

## **Abstract 30**

### **Exploring Pre-clinical Education Through Making 3D-Printed Prosthetics for Children**

#### **Background**

Growing numbers of students are learning through engaging in various forms of “Making” [1] – self-directed, creative activities which produce physical items for a certain goal [2]. A compelling example, particularly relevant for pre-clinical education, has been the development of open-source, 3D-printed prosthetic devices for children [8-10,13]. This kind of activity has served as an educational challenge problem across academic disciplines, and a variety of individuals and non-profit organizations currently help to support the creation and delivery of devices to families and recipients in need. Device creation may occur within “Makerspaces” - specialized facilities that aim to foster a supportive community of practice and the opportunity for peer-driven education through Making. Although these communities are increasingly common in pre-clinical education, their impact on formal student education remains understudied [3]. Our research investigates the informal, pre-clinical educational aspects of a Makerspace across K-12, undergraduate and graduate levels, centered on fabricating prosthetic devices for children.

#### **Objectives**

The objective of our research is to explore pre-clinical learning related to Making. We expect that socially relevant Making will have a positive impact on pre-clinical learning, including aspects of moral virtue which are vital for a good physician [4] yet increasingly difficult to teach [5]. Through a series of interventions, we are engaged in formative assessment on impacts and development of resources which can be used to scaffold learning experiences for new persons or groups to participate in developing open-source, 3D-printed prosthetic devices.

#### **Methods**

Our approach is to observe the UNC-Charlotte Makerspace’s activities and interventions, which engage a diverse group of students across multiple levels of education. One specific set of activities are those of The Helping Hand Project at UNC Charlotte, a student volunteer group which supports children with limb differences. Workshops for undergraduates, mentorships with high school students, outreach to grade schools in underserved areas, and development of evaluation instruments for informal learning [6] are also part of our approach. All activities will have a tie in to 3D printing prosthetic devices for children. Interviews, surveys and observational studies will be utilized as formative and summative assessments. Our initial findings have provided a baseline for structuring more formal interventions and evaluation [11-12].

#### **Evaluation Plan**

The evaluation approach is being developed by project contributors to integrate a responsive evaluation practice, characteristic of organizational learning [7]. Quantitative measures are being developed to survey knowledge gains, application, design, creativity, and sense of engagement in Making. Measures will be correlated to LCME standards for medical education, especially those related to self-directed problem-solving (6.3, 6.6, 7.4), social competencies (7.1, 7.2, 7.5, 7.6), moral virtue (7.7) and collaboration (7.8, 7.9) [14].

#### **Conclusions**

Initial research has shown the benefit of informal pre-clinical learning through Making 3D printed prosthetic devices to support important skills, such as design thinking and computational thinking. Exploring the integration of sociotechnical aspects and connecting with LCME standards for medical education will require further development and evaluation of interventions.

## References

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### Questions, Challenges and Obstacles for Moving the Project Forward

- 1) What does the panel believe to be the most important pre-clinical skills that could be developed through making 3D printed prosthetic devices for children?
- 2) Evaluating informal educational activities can be challenging, as participants are involved in their free time and activities are not standardized. What are the most important outcome measures that the panel would hope to gain from our educational activities?
- 3) Our study, detailed in “DIY Assistive Technology for Others: Considering Social Impacts and Opportunities to Leverage HCI Techniques.”, found evidence to suggest that the social aspect of making 3D printed prosthetic devices were secondary to the technical aspects. How may we improve the social focus of this educational experience for students, especially those who enter with a focus on engineering?
- 4) We may be able to utilize the Makerspace as a pipeline for diverse medical students. Does the panel have ideas on how we may better correlate 3D printing prosthetic devices and other Makerspace activities to medical disciplines?