Pedagogical proposal of tactile graphical framework for delimiting permanent preservation areas for the visually impaired

Proposta pedagógica de esquema gráfico tátil de delimitação de áreas de preservação permanente para deficientes visuais

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ABSTRACT
One of the biggest challenges for visually impaired people is learning cartographic content. Among the cartographic contents, the conceptualization and delimitation of preservation areas is an applied example with extreme relevance for environmental education. This article presents the process of developing a tactile graphic scheme for environmental education for visually impaired people regarding the delimitation of permanent preservation areas around springs and rivers. The creation of the teaching resource used easily acquired materials and followed format recommendations indicated by academic literature on tactile maps. The didact resource has textual content in Braille and Roman numerals, as well as legend and graphic scale in high relief. Special care was taken so that the teaching resource can be used in an inclusive manner, involving, at the same time, blind, partially visually impaired and students with full vision, to promote an inclusive educational environment. This resource can be a useful tool for teaching cartography topics applied to environmental conservation contexts.

Keywords: tactile maps, permanent preservation areas, inclusive special education, environmental education, visual impairment

RESUMO
Um dos maiores desafios para deficientes visuais é o aprendizado de conteúdo cartográfico. Dentre os conteúdos cartográficos, a conceituação e delimitação de áreas de preservação permanente é um exemplo aplicado com extrema relevância para a educação ambiental. Este artigo apresenta o processo de elaboração de um esquema gráfico tátil para educação ambiental de deficientes visuais quanto à delimitação de áreas de preservação permanente de entorno de nascentes e rios. A confecção do recurso didático utilizou materiais de fácil aquisição e seguiu recomendações de formato indicadas pela literatura acadêmica sobre mapas táteis. O encarte possui conteúdo textual em braile e algarismo romanos, legenda e escala gráfica em alto relevo. Tomou-se um cuidado especial para que o recurso didático possa ser utilizado de maneira inclusiva, envolvendo, ao mesmo tempo, cegos, deficientes visuais parciais e alunos com visão completa, de forma a promover um ambiente de educação inclusiva. Propõe-se que se trata de
INTRODUCTION

Cartographic content is commonly identified as the greatest difficulty faced by visually impaired people in learning Geography (Jordão 2015, Jordão et al. 2015). Several studies show that the use of tactile maps in teaching the visually impaired improves understanding of the content of the Geography subject and contribute to better results in assessments (Gomes et al. 2012, Andrade 2013). Furthermore, through tactile cartography, visually impaired people develop mental representation, reasoning and spatial orientation skills that will be useful in their everyday lives (Almeida 2002). An important recommendation of Sgarrabotto and Duranti (2010) and Jordão et al. (2015) is that tactile map strategies for students with visual impairments in Geography courses bring possibilities for interaction with other students, in an inclusive education context.

In this context, this article aims to present the process of developing a tactile graphic framework of permanent preservation areas for the visually impaired. It is discussed how this teaching resource can be used to teach cartography to the visually impaired, applied to the context of environmental conservation, in Geography classes.

The theme of delimiting permanent preservation areas was chosen as it is a possibility of reconciling the teaching of cartography, territorial occupation planning and nature conservation. Under the terms of the Brazilian Federal Law No. 12,651 of 2012 (Brazil 2012), permanent preservation areas are protected areas, with the environmental function of preserving water resources, the landscape, geological stability, and biodiversity, facilitating the gene flow of fauna and flora, protect the soil and ensure the well-being of human populations (art. 3, II). Vegetation in the permanent preservation area must be maintained by the owner of the area, and must be restored in the event of illegal vegetation removal (Art. 7). The correct identification and delimitation of permanent preservation areas is fundamental to the effectiveness of Brazilian environmental legislation. In the specific case of areas surrounding springs and rivers, the aforementioned law specifies:
Art. 4 The following are considered Permanent Preservation Areas, in rural or urban areas, for the purposes of this Law:
I - the marginal strips of any perennial and intermittent natural watercourse, excluding ephemeral ones, from the edge of the regular bed channel, with a minimum width of:
a) 30 (thirty) meters, for watercourses less than 10 (ten) meters wide;
b) 50 (fifty) meters, for watercourses that are 10 (ten) to 50 (fifty) meters wide;
c) 100 (one hundred) meters, for watercourses that are 50 (fifty) to 200 (two hundred) meters wide;
d) 200 (two hundred) meters, for watercourses that are 200 (two hundred) to 600 (six hundred) meters wide;
e) 500 (five hundred) meters, for watercourses that are greater than 600 (six hundred) meters wide;

IV - the areas surrounding springs and perennial water holes, whatever their topographic situation, within a minimum radius of 50 (fifty) meters;

(Brazil 2012)

2 MATERIALS AND METHODS

The planning and elaboration of the tactile graphic scheme followed recommendations from academic literature on tactile cartography, based on experiences from previous applications. In this context, Almeida (2011) recommends that tactile maps be wide enough for exploration by hand. Andrade et al. (2015) recommend that tactile maps be sparing in the number of textures and recommend special care when constructing their legends. Furthermore, Andrade (2013) recommends the use of shapes, sizes and relief as additional ways to differentiate tactile cartographic elements.

