Evaluating Multi-sensory Learning and Relationship Building through STEMPunk: A Reverse Science Fair

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Research Goals
- Determine the effects of hands-on activities, relationship building, personal attitude and atmosphere in enhancing STEM enthusiasm and learning
- Provide real-world examples demonstrating comparisons between lecture/demonstration style presentations and multi-sensory, immersive experiences in learning with middle school students
- Increase awareness of the need for more creative and engaging STEM Outreach experiences
- Illustrate additional enhancement of experiences via collaboration with non-STEM groups

Hypothesis
Immersive, engaging environments where students can visualize themselves as a STEM professional via collaborative exploration of a diverse set of topics provides a higher degree of engagement and enjoyment than passive demonstration/lecture presentations.

Background
Researchers and educators are uniting in their concern and passion for bolstering the number of students who pursue Science, Technology, Engineering and Math (STEM). The growing consensus is that students are not only lacking in aptitude for these topics but also interest [1]. However, little consensus has been achieved in the methodology to motivate and inspire them [2]. The NSF has called for innovation and collaboration in STEM outreach [3] through informal learning environments and out of box ideas. Studies have shown that informal learning environments, defined as voluntary, self-directed, motivated by personal needs and interests, is an effective outreach model for students in K-12 [5].

This research presents a new kind of STEM outreach. Our students were introduced to STEM fields via a Reverse Science Fair, where researchers presented their current projects to students in a fun and engaging environment where they can visualize themselves as a STEM professional via costuming and hands-on investigations.

Related Work
There have been similar examples of hands on learning with medical simulations [2], art projects [6], and even “whole body learning” through virtual environments [7] [8] [9]. Immersive learning has seen some recent positive research results including a study on space education via a computer or an immersive planetarium dome presentation [10]. One group using the Cognitive Apprenticeship learning model saw great success with a middle school robotics camp [1]. They note the need for immersion with guided-inquiry and provide students with all the tools to make them feel like STEM researchers.

STEMPunk: A Reverse Science Fair
The STEMPunk event is a multi-disciplinary event where researchers and educators (instead of students) present their current and past research projects to a small group of students in a “Reverse Science Fair.” The presenter gives an overview of their discipline and information on their current research. They also incorporate a hands-on activity for the students to experience what it is like to be a STEM professional and solve real research questions. The collaboration is further enhanced by the inclusion of artistic elements. Presenters have booths that are decorated and all participants (students and presenters) are costumed in the steampunk genre. Steampunk is a sub-genre of science fiction that typically features elaborate costumes and imaginary machinery—particularly works inspired by industrialized Victorian settings. Steampunk features anachronistic technologies or retro-futuristic inventions. Such technology may include fictional machines like those found in the works of H. G. Wells and Jules Verne. Steampunk also refers to any of the artistic styles, clothing fashions and “gadgets” that have developed from the aesthetics of steampunk fiction, Victorian-era fiction, art nouveau design, and films from the mid-20th century. Various modern utilitarian objects are often modified by these creative minds to produce “punked” paraphernalia. The ideas that result from Steampunk are always visionary, inventive, inspiring, often creative minds to produce “punked” paraphernalia. The ideas that result from Steampunk are always visionary, inventive, inspiring, often

Conclusions
The STEMPunk Reverse Science Fair provided students with the opportunity to interact with nationally funded researchers and their projects in a hands-on immersive environment that encouraged relationship building through theatrical elements. Student experiences were shown to be significantly better in various areas when compared to a traditional presentation as assessed by post-Presentation surveys. The results strongly support the concept that active and engaging learning are more likely to occur in an immersive environment where students are creating relationships with presenters and they can visualize themselves as a STEM professional. We hope that this research encourages future STEM outreach organizers to pursue immersive learning environments through collaboration and Interdisciplinary presentations.

References