Journal of ICSAR
ISSN (print): 2548-8619; ISSN (online): 2548-8600
Volume 6 Number 2; DOI: http://dx.doi.org/10.17977/um005v6i22022p125

Braille for Physics

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Abstract: The demand for learning media for those who have visual impairments in learning physics is growing. Braille letters that cannot accommodate physics equations and symbols are an impediment that must be addressed promptly. The technique that can be used is, of course, to present a new version of current Braille. The Braille form for Physics in this article is still a work in progress. We are eager to collaborate with professionals in physics and Braille. In addition, as a follow-up, we will consider validating and constructing a Braille physics dictionary utilizing 3x3 Braille forms.

Keywords: Braille, Physics, Visual Impairments, Students

INTRODUCTION

Physics concepts can be represented in several forms. There are at least four formats of representational ability in physics (Kohl & Finkelstein, 2005, Rosengrant, Etkina, & Van Heuvelen, 2007), namely verbal, mathematical, graphic, and image. The ability of representation determines how individuals solve problems and construct their knowledge. For instance, individuals with the potential for verbal presentation will be able to solve problems in oral form, similarly, to individuals with other representational abilities. Representation in physics learning is essential for students to attain holistic comprehension (Yesildag Hasanebi & Günel, 2013). Each individual can have one or more prominent representational abilities.

DEVELOPMENT OF BRAILLE

Accessibility of knowledge for blind people has been fought for since the 17th century. Francesco Lana Terzi suggested a reading system specifically designed for blind people in his work entitled 'Prodromo overo saggio di alcuune invenzione nouve.' The work concluded that people with disabilities who were born blind could write and hide their secrets in code and understand the answers in the same code' in 1670 (Chirone & Dassa, 2008). It is one of the new milestones in reading systems because it is different from general reading systems.

In 1808, Charles Barbier de la Serre, who would later be Captain Charles Barbier, was an Artillery Captain in Napoleon's battalion. He published an Expediography Table and published his writing procedures in 1809 (Bullock & Galst, 2009). Barbier created this to facilitate communication on the battlefield through writing at night. The system is known as écriture nocturne or night writing, where the paper will be scratched using a stylus and will produce raised dots (Sadato, 2005). However, the military captain can see.

In addition, Valentine Haüy developed a pedagogical system for children with visual impairments to learn by reading Roman letters using their sense of touch (Warne, 2016). Formerly, these embossed letters were made by people who could see. Valentine Haüy adapted the ordinary people reading system by modifying the printing of characters in embossed letters. This system was designed to aid blind people to read by recognizing ordinary letters through their sense of touch, and the writing system through typographic composition (Oliphant, 2008).

Louis Braille, who later created the Braille system, studied using this pedagogical system at the Institution Royale de Jeunes Aveugles or the Royal Institute for Blind Youth, a boarding school for the blind in France. Considering that L. Braille was completely blind when he was five years old, he tended to quickly absorb the lessons given by his school with his remaining visual memory (Jiménez et al., 2009).

In their development of learning using embossed letters, Braille and his friends experienced significant difficulties. Then, in 1823, Barbier wrote to the Royal Institute for Blind Youth, asking for permission to test his findings on the children who attended the school. The test result suggested that children could easily recognize letter marks in the form of raised dots. After that, the Braille system was introduced in France. Although it faced various rejections, this system was eventually adopted and increasingly popularized.

RESULT AND DISCUSSION

Braille for Physics)

Default form of Braille

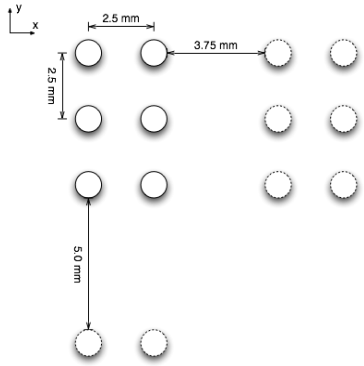

Figure 1. Default form of Braille

Braille code is a writing system that enables blind and partially sighted people to read and write through touch. Braille consists of patterns of raised dots arranged in cells of up to six dots in a 3×2 configuration. Each cell represents a braille letter, numeral, or punctuation mark. Some frequently used words and letter combinations also have their own single-cell patterns (https://brailleworks.com/braille-resources/braille-alphabet/).

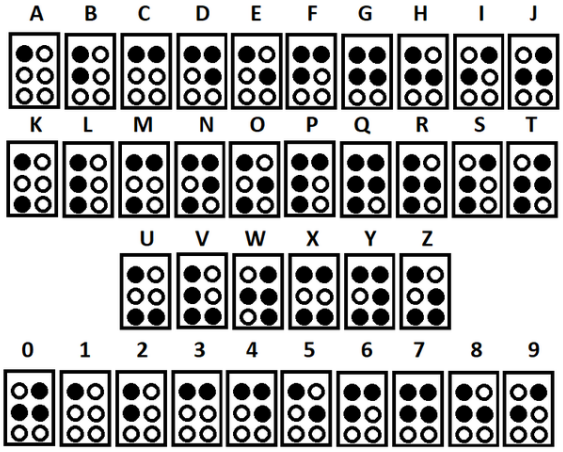

Figure 2. Default Braille form for alphabet and number. (Source: https://www.geeksforgeeks.org/braille-system-light-class-8-physics/)

New form of Braille

Braille for Physics code is a writing system that enables blind and partially sighted people to read and write through touch. Braille for physics consists of patterns of raised dots arranged in cells of up to nine dots in a 3×3 configuration. The first column shows the formula (ex. Force), mathematical notation (ex. Sigma), and the default form of Braille). Cell 1x1 represents that the braille letters are written according to the default form of Braille, Cell 2x1 represents that the characters written represent formulas, while Cell 3x1 represents that the characters written are symbol notations.

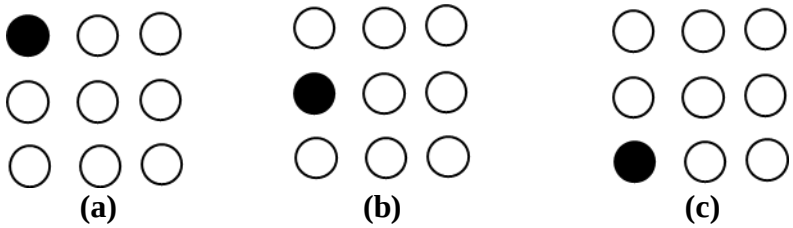

Figure 3. Braille for Physics, (a) the dot in cell 1x1 means the default Braille form, (b) the dot in cell 2x1 indicates writing the formula character, and (c) the dot in cell 3x1 indicates writing the symbol notation character.

Examples of usage in physics

Force is the change in momentum over time which can be written mathematically as equation 1).

$$F = \frac{\Delta p}{t} \qquad 1)$$

By using Braille for Physics it can be interpreted as shown in Figure 4.

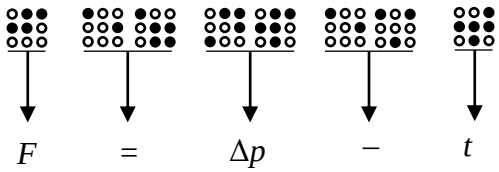

Figure 4. Example of using Braille for Physics to write formulas

FUTURE DIRECTIONS

The Braille form for Physics in this article is still an idea that needs to be developed further. We as researchers are very open to collaboration with experts in the field of physics and Braille. In addition, as a follow-up, we will think about validating and developing a Braille physics dictionary using 3x3 Braille forms.

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