

ACCESSIBILITY WITH RAPID PROTOTYPING FOR PEOPLE WITH VISUAL DISABILITIES

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Resumo:

The university and society have been undergoing major changes in recent years. One is the speed with which technological innovations are developed and diffused, and it is fundamental for the university to create potential for the development of science and technology and to contribute to the training of students for this reality. In this context, strengthening the integration between teaching, research and extension is fundamental. This study aims to analyze the difficulties and needs of the visually impaired or of individuals with low vision, using rapid prototyping technology (3D printing) in order to reduce these difficulties. Our laboratory makes use of Molten Polymer Deposition (MPD) technology, also known as Fused Deposition Modeling (FDM) or FFF (Fused Filament Fabrication), in which a thermoplastic filament is forced through a heated extrusion nozzle. The machine is formed by a head which moves in the x and y axes, and a platform responsible for translate vertically. The material injector heats and pulls the plastic filament that gets rolled up in a coil. The material passes through an extruder nozzle located on the head to then be deposited on the platform. The laboratory contributes to the creation and development of a more personalized, fast and low cost of customized parts and products of materials for people with visual impairment. Using rapid prototyping technology, materials adapted to the visually impaired are being developed and created, favoring the fixation and facilitating detail discrimination through touch, taking into account the peculiarities of the visually impaired. In conjunction with other departments of Universidade Federal do Rio Grande (FURG), were already developed some products, as the Prototype of the central library tactile map of Carreiros Campus, some platelets with Adinkras in high relief, Braille cube, 3D printer with solar system model, Orion constellation with the Martian crater and a T7 human vertebra. The inclusion of people with visual impairment is something that is happening and opens up a vast field for the research and development of teaching in our country.

Palavras-chave: 3D printing; acessibility; visual impairment

Modalidade de Participação: Iniciação Científica

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1 INTRODUCTION

The university and society have been undergoing major changes in recent years. One is the speed with which technological innovations are developed and diffused, and it is fundamental for the university to create potential for the development of science and technology and to contribute to the training of students for this reality.

And among other changes, now with regard to education and inclusion of students with disabilities, whether in higher education or in regular schools. Schools and universities need to reinvent themselves, and architectural adaptations and pedagogical practices are needed to attend all diversity.

In this context, strengthening the integration between teaching, research and extension is fundamental. This study aims to analyze the difficulties and needs of the visually impaired or of individuals with low vision. And using rapid prototyping technology (3D printing), which allows the production of complex and customized products, and Arduino - a set of open source electronic prototyping tools that aims to make electronic implementation easier on equipment - create and produce materials didactics for the teaching of physics and sciences adapted for people with some visual disabilities.

2 METODOLOGY

The technology of 3D printers, also called Rapid Prototyping machine, have been developing over time and changing the way of manufacturing objects. A variety of printing methods already exist, and each one works in a distinctive way and uses its own materials.

Our laboratory makes use of Molten Polymer Deposition (MPD) technology, also known as Fused Deposition Modeling (FDM) or FFF (Fused Filament Fabrication), in which a thermoplastic filament is forced through a heated extrusion nozzle (RAULINO, 2011). The machine is formed by a head which moves in the x and y axes, and a platform responsible for translate vertically. The material injector heats and pulls the plastic filament that gets rolled up in a coil. The material passes through an extruder nozzle located on the head to then be deposited on the platform. The most commonly used building materials are Poly Lactic Acid (PLA), Acrylonitrile butadiene styrene (ABS) and Polyethylene Terephthalate (PET).

Rapid prototyping (3D printing) enables the production of customized products at an affordable cost. And so it is ideal for the creation and development of products adapted to the visually impaired, who at many times face the not attended need for custom parts and products, because it is difficult to produce at low cost if produced by traditional methods.

3 RESULTS AND DISCUSSION

The laboratory contributes to the creation and development of a more personalized, fast and low cost of customized parts and products of materials for people with visual impairment.

In collaboration with the Center for Inclusive Studies and Actions (NEAI) and the the Accessibility Sector of Library System (SIB), a tactile map prototype was created (Figure 1a) from the Central Library of Campus Carreiros of FURG.

Adinkras in high relief (Figure 1b) were also made for Sandra Lee dos Santos Ribeiro and Simone Przybylski, both of SIB. They develop a project that aims to provoke a new look at accessibility, promoting Afro-Brazilian culture for people with some visual impairment (RIBEIRO, 2017).

From the proposal of an inclusive education were developed and/or produced some products to help the education of people viually impaired, such as:

The Braille cube (Figure 1c), which has different patterns of protruding points on its faces corresponding to the Braille representation of letters in any language. With 6 dot positions, Braille supports up to 63 dot patterns, which can represent all letters of any alphabet. All these letters can be formed on any facet of the Braille Cube.

A solar planetary (figure 1d) in scale of size between the planets of this system. The Solar System comprehends the set constituted by the Sun and the celestial bodies that are under its gravitational domain.

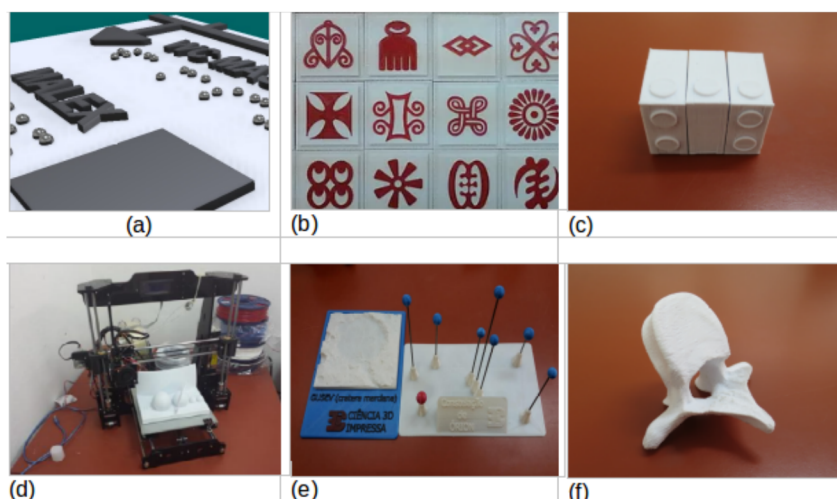
The stars of the Orion constellation (figure 1e) arranged in a three-dimensional way, with the stars in positions proportional to their distance in years lights.

The topographical representation of a Martian crater (figure 1e).

Anatomy pieces, such as the human T7 vertebra (figure 1f), so a better study of anatomy through touch is possible.

It is hoped that these and other educational products, in collaboration with teachers of the José Álvares de Azevedo School, will be widely used for teaching people with visual impairments.

Figure 1. Products made by our laboratory for visually impaired people (a) Prototype of the central library tactile map of Carreiros Campus. (b) Some platelets with Adinkras in high relief. (c) Braille cube. (d) 3D printer with solar system model. (e) Orion constellation with the Martian crater. (f) T7 Vertebra.



Font: The Author(s)

4 FINAL CONSIDERATIONS

The inclusion of people with visual impairment is something that is happening and opens up a vast field for the research and development of teaching in our country. Using rapid prototyping technology, materials adapted to the visually impaired are being developed and

created, favoring the fixation and facilitating detail discrimination through touch, taking into account the peculiarities of the visually impaired.

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