The teaching material was built on an MDF (Medium Density Fibreboard) clipboard. A3 size was chosen, as recommended for tactile maps by Tatham (1999), with half being used for title, legend and scale, and the other half used for the graphic-spatial scheme itself. We chose to place the title, legend and scale above the graphic-spatial content because the visually impaired person first needs to understand the elements and information on a map in a sequential way (Tatham 1999, Carmo 2009), analogously to a text, and only after that in a synoptic way (i.e., as an integrated image of the map). The teaching material was separated into different tables (title, legend, scale and drawing), each corresponding to a rectangle of cork paper in which the other information elements were included.

The teaching material presents textual information in Braille, using plastic beads (material for making handcrafts). The clipboard additionally presents the text in Roman numerals and the legend in different colors, so that teaching activities can include, at the same time, both students with visual impairments and other students. In this way, it encourages interaction between all
students and contributes to a more inclusive educational environment. The text in Roman numerals also facilitates understanding by teachers who are not familiar with writing Braille. The colors of the text and cartographic elements were chosen because they have high contrast between them, enabling better visualization in cases of partial visual impairment, as suggested by Carmo (2009).

The Roman numerals are made of self-adhesive stickers with a glitter coating and are rough to the touch. The spring was represented by a blue button, and its respective APP was represented by a circular self-adhesive felt sticker for table legs, with a 2cm radius, white and with velvety texture. In the legend, it was decided to keep the spring APP symbol in a circular shape, in order to also convey information about the shape that it will appear in the graphic-spatial scheme. The river was represented by blue EVA fabric covered in glitter of the same color, while its respective permanent preservation area was represented by green textured paper with roughness in parallel lines. For the graphic scale, wooden sticks were used.
Figure 1 shows the didactic resource created.

Figure 1 - Tactile graphic diagram of Permanent Preservation Areas
3 RESULTS AND DISCUSSION

The tactile graphic scheme of permanent preservation areas can be used in the geography courses both for teaching cartography content, presenting an applied example, and in classes on nature conservation. For example, in the Minimum Curriculum prescribed by the State Department of Education of the Government of Rio de Janeiro, in Brazil (SEEDUC, 2012), cartography content is taught in the second two months of the sixth year of elementary school and in the first two months of the first year of high school. Environmental issues topics are covered in the fourth quarter of the sixth year of elementary school and in the third and fourth quarters of the first year of high school.

It is recommended that, prior to contact with the teaching material, the teacher explains the context of the legislation on permanent preservation areas and explicitly focuses on the rules for delimiting permanent preservation areas around springs and riverbanks. In this way, the spatial concepts of position, adjacency, contiguity and distance relating to this content will be presented to students conceptually, before being practiced with the teaching resource. If students do not yet have knowledge of cartography, especially regarding legends and scales on maps, a prior explanation by the teacher is also important.

During practice with the tactile graphic scheme, the teacher must guide the visually impaired student to go first through the title, then the legend, then the scale and only then to the graphic-spatial content. As suggested by Sena (2008), students with visual impairments can keep one hand on the scale and the other on the graphic content, to have a constant notion of the distances represented.

4 FINAL REFLECTIONS

The developed tactile graphic scheme presents a potential alternative to address the cartographic and environmental conservation content related to permanent preservation areas for visually impaired people. The teaching resource also makes it possible to include visually impaired people with other students in the same learning environment. The materials used to make it are easily found in handcraft and school supply stores.

The theme of permanent preservation areas also presents several other possibilities of approach for the visually impaired, especially in the form of tridimensional models. In this way, tridimensional models could be created exemplifying other permanent preservation areas of
hilltops, plateau edges and steeply sloped slopes. The construction of tactile maps of contour lines mirroring the tridimensional models, as proposed by Sousa & Musse (2010), can provide yet another complementary cartographic learning opportunity for the visually impaired. Although the content of permanent preservation areas is a practical context, such tridimensional models would also cover various concepts of cartography and geomorphology, such as slope and relief forms (hills and plateaus).

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REFERENCES


