CS 6460: Educational Technology Assignment 6
Personal Question Robert Bobkoskie

I. INTRODUCTION

For this assignment, I will consider my personal question. The format of this assignment will change from the previous two assignments, where I started research on my project: *Assistive Technology for the Visually Impaired*. The previous two assignments were formatted with SIGCHI conference proceedings requirements. I chose a more informal look for this assignment to provide clarity by eliminating extraneous information. For reference, I will include my project abstract, and personal question in this assignment.

II. PROJECT ABSTRACT

Digital media is becoming much more than a supplement in the field of educational technology. Online books, journals, collaboration, and even graduate degrees can be obtained exclusively through digital resources. Indeed, pedagogy has kept pace with advances in digital technology, and for most, the educational experience has been enhanced. However, for those with a visual impairment, the ability to travel unabated in a digital world is rife with restrictions that limit access to information and educational enrichment. Although tools such as screen readers (text to speech), magnifiers, and high contrast settings allow the visually impaired to ride this information superhighway, these assistive technologies are difficult for the visually impaired to identify, locate, and configure. Even when configured, there are many differences in how assistive technologies are implemented. These inconsistencies further compound accessibility issues for the visually impaired. Introducing a standard(s) based approach for assistive technology would create uniformity across digital media, and would open the digital autobahn to the visually impaired. Another technology known as sonification [3] shows promise as an assistive technology to enhance learning. Sonification uses sound: frequency, amplitude, and timbre to convey information. Sonification can increase accessibility by allowing observable objects such as curves in a Euclidian plane can be visualized. Sonification and Standardization of assistive technology are tractable, cost effective approaches to enhance pedagogy for the visually impaired.

III. PERSONAL QUESTION

What is sonification? Is this concept widely used in educational technology? Why or why not? Are there any current tools available to help address the accessibility of technology? How can they be improved? What factors go into creating a great course? What are some effective online teaching methods in online courses?

IV. DISCUSSION

My project will focus on addressing the need to improve accessibility to digital media for the visually impaired. In the context of this project, visually impaired will refer to individuals with low vision that require special needs. According to the National Eye Institute, "low vision means that even with regular glasses, contact lenses, and medicine or surgery, people find everyday tasks difficult to do. I will reference my project to frame my answers to my personal question(s).

1. What is sonification?

   Sonification [1] uses sound: frequency, amplitude, and timbre to convey information. Sonification can increase accessibility by allowing observable objects such as curves in a Euclidian plane can be visualized. Upson [7] discusses using sonification to visualize geometry, which is a completely visual form of mathematics. Upson's proposes sonification as another vector for assimilating information, and targets middle school pupils. Essentially, using both sight and sound will increase the absorption of the material. Although Upson is not targeting the visually impaired, others [8, 9] have used sonification for this audience.

2. Is this concept widely used in educational technology? Why or why not?

   Sonification as an educational technology is not widely deployed. Upson discusses using sonification [7] for middle school visual mathematics, geometry. This is a narrow topic in a single subject over the pedantic universe. Even more narrow is the visually impaired slice of this audience. Sonification is analogous to orphan drugs, a small market lacks economies of scale. Walker and Cothran [9] explore addition reasons why sonification is not widely used: "few sonification toolkits that have been developed are either proprietary, dependent on a specific hardware or software platform (e.g., SGI/Irix), are not powerful enough, or are built for the expert sonification designer, and not the schoolteacher or student". I plan to extend the work of Walker and Cothran to include high contrast options in my sonification toolkit. I'd like to study human factors to evaluate sonification and high contrast settings for the visually impaired population.

3. Are there any current tools available to help address the accessibility of technology? How can they be improved?

   I plan to explore existing, no cost technologies to help address the accessibility of technology for the visually impaired. A very effective assistive technology for the visually impaired is the High Contrast Setting (HCS) available on most operating systems (OS), and applications such as Adobe Reader and various web browsers. HCS is freely available, both in cost and distribution, and will be the focus of my research. Fok, et al. [2] show that Adaptive Computer Technologies (ADT) such as HCS are used by 57.7% of their sample group. Although this seems high, it is not

the most used assistive technology from their study. If HCS is so effective, why would it not be more widely used? Phillips and Zhao [6] identified the ease of device procurement, and poor device performance as reasons why users abandon assistive technology. My project will further explore why existing HCS applications fail in both procurement and performance. Further, I will suggest that standardizing HCS can increase the adoption of HCS by the visually impaired community. To gather data, I plan a human factors evaluation of my sonification application. This will study accessibility corresponding to high contrast and sonification.

