Chapter 2
Strategies and Technology Aids for Teaching Science to Blind and Visually Impaired Students

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ABSTRACT

This chapter aims to provide a panorama of suitable teaching resources and strategies for science education of blind and visually impaired students. Although it is not a thorough review, its intention is to provide examples of what is possible to do specifically for experimental sciences (Biology, Chemistry, and Physics). The authors will also present the foundations for designing inclusive learning materials based on the user-centered design and universal design for learning (UDL) frameworks, using as example the development of technology-based tactile three-dimensional prototypes for teaching biology. An example of low-technology adaptations for making accessible instruments for the chemistry lab, using recycled materials will also be described, as well as adaptations for laboratory safety. Finally, there is also a section elaborating on the educational strategy to create inclusive and engaging environments in science laboratories.

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INTRODUCTION

Inclusive education of students with visual disabilities, particularly with respect to science-learning activities, can be a challenge for teachers in the regular classroom. This is because traditional teaching mostly relies on visual resources that are not accessible to blind students, and are little illustrative for those with weak vision (López Suero et al., 2017). Currently, the prevailing resources for blind and visually impaired students available in schools are thermoformed vinyl graphics and Braille-printed texts, usually both have no color or text for sighted users. These resources are widely distributed because they are low cost; however, their use requires the learner to develop additional skills in order to interpret the information they try to convey, and certainly are not attractive for students who are sighted. This characteristic makes them non-suitable for their use in inclusive classroom environments. It then becomes important the development of novel resources specially designed for inclusive education, or the precise adaptation or improvement of existing materials, as an essential footstep to promote and facilitate inclusive science education.

This chapter aims to provide a panorama of suitable teaching resources and strategies for the inclusive science education of blind and visually impaired students. Mainly, it aims to provide examples of what is possible to do specifically regarding activities and experiments in the experimental sciences, such as those for Biology, Chemistry and Physics at the middle school or high school level. In terms of teaching resources and adaptations for inclusion, needed to carry on the curricula in regular classrooms, two design frameworks will be discussed. In particular, how they have been applied for the development of technology-based tactile three-dimensional prototypes for teaching biology. There are also suggestions on the educational strategy to be used by science teachers who aim to provide inclusive environments.

USER-CENTERED DESIGN AND UNIVERSAL DESIGN FOR LEARNING, TWO FRAMEWORKS TO FOSTER INCLUSIVE EDUCATION

User-centered design is a design philosophy and a variety of methods for creating products that meet the needs of the users; it takes into consideration their characteristics, needs, motivations and expectations. Indeed, the users should be involved in the design process either at specific times (prototype tests, interviews, feedback, observations) or as partners in the entire design process, in order for the design to be effective (Abras et al., 2004). In the case of a user-centered design focused in persons with

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