Can a Human-Centered Design Activity Improve the Quality of Low Vision Simulations?

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Introduction

Technology and Engineering educators engage their students with everchanging design activities. One recent trend in problem solving classes are low vision simulations. They can take many forms from blindfolds to low vision goggles and have been used in elementary to high school classes. Unfortunately, many teachers are misinformed about the risks of these simulations when performed poorly. For example, **low vision simulations are likely to create and reinforce stereotypes and misconceptions about the abilities of a person with disabilities** [1]. In addition, they represent an incomplete viewpoint of someone with a disability [2]. In an effort to diminish the negative effects and maximize possible positive outcomes our research analyzes the effects of a reimagined low vision simulation in conjunction with a human centered design project.

In 2017, four Creative Design classes at TCNJ engaged in low vision simulations with differing approaches. Following the simulations, students were placed in groups to conduct a human centered design project for someone with a vision impairment. Our predecessors collected data from pre and post surveys and written reflections submitted online. Pre-analysis was done on the relationship from pre survey to reflection to post survey and we continued this analysis.

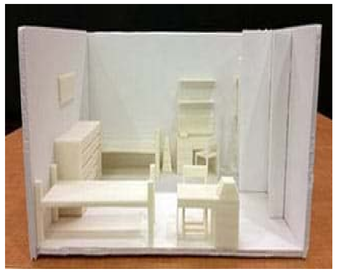

Figure 1: Student example of human centered design project in a dormitory setting.

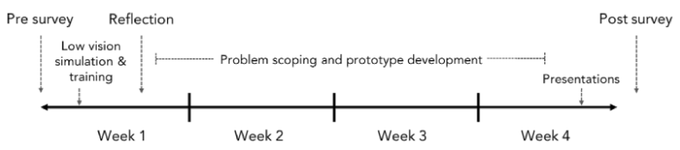

Figure 2: Design activity instructional timeline. Pre/Post survey and personal reflection collection points are identified.

Methods

We produced a 10 word code book after several rounds of coding reflections. We individually coded all responses and found the frequency of the codes. These codes helped to determine correlations and generate themes among the classes. In addition, every reflection was assigned a positive or negative connotation. The connotations were compared between researchers and agreement determined the final connotation. These connotations determined the individual and overall class views on the low vision simulation. Pre and post survey deltas per student and class, determined the formation or dissolution of misconceptions and increases in perceived knowledge. Using these perspectives the effectiveness of the approaches was determined. In addition, we analyzed trends among selected students to create narrative characters which were made into information graphics (Figure 3). This allowed us to display information that students were experiencing into a visual format.

Figure 3: Mock trading card of a themed student experience which displays information from their survey results and reflection.

Results

Table 1: Observations from the Qualitative Analysis and Survey Results

	Description	% of Negative Reflections	Most Frequent Theme	Least Frequent Theme	Normalized Aggregate Gained Knowledge
Case 1	Blindfolds only (dormitory)	73.7%	Navigation	Difficulty, Sympathy & Education	+3.25
Case 2	Simulators and blindfolds (dormitory)	69.5%	Dependence & Vulnerability	N/A	+3.18
Case 3	Training session, simulators and blindfolds (classroom)	55.0%	Education	Independence, Empathy & Navigation	+3.94
Case 4	Training session, group interview, simulators and blindfolds (dormitory)	70.0%	Difficulty & Sympathy	Vulnerability	+6.24

