INTERNATIONAL JOURNAL FOR INNOVATION EDUCATION AND RESEARCH
ISSN: 2411-2933

Journal URL: https://scholarsjournal.net/index.php/ijier

DOI: https://doi.org/10.31686/ijier.vol11.iss5.4112

Development of three-dimensional pieces of inclusive didactics to assist in the teaching and learning process of people with visual impairments

Ana M. M. Favacho[1] Ian G. Mota[1], Vinicius B. Coelho[1] Márcio A. C. Pompermaier[1] Sidivan A. Nascimento[1] Cléver R. Stein[1]

[1] Federal Institute of Rondônia IFRO Porto Velho Calama.

1. Ana Márcia Moraes Favacho (anamarciamoraesfavacho@gmail.com)
2. Ian Gil Mota (iangilmota@gmail.com)
3. Vinicius Borges Coelho (vbc27062004@gmail.com)
4. Márcio Augusto Campos Pompermaier (pompermaier@msn.com)
5. Sidivan Aves do Nascimento (sidivan.nascimento@ifro.edu.br)
6. **(Corresponding author)** Cléver Reis Stein clever.stein@ifro.edu.br

Abstract

The teaching of some contents of the disciplines of the exact sciences and the earth are considered complex and this scenario worsens when the student has some disability, among these visual deficiencies is one that presents a higher degree of complexity, because the student cannot see what is being demonstrated. Based on this panorama, this article has as its central objective to present some three-dimensional pieces of inclusive didactics, which were developed in software that design three-dimensional objects and later printing in 3D printers, a process that resulted in handleable parts and with information of dimensions, shapes and writings in braille, this set of information aggregated in the construction of these pieces aims to collaborate in the process of teaching and learning of content related to exact disciplines.

Keywords: pieces of inclusive didactics; 3D printer; braille;

1. Introduction

Society is experiencing an era of gigantic technological development and this process extends to all areas of human coexistence. Within this perspective, education has undergone significant changes, from teaching methodologies through physical facilities and to pedagogical tools, thus, the transformation of the environment and the individual is closely linked to technological evolution that encompass them. Within this universe of opportunities, a small portion of individuals who for many years have been disadvantaged by the lack of incentives and public policies of inclusion have been contemplated with the advent of science in this area of knowledge, which are people with disabilities, in this group, the visually impaired deserve highlights, not only for the complexity that involves teaching to this public, but also by the challenge of developing technologies capable of transforming abstract information into meaningful experiences and thus contributing to the teaching and learning process of these individuals.

Lately, society, through systematic affirmative action policies, which have as a priority to contemplate groups of individuals who have special needs and who do not have an opportunity for development in the educational environment due to the lack of infrastructure and technologies that contemplate the improvement of the life of this public and, one of the actions is to offer opportunity to all those who use intelligence to make new research aimed at promoting inclusion and social development of this group of individuals. With these actions, the population as a whole begins to enjoy equal opportunities, focusing on democracy in all areas of civilized society.

In this sense, one of the technologies that has been emerging in recent years is the 3D printer, which is a fantastic instrument for the production of parts that can help in the teaching of numerous contents in various disciplines.

Of course, the commitment between the teams prepares us to face atypical situations experienced in daily life, such as teaching to a person with visual impairment, so that we rely on strategic knowledge to achieve excellence and overcome the problem in question. The certification of methodologies that help us to deal with the emergence of physical and virtual barriers offers an interesting opportunity to verify all the functional resources involved in this context. Similarly, the growing influence of the media presents trends in encouraging the inclusion and development of opportunities in order to contemplate all classes regardless of their particularities. Based on this panorama, it is noteworthy that research is the way to expand knowledge and consequent inclusion of individuals in this technological educational atmosphere. With the purpose of contributing to the inclusion of people with visual impairments in the educational context, the present work presents the development of three-dimensional didactic parts and, with braille writing to enable reading through touch, the pieces are related to basic mathematics, were produced by the 3D printer and represent several geometric shapes, which favors the handling and study of each element in question.

2. Materials and methods

The process of designing the didactic and inclusive three-dimensional pieces had as its initial point the search for contents that could be presented in formats in the three spatial dimensions, with this in mind, the construction of triangles was made in the three-dimensional projection software. In the construction of the pieces were included the braille information, which allows the reading by the visually impaired, this configuration was possible due to the potential of the 3D printer to reproduce with quality the small details projected in the virtual parts. After this first phase, the second stage consisted of the printing of the parts, where the PLA filament was used, which is a material consisting of polylactic acid, which makes it possible to obtain the appropriate model for the needs and functionalities that were instituted. In the configuration of the internal filling of the pieces was used 20 % of material, with this the piece offers good stability and rigidity for the application proposal, finally, the piece is ready to be used in the experimental activities, it is emphasized at this point that the pieces can be used both by people with visual impairments and by regular students, since with the demonstration of an object that corresponds to the drawing that are represented in the textbooks, the student will have a significant experience and will have the image of object engraved in the mind and that will be related whenever studying on that particular subject.

