasing the glass's strength (Corning 2012a). According to Corning's Gorilla Glass® products list (2012b), the glass can be found in more than 750 electronic devices.

As glass evolves, it has many implications in the world of technology. According to Elgan (2012) it "will affect nearly every category of consumer electronics, from smart watches to phones to tablets to desktop computers to smart homes and offices (p.1)." Google Glass is one such example. The glasses, which feature a small screen in front of one's eyes just as with regular glasses, connect the individual to the Internet via the cloud. Through the use of voice commands, the Google Glass wearer can access information, create pictures or videos, and utilize apps instantaneously. The concept is to produce an "augmented reality", in which an individual can see the projected image or information alongside what is actually there (Rivington, 2012). The idea of augmented reality is presented in Corning's video "A Day Made

of Glass 2" (2012d). Students on a virtual field trip interact with dinosaurs in what seems like real life; however, the image is actually projected through a glass tablet. Google glasses produce a similar effect using wearable glass technology.

Microsoft (2011) has their version of future uses for glass as well. In their video "Productivity Future Vision", smart glass is used for everything from monitor displays to coffee cups to newspapers. In Microsoft's version of the future, augmented reality takes the form of car windows and tablets. Glass tables become large-scale tablets capable of displaying everything from graphs in a business meeting to recipes in a home kitchen, while the glass front of a refrigerator illustrates what can be found inside. Microsoft's version of a smartphone appears to be a thin slice of glass similar to a credit card. With it, individuals seamlessly send messages to other glass surfaces either in front of them or miles away. The world shrinks as videoconferencing via sheets of intelligent glass makes the participants appear to be in front of each other.

While Microsoft calls this a future vision, Elgan (2011) asserts that such technology is not far off. He claims that the displays depicted in the videos are more sophisticated versions of Microsoft Surface tables, already in existence. The gestures shown in the video are extensions of the Microsoft Kinect technology that can be found in many homes today. Elgan (2011) claims, "although breathtaking to look at and consider, everything in Microsoft's videos are fairly conservative predictions based on existing products or technology actively being developed" (p.2).

In addition to Gorilla Glass®, Corning is also developing an antimicrobial glass for medical uses. In "A Day Made of Glass 2: Unpacked (Corning 2012e)", two doctors videoconference and collaborate about a patient via a large glass wall. According to Corning CEO Wendell Weeks, the glass is an attempt to combat germs in a hospital environment. It is reported to kill 99% of viruses and bacteria, and its life could be many years long. While the glass's use is depicted in a hospital, Weeks claims there are applications beyond the medical field as well (Zick, 2012). For example, antibacterial glass would be useful in a classroom setting where children share glass surfaces, thereby reducing the risk of sharing germs with their classmates.

At the Massachusetts Institute of Technology (MIT), researchers have been working to combat the issue of glare that affects glass's use. They have discovered a new formulation of glass with "a revolutionary surface pattern made of nano-scale cones of glass" (Elgan, 2012). Inspired by organisms found in nature, such as beetles and leaves, the glass is designed to adjust to any environment. Not only is the glass without glare or reflection, it repels water as well. The nano-scale cones contained in this type of glass allow water to roll quickly off the glass's surface, carrying with it dirt and sweat. The self-clearing glass boosts the efficiency of existing glass in solar panels because of its lack of glare and dirt-removing properties. Additionally, the glass's ability to resist dirt, sweat, and smudges make it an intelligent choice for any technology that relies on touch (Smith, 2012).

Another innovation in the world of glass technology has recently been developed by Hitachi. The Japanese electronics firm has invented a new data storage medium using quartz glass. The data is etched into the material by a laser at four different points. It is then read using an optical

microscope. While the technology is aimed at companies who have large amounts of data they must save, or for important historical data that must be preserved, the new technology will actually be capable of saving the data for hundreds of millions of years. The glass is capable of storing more information per square inch than compact disks (Alabaster, 2012).

Interactive collaborative walls are now in the marketplace. The interactive walls of large glass monitors allow for real-time communication between the touchscreen in the room and devices that are off-site. Remote participants in collaborative projects use tablets, laptops, and smartphones to interact with the group that is on-site. Local teams can multitask through the use of numerous objects available for manipulation by multiple individuals. Bluescape's website demonstrates the ease of collaboration across space (Bluescape, 2016).

