

# Uncovering Challenges and Opportunities for 3D Printing Assistive Technology with Physical Therapists – Final Report

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## Goals of the Project

By creating 3D printed assistive devices, we believe assistive device developers and users can be empowered to create inexpensive and highly customizable assistive technology in a timely manner. More specifically, we believe physical and occupational therapist (PT) (OT) have the pre-existing making skills and medical expertise needed to become primary producers of AT. The purpose of the project was to explore 3D printing as an additional tool for PT and OTs to use to create assistive technology (AT) for their patients.

## Related Work:

Buehler, E. 2016 “Fabrication Lends a Hand: Creating Custom Assistive Technology.” ACM XRDS, Spring 2016, to appear

Buehler, E. Easley, W., McDonald, S. Comrie, N., and Hurst, A. (2015). “Inclusion and Education: 3D printing for Integrated Classrooms.” (ACM ASSETS 2015).

## Process

Standardized assistive technology (AT) such as crutches, canes, and walkers provide little to no customizations for users, leading to AT abandonment. While customizations could improve usability, current customizable technologies can be costly to the user and hard to obtain in a timely manner. To address this issue, we incorporated 3D printing into the practice of physical therapy to test the potential use of 3D printing technology in this field.

- We taught 60 PhD PT students three introductory lesson on 3D printing and AT design. These classes focused on the history of 3D printing in the medical field,

the design of assistive technology in 3D modeling environments, and the implementation of 3D printed assistive technology for patient use.

- We conducted interviews and collaborative sessions with a handful of PTs and two PT instructors at a university hospital. These sessions were used to gather information on PT needs for AT development, viewpoint on 3D printing technology, and knowledge on liability and uses of 3D printing in their practice.
- We worked with PTs to create 3D printed hand grips augmented onto existing standardized crutches for users with prolonged hand strain. This allowed us to collaborate with PTs to demonstrate the potential of 3D printing to produce customized modifications to assistive devices.

## **Results and Discussion**

By performing this research, we identified potential barriers of 3D printing in the physical therapy field and present concrete recommendations to assist clinicians developing 3D printed assistive technologies.

- **Barriers:** The OTs and PTs we collaborated with are eager to use 3D printing technology in their practice, but face considerable barriers to entry thereby limiting 3D printing use for AT development. These barriers included constrained time and resources for 3D printing education, pre-conceived concerns of liability, and limited time to design and modify AT in their practice. If these barriers are addressed, we believe 3D printing can become an integral part of AT development in PT and OT practices.
- **Augmentation vs. New Designs:** Our PTs were more interested in customizing off-the-shelf AT through various augmentations in comparison to creating new AT customized to the patient's needs.
- **3D Modeling and Printing for PTs:** Despite their technical backgrounds, approximately 90% of students experienced difficulty using the Tinkercad software. Although there are many personal 3DP technologies made for novice users, it is clear there is still a steep learning curve that needs to be addressed in the design of 3D modeling software.
- **Prototyping Fidelity:** we found high fidelity AT prototypes to be very important to the clinicians when testing AT design. Prototyping for clinicians requires high fidelity models to provide for the most realistic analysis of usability.

## **Presentations and Publications**

- Our team presented a poster in the Information Systems Department student research poster competition at UMBC. Our team won best undergraduate poster in the department.

- Our team presented the same poster at UMBC’s Undergraduate Research and Creative Achievement Day (URCAD).
- Our team completed a paper for TAPIA conference and we were accepted to the conference.
- Our team completed a full paper submission to ASSETS, a conference exploring computing and information technologies used to benefit people with disabilities. Results of this submission will not be returned until mid summer.