3. Results and discussions

In the teaching of Nature and Land Sciences, the performance of experimental activities that reproduce the phenomenon under study is of fundamental importance for the student's understanding and this task becomes more challenging when the student has some disability, especially the visually impaired, present a greater difficulty in assimilating to the experimental practice and/or the theory presented, this principle is a consensus among teachers, instructors or researchers who work in these lines of research. However, it is observed that the provision of adequate didactic tools favors the teaching and learning process of all involved. And, with this point in mind, the 3D printer can be used as an instrument for constructing inclusive parts, since the parts modelled in three-dimensional projection software can be printed resulting in objects that can be groped, in this sense, Figure 1 represents the design of a three-dimensional part of a right triangle.

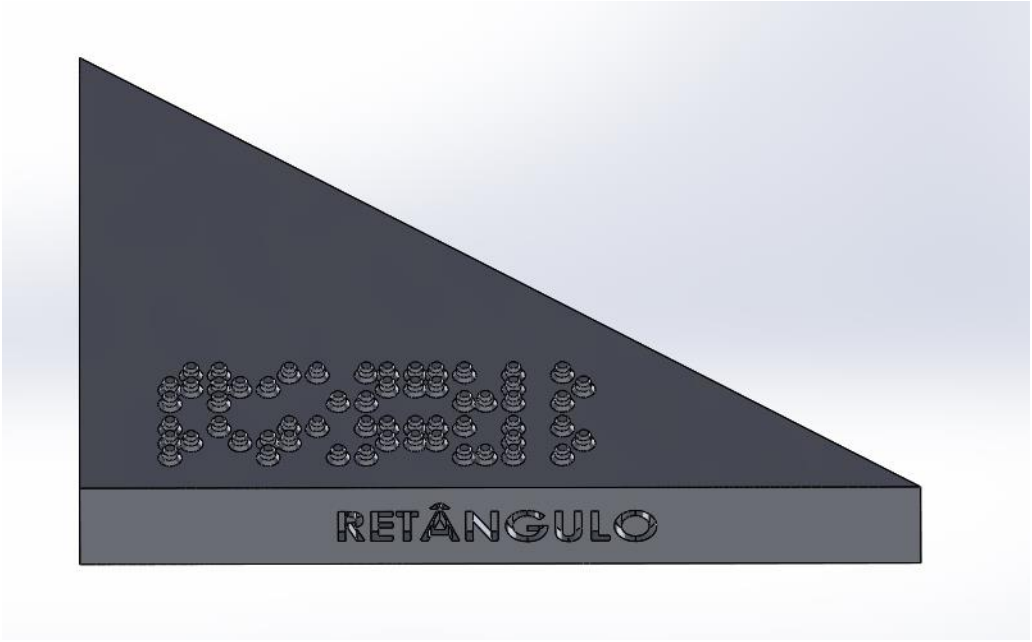

Figure 1. 3D figure of a rectangle triangle building in a three-dimensional projection software.

As can be seen in the figure above, it has graphed on one of its sides the name of the triangle and on its surface this same information is written in Braille, so a student who has low vision or blindness can read the information and handle the piece at the same time. This simultaneous experience of reading and recognizing the dimension and shape of the piece becomes significant for the student, because he now has a reference of what is said and that he cannot see.

After completing the construction of the part in the software with all the details, dimensions, format, writings and high-reliefs, the project is ready to be taken to the 3D printer for the manufacture of the part. Figure 2 illustrates the printed part.

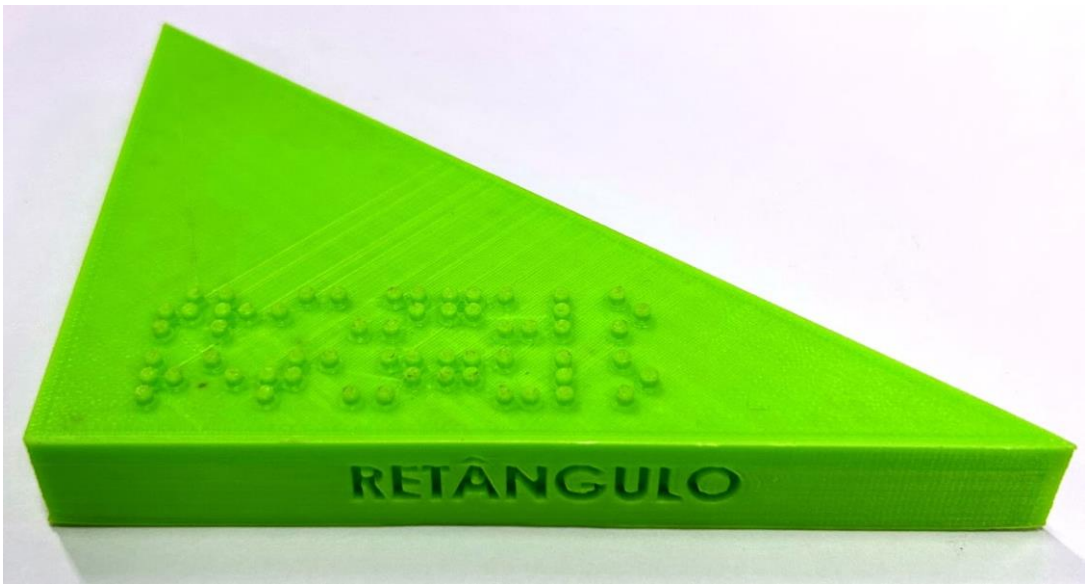

Figure 2. 3D part of the didactic and inclusive three-dimensional rectangle triangle.