4. What factors go into creating a great course? What are some effective online teaching methods in online courses?

   These are questions are very broad, yet share some common attributes. In fact, a great course is highly correlated to effective online teaching methods (for online courses). Thus, my response to these two questions will have some cross pollination. In addition, I will touch more on the psychological aspects that factor into the makeup of a great course and effective online teaching methods for online courses. I will also attempt to frame my answers based on my project: *Assistive Technology for the Visually Impaired*. As a bonus, this research will be incorporated back into my class project.

   A course is 'great' if a student has achieved the course objectives, and more importantly a sense of accomplishment from the course. Quantifying and increasing achievement can be attained with effective school assessments. Guskey [10] suggests that the most successful assessments empower the student, and enable teachers to get timely feedback on the assessment. The type of assessments that work best provide meaningful information for educators, that does not surprise students. These assessments are typically traditional tests and quizzes given during the course. Assessments that demoralize a student will negatively impact a students' perception of the class. This can manifest as a feeling of exclusion, and in the extreme case, withdraw from education [11]. Conversely, engaged students do more than attend or perform academically, they also put forth effort, persist, self-regulate their behavior toward goals, challenge themselves to exceed, and enjoy challenges and learning [11]. Strong student engagement is the realization of their sense of accomplishment.

   There are numerous methods to increase student engagement. Integrated Course Design (ICD) [12] provides a model for increasing student engagement. Defining goals for learning, providing activities to achieve goals and utilizing feedback and assessment to refine the model are the foundation for integrated course design.

Learning Goals	Teaching and Learning Activities	Feedback and Assessment
1. How to solve problems	Practice solving problems, with feedback	Solve new, complex problems
2. How to work with others in a team	Work with others—with periodic feedback	Assessment by peers
3. How to plan for future learning	Identify future learning needs, develop a learning strategy	Assess the learning plan

For the visually impaired student, assessment and engagement are no less important. The only difference are the accessibility requirements for the visually impaired. Assessments and educational resources may be both physical (paper) and digital. Although both formats need to be accessible for he visually impaired, there is a transition toward electronic content, thus this format will have greater significance going forward. Research shows this transition to digital content, where 56% of educators are customizing digital content to meet the needs within their instructional plans [4]. Alves, et al. [5], discuss the importance of using assistive technology resources in educating students with visual impairment: 84.2% of the teachers declared that the resources were very important to enhance reading and writing skills as well as to communicate with the world on an equal basis (95.8%). Provided accessibility is addressed, a visually impaired student can be engaged and assessed similarly to a fully sighted student.

A great (online) course is highly correlated to effective online teaching methods. The use of models such as ICD provide a process to increase student engagement, and impact student achievement in a positive way. Another effective pedagogical strategy for online teaching is constructivism. A Delphi study [12] of experts in instructional technology propose that constructivist principles for an online class should be relevant, interactive, project-based, and collaborative, while providing learners with some choice or control over their learning. Like ICD, constructionism emphasizes interactive project based pedagogy and learner autonomy. One need not look to far for examples of models for effective online teaching. The Georgia Institute of Technology's OMSCS program employs many of the principles of ICD and constructionism: collaboration is emphasized by many courses for large projects, peer feedback and piazza are extensively used to provide assessment.

ICD and constructionism address student engagement and cognitive aspects to increase the effectiveness of online teaching. This interplay of emotion, cognition, and learning is addressed by Wang and Shen [13]. They provide evidence that gains in learning are correlated with the alleviation of frustration and self-doubt.

The foundational characteristics of teaching models inherently address the needs of visually impaired students. An instructor will need to consider accessibility issues with digital content. However, if accessibility issues are addressed through sonification and assistive technologies such as high contrast settings, the instructor can focus resources on effective teaching, and making the class great.

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