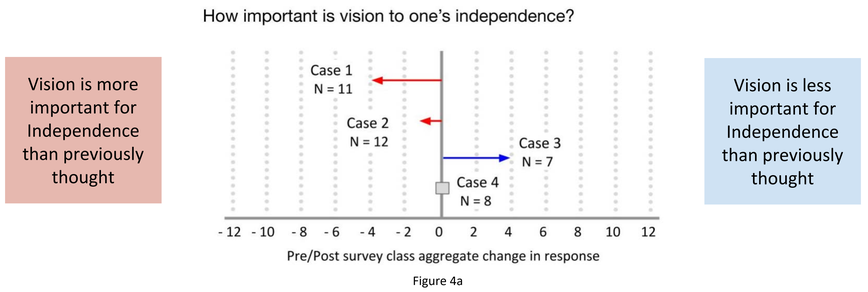

Figure 4a

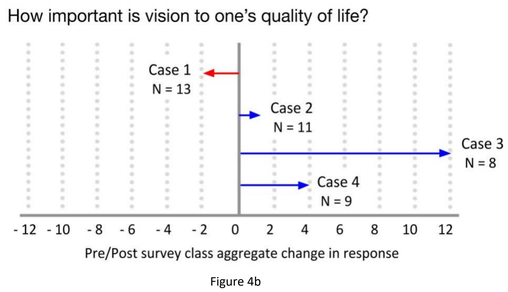

Figure 4b

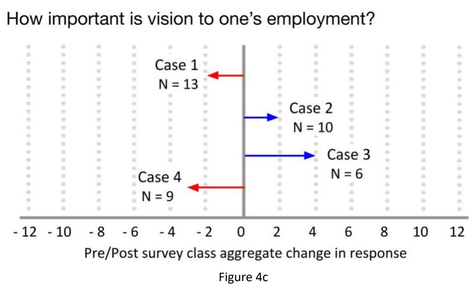

Figure 4c

Figures 4a, 4b, and 4c: Red arrows signify the class overall thought vision was more important to independence/quality of life/employment compared to their pre survey data. This change demonstrates misconceptions were created or reinforced. Meanwhile, Blue arrows signify the class overall thought vision was less important to independence/ quality of life/ employment compared to their pre survey data. This change represents breaking down misconceptions.
Figure 4A: Delta changes (per case) in student pre/post survey when asked the question: "How Important is vision to one's Independence?".
Figure 4B: Delta changes (per case) in student pre/post survey when asked the question: "How Important is vision to one's Quality of Life?".
Figure 4C: Delta changes (per case) in student pre/post survey when asked the question: "How Important is vision to one's Employment?".

Aggregate changes were calculated from the sum of the delta change for every student's pre to post survey.

Cases 1 and 3 act in a heavily negative and positive manner respectively across common misconception questions.

Case 2 and 4 are mixed in all three categories and do not follow a direct trend, with close to neutral scores in every chart.

Discussion

For our research purposes, Kouprie's definition of empathy is used to determine empathetic rather than sympathetic views. This version of empathy is demonstrated when someone has communicated and understood another's state of being well enough to identify with it for a period of time [3]. This distinction is important in establishing when true and positive empathy is displayed.

Compounding factors in Case 3 produced the most positive reflections. In this case, students used assistive technologies for low-vision workers and broke misconceptions about capabilities. In addition, the simulation for this case was conducted in a classroom which allowed students to be in a familiar environment as opposed to an unfamiliar dormitory room.

To further establish the combination of design thinking and low vision simulations, future work needs to be done to examine the effects of alternative simulation types, such as virtual reality, as well as, conducting research at different age groups to determine appropriate training and discussions.

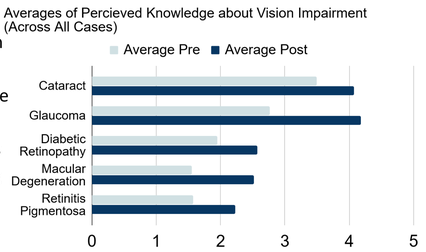

Figure 6: Average change in the student's perceived knowledge across all cases

Conclusion

This research provides a preliminary look at the use of low vision simulations integrated into a human centered design project. Our research reinforces that a low vision simulation with blindfolds alone has the most negative impact. Therefore, **blindfolds should not be used in simulations**. In addition, simulations alone will likely be negative experiences if not reinforced by other interventions. We have found that training sessions improve reflection positivity and diminish prior misconceptions such as independence, quality of life, and employment. Social contact with someone with the simulated disability can improve the perceived knowledge about vision impairment. Furthermore, the design project portion prompted research improving awareness of eye diseases. Therefore, **low vision simulations can be improved by educational resources and should only be conducted if care is taken to use them appropriately**.

Future Work

Our future goal is to write an article in a journal which will allow teachers, specifically technology education teachers, to effectively use low vision simulations in a classroom setting alongside a design oriented project. We also plan to publish a manuscript in a professional journal to make this research public. This research will help prompt other studies to be conducted with more variance and other learning resources to ascertain the real worth of low vision simulations.

References

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[3] Kouprie, Merlijn & Sleeswijk Visser, Froukje. (2009). A framework for empathy in design: Stepping into and out of the user's life. Journal of Engineering Design - J ENGINEERING DESIGN. 20. 437-448. 10.1080/09544820902875033.

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