Educational Applications

Glass in the Classroom.

The glass technology provides the teacher with options for displaying and interacting with information in new ways. The teacher will be able to display information that is seemingly brighter than projection screens, as well as more lifelike and visually appealing. The glass display could be placed in any part of a classroom, turning every surface into one that can be utilized for learning. With glass technology the teacher can have a large seamless learning wall similar to a white board, but different in that it is fully interactive. Gesture technology can be integrated so the objects on the glass wall can be easily manipulated. The larger screen surfaces allow for multitasking and integration of several programs at the same time to allow educators to create interactive learning actions, which engage the students in their educational experiences. The combination of the gestures with the integration of programs allows educators to design programs that are intuitive for children to interact with and to engage in learning (Corning Glass Works, 2012e).

The instructional materials can be transferred from the wall to a large glass community activity table. This table represents the marriage of glass and touch technologies on which students and teachers can manipulate and create new knowledge. Within the "A Day Made of Glass 2: Unpacked" video students fully interact with the information, the teacher, and each other, as they use their fingertips to manipulate the display and explore their new knowledge, even expanding the information shown. The larger flat surface promotes collaboration. Individual students are able to work on their own projects and then combine them quickly and easily. Students can also work together, manipulating different portions of the workspace simultaneously (Corning Glass Works, 2012d).

Glass Enhanced by Interconnectivity.

Glass can be used in virtually every surface in a classroom, from walls to worktables to tablets. The seamless communication between all of these devices allows for sharing and collaboration among students, as well as from teacher to student and vice versa. Depicted in Corning's video (Corning Glass Works, 2012e) the teacher's display is linked to the students' individual glass tablets. She is able to send her presentation to her students' individual devices, which

communicate with the glass desktops before them. The students in the video are completely engaged in the activities, as they are fully immersed in them, rather than passively watching the teacher.

Glass and Communication.

Communication will be completely different because of glass's transparency. When connected through video conferencing, it will seem as if the person is on the other side of the glass. In the video "Technology in 2019 – What the Future of Tech looks like" (uTuberXtra, 2013), the children from around the world see each other through the glass and manipulate their workspace simultaneously. The collaboration across space will allow students to work together in a ubiquitous realistic manner.

Augmented Reality and Glass.

According to Kapp and Balkun (2011), "at its core, augmented reality is a predominantly real-world space in which virtual elements are inserted in real time" (p. 101). In using augmented reality, students can be transported to different places. In Corning's (2012d) video "A Day Made of Glass", the students attend a virtual field trip at a state park. The RFT signal triggers a video representation, and because of the see-through quality of the glass tablet, the students are able to interact with dinosaurs as if they were actually there.

Another benefit to using augmented reality, according to Kapp and Balkun (2011), is that textbooks can be easily supplemented. Glass can enhance augmented reality textbooks by making the interactions with the content ubiquitous. What was once a static set of information, now becomes dynamic and constantly adaptable. Students can also interact with digital manipulatives, perform virtual science labs, and solve complex problems that require thinking beyond memorization through augmented reality (*Online Universities*, 2012). Through a partnership between Massachusetts Institute of Technology's Education Program and the Education Arcade, educational games and augmented reality experiences are being developed for use in the classroom. Students who participate in such games are engaged in real-world scientific exploration that would not be as authentic without the use of augmented reality (Dunn, 2013).

Google Glass presents a myriad of educational applications as well. The glasses provide wireless connectivity to the Internet using the Android operating system (Team, 2012). By literally putting access to the Internet in front of students' eyes, learners can explore different languages, do research while immersed in the real world, and immediately record images or videos of what they observe (Burke, 2013). Communication in new ways will also be made possible through the use of Google Glass. Teachers and students can instantly communicate with other schools, or students who learn in a home school setting can seamlessly be a part of a classroom, though they are not physically there. Google Hangout can be utilized as a means for teachers to provide remote tutoring, or as a way for students to set up peer-to-peer help sessions (Lepi, 2013).

Extending the Classroom to Home.

At the end of the day in "A Day Made of Glass 2: Unpacked (Corning 2012e)", the student shares her virtual field trip with her family. The information stored in her tablet from the day at school can be displayed on the glass wall in their living room. Glass technology such as this opens lines of communication between the classroom and the home. Rather than papers and books, the students carry an electronic backpack in the form of their glass tablet, which houses all of the learning activities they have done and allows for complete and instantaneous sharing between home and school.