As can be seen in the piece presented above, the visually impaired student has the opportunity to handle the object that has the exact shape of the equilateral triangle and the information is graphed in braille at the top, thus facilitating the absorption of the content presented in an abstract way.

Figure 3 shows other parts developed and printed by the 3D printer; these pieces have braille information graphed on the surface for easy reading through touch.

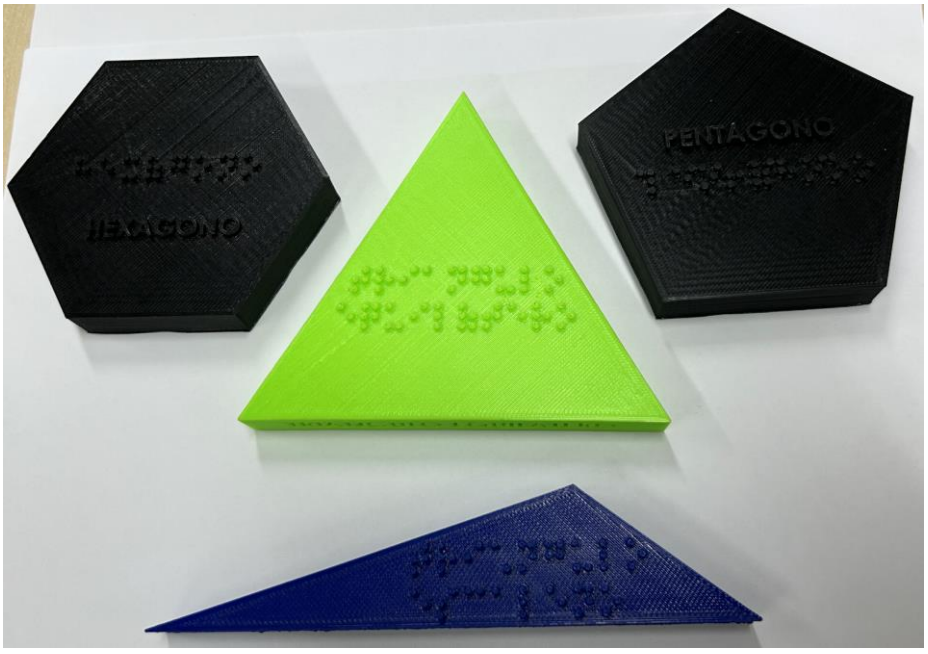

Figure 2. 3D didactic and inclusive parts. The pieces represent some geometric shapes.

It is interesting to note that the pieces open the range to a larger number of applications, as they present the possibility of variation in size and color of printing, and recreational activities can be elaborated for regular students and for those with visual impairments, added to this, color variation can facilitate the learning of students who have low vision, since some colors are more noticeable to this audience. In summary, these

teaching tools contribute to the teaching and learning process by providing a meaningful experience and at the same time allows the inclusion of students with disabilities in regular classrooms.

4. Conclusion

The construction of three-dimensional didactic parts and with information arranged in braille allows the design of a significant experience and at the same time provides the inclusion of students with visual disabilities. The pieces are easy to build and bring visual information to regular and tactile students for those who lack vision, thus collaborating for an inclusive and quality teaching. In addition, these prototypes are didactic tools that teachers can use in explaining the subject. Finally, we emphasize that the intention of the development of didactic three-dimensional pieces aims to awaken research that results in tools capable of promoting quality and at the same time inclusive teaching

5. Acknowledgement Heading Level-1

The authors thank Federal Institute of Rondônia - IFRO, Campus Porto Velho Calama - DEPESP for the provision of scholarships to students and costing of activities and publication.

6. References

1. BARBOSA, J. O. PAULO, S. R.; RINALDI, C. Investigação do papel da experimentação na construção de conceitos em eletricidade no ensino médio. Caderno Catarinense de Ensino de Física, v.16, n.1: p.105-122, abr. 1999.
2. AXT, Rolando. O papel da experimentação no ensino de ciências. In: MOREIRA, M. A. & AXT, R., Tópicos em ensino de ciências. Porto Alegre: Sagra, 1991.
3. BENFÍCA, K. F. G. PRATES, K. H. G. As contribuições do uso de experimentos no ensino – aprendizado da física, Brazilian Journal of Development, 6(6), p. 33686-33703, 2020.
4. BORGES, O. Formação Inicial de Professores de Física: Formar Mais! Formar Melhor! Revista Brasileira de Ensino de Física, v. 28, n. 2, p. 135-142, 2006.
5. BORGES, A. T. Novos rumos para o laboratório escolar de ciências. Caderno Brasileiro de Ensino de Física, v. 19, n. 3, p. 291-313, 2002.