Other Uses of Glass by Schools

Corning's glimpse into the future of education through its video "A Day Made of Glass 2: Unpacked (Corning Glass Works, 2012e)", depicts Park Elementary using glass panels in a variety of ways. In the video, the narrator explains how the school is "not just energy independent, but…an energy provider" (4:45). Solar panels containing self-cleaning glass will allow for the most efficient energy sources imaginable. Freeing schools from the cost associated with energy use could allow for funds to be spent in other areas, such as other types of technology.

Implementation

According to Billinghurst and Dunser (2012), some classrooms have already begun implementing augmented reality, though the experiences are "largely the ad hoc creation of either educators with little understanding of the technology or developers with little understanding of education" (p. 62). Because glass technology as a whole is so new, it will be incredibly important for the two groups to work together in support of each other.

Many of the examples of glass technology contained in Corning's (Corning Glass Works, 2012d) and Microsoft's (2011) versions of a future classroom are large in scale. For example, the glass wall depicted in both must be specifically installed. Plans must be made at a district or school level to equip classrooms with the necessary wireless technology before they can be utilized. What type of infrastructure technology will be needed to support glass walls, glass worktables, glass tablets, or glasses such as Google's? Where will schools obtain such funds?

Other concepts shown in the videos are very similar to technology that is already in existence. For example, the glass tablets that the students use in Corning's (2012d) video do not appear to be drastically different than the tablets that are currently being utilized. Developers of educational programs will need to take advantage of the integration of the gesture, wireless, and advance programming interfaces to develop the interactions envisioned in the futuristic technology presentations.

As new apps and programs are developed, it is realistic to expect that teachers and students will need training on how to use specific programs. This training must include the best instructional uses for the technology. The technology deployed should be seamless as it appears in the video, which means educators will need to be one step ahead of their students in order to plan

meaningful learning experiences. Educators need to be cognizant of the future of technology to ensure that they are installing the proper technology, one that will allow them to benefit from newer formats as they become available. Eventually, as glass technologies become popular, more and more individuals will likely be exposed to the technology, lessening the need for training for the masses.

Limitations

The first limitation is an obvious one: breakage. The technology being discussed is, after all, made of glass, and glass is inherently breakable. While Gorilla Glass was developed to be significantly stronger than the traditional material, it is not invincible. In fact, according to Gardiner (2012):

> Drop a phone once and the screen may not fracture but you may cause enough damage (even a microscopic nick) to critically sap its subsequent strength. The next drop, even if it isn't as severe, may be fatal. It's one of the inevitable consequences of working with a material that is all about trade-offs, all about trying to create a perfectly imperceptible material (p. 7).

When glass breaks, it can create a potential safety hazard, either in the shards that remain or in the sharp edges of the broken device itself. According to Corning (2012a), Gorilla Glass® is strong enough to withstand the unexpected abuses of everyday life. However, one could argue that the stresses placed on devices by children in a school setting are more rigorous than that of the average person. The fragility of glass devices and the subsequent cost associated with possible damages could somewhat limit the use of glass technology in schools.

Another issue is the significant amount of data that is transferred in Corning's (2012e) video through the glass wall and the individual tablets. According to Corning, however, they have already considered this issue. They aim to design their new glass technologies to accommodate the increased bandwidth. Schools' networks may not be able to handle the load, so in order to implement some glass technologies that have been developed, districts might have to make preparations to increase the speed of their networks.

Augmented reality use in classrooms presents an additional concern. According to Kapp and Balkun (2011), some doctors are concerned about the use of three-dimensional environments with young children. They fear that the experience could affect their visual development. Because of this concern, it may be best to reserve technology such as augmented reality for secondary level students.

Conclusions

While glass is a medium that has been in existence for a staggering length of time, recent developments have allowed for it to be utilized in some of the most cutting-edge technologies available today. Those technologies include interactive glass walls, tables, and tablets, improved glass solar panels, and augmented reality glasses, among others. While all of these technologies have direct uses within a classroom, they also have limitations. Still, despite these limits, there

exists a real possibility that teachers may utilize these types of glass technologies in the near future, and that they may have a great impact on student learning and achievement. When one considers a world like the ones pictured by Corning and Microsoft, the possibilities appear to be endless.

References

Alabaster, J. (2012, September 25). Hitachi targets 2015 for storage medium that lasts 100M years. *Computerworld.* Retrieved from http://www.computerworld.com/s/article /9231665/Hitachi_targets_2015_for_storage_ medium_ that_lasts_100M_years.

Billinghurst, M. & Dunser, A. (2012). Augmented reality in the classroom, *Computer, 45*(7), 56-63.

Bluescape. (2016). Retrieved from https://www.bluescape.com/.

Burke, M. (2013, April 3). 5 ways Google Glass can be used in education. Retrieved from http://www.emergingedtech.com/2013/04/5-ways-google-glass-can-be-used-in-education/.

Cingrao. (2013, September 13). Using Google Glass to transform education [Weblog]. Retrieved from http://teach.com/education-technology/using-google-glass-to-transform-education.

Corning Glass Works. (2012a). Gorilla Glass FAQs. Retrieved from http://www.corninggorilla glass.com/faqs.

Corning Glass Works. (2012b). Gorilla Glass full products list. Retrieved from http://www.corninggorillaglass.com/products-with-gorilla/full-products-list.

Corning Glass Works. (2012a). Gorilla Glass applications. Retrieved from http://www.corninggorillaglass.com /applications.

Corning Glass Works. (2012d, February 3) A Day Made of Glass 2 [Video file]. Retrieved from www.youtube.com/watch?v=jZkHpNnXLB0.

Corning Glass Works. (2012e, February 3) A Day Made of Glass 2: Unpacked [Video file]. Retrieved from www.youtube.com/watch?v=X-GXO_urMow.

Dunn, J. (2013, September 26). How to use augmented reality in education. Retrieved from http://www.edudemic.com/augmented-reality-in-education/.

Elgan, M (2011, October 29). Why Microsoft's vision of the future will really happen. *Computerworld.* Retrieved from http://www.computerworld.com/s/article /9221298/Why_Microsoft_s_vision_of_the_future_ will_really_happen.

Elgan, M (2012, April 28). I have seen the future (and it's made of glass). *Computerworld.* Retrieved from http://www.computerworld.com/s/article/9226670/I_have_seen_ the_future_and_it_s_made_of_glass_.

Gardiner, B. (2012, September 24). Glass Works: how Corning created the ultrathin, ultrastrong material of the future. *Wired Magazine.* Retrieved from http://www.wired.com/ wiredscience/2012/09/ff-corning-gorilla-glass/.

Kapp, C., & Balkun, M.M. (2011). Teaching on the virtuality continuum: Augmented reality in the classroom. *Transformations: The Journal of Inclusive Scholarship and Pedagogy, 21*(1), 100-145.

Kurkjian, C.R., & Prindle, W.R. (2005). Perspectives on the history of glass composition. *Journal of the American Ceramic Society, 81*(4), 795-813.

Lepi, K. (2013, September 7). How to use Google Glass in education. Retrieved from http://www.edudemic.com/how-to-use-google-glass-in-education/.

Microsoft (2011, October 25). Productivity Future Vision. Retrieved from www.youtube.com/watch ?v=a6cNdhOKwi0.

Rivington, J. (2012, August 8). Project glass: what you need to know. *Techradar*. Retrieved from http://www.techradar.com/us/news/video/project-glass-what-you-need-to-know-1078114.

Smith, D (2012, April 26). MIT researchers invent 'perfect glass'. *International Business Times.* Retrieved from http://www.ibtimes.com/mit-researchers-invent-perfect-glass-video-693247.

Staff Writers. (2012, September 9). 8 amazing ways Google glasses will change education [Weblog]. Retrieved from http://www.onlineuniversities.com/blog/2012/09/8-amazing-ways-google-glasses-will-change-education/.

Team, T. (2012). Google glasses sound as crazy as smartphones and tablets once did. Forbes. Retrieved from http://www.forbes.com/sites/greatspeculations/2012/04/05/google-glasses-sound-as-crazy-as-smartphones-and-tablets-once-did/ .

uTuberXtra. (2013). Technology in 2019 – What the future of tech looks like. Retrieved from https://www.youtube.com/watch?v=6yWzKvQXsYM.

Zick, J. (2012, April 26). Corning Inc. developing killer glass. *The Leader Corning, NY*. Retrieved from http://www.the-leader.com/news/x1148066921/Corning-Inc-developing-kill-glass.