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### ► To cite this version:

Léa Pacini, Jérôme Dupire, Isabelle Barbet, Olivier Pons, Camille Guinaudeau, et al.. Textbook's accessibility for children with dyspraxia and visual disability. 17th International Conference of the Association for the Advancement of Assistive Technology in Europe, AAATE 2023, Association for the Advancement of Assistive Technology in Europe, Aug 2023, Paris, France. hal-04410340

**HAL Id: hal-04410340**

**<https://hal.science/hal-04410340v1>**

Submitted on 22 Jan 2024

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# Textbook's accessibility for children with dyspraxia and visual disability

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## Abstract

This paper introduces the beginning of our work to design accessible textbook's for children with disabilities, first with the understanding of transcription processes then with tests with end-users.

## Keywords

LaTeX Accessibility, Special Education, Single Case Design, Disabilities

## Context

In France, the 11th February 2005 law, “for equality of rights and opportunities, participation and civic rights” supports inclusion of children with disabilities in schools. However, the access to scholarship and to the compensation means, the materials and infrastructures remains low. Our work is part of the ANR project “MALIN” (MANuels scolaires INclusifs, ie. Inclusive Textbooks). Its purpose is to make digital textbooks more accessible. To this day, only few textbooks are adapted for children with disabilities and these process are still time- and money-consuming. The MALIN project seeks, on one hand, the automation of the process and, on the other hand, the conception of a platform allowing to choose for the most fitting adaptation depending on the user. The aim of the project is to allow for a better access of textbooks for the children with disabilities but the overall goal is to provide a way to adapt the textbooks to try to compensate the difficulties children can face at school during their learning process. The core of the project focuses first on two specific populations (dyspraxic people and visually disabled people), but once expanded with other type of targeted user profiles, the created basis will make all of the students able to use the same pedagogical material. First, our goal is to better comprehend the execution of the textbooks transcription process, including the issues and needs the experts face. In order to do that, we chose an expert-centered method. The activity of transcription will be analyzed through shadowing observations. We

will work with the two following experts. The first one is the “Institut National des Jeunes Aveugles” (ie. Young Blind People National Institute, in Paris, France). This institute aims to develop the autonomy of children and provide adapted individual project with constant follow-up care during the whole education time. Hence, it also deals with transcription of textbooks and learning materials for people with visual disabilities to make access to knowledge easier. The second one is the association “Le Cartable Fantastique” (ie. The Fantastic Schoolbag), which provides resources for teachers to facilitate the education of children with dyspraxia. Dyspraxia is a neuro-developmental disorder of the coordination which means that people struggle to automate gestures. One of the resource provided is an online platform allowing to recreate the exercises of a French language textbook on a web page. The exercises are then displayed on the computer and the dyspraxic children are able to do the same thing as their peers in class, without having to hand write. The expertise of both the association and the institute will allow us to better understand the process of creation of textbooks adapted for people with dyspraxia and with visual disabilities. We will then propose a modeling of the process, which will be integrated in the platform in the form of adaptive user profile. Then, we aim to understand how these experts take into consideration the drivers, constraints and needs of the population they work for and with. This expertise and knowledge will help to think about the conception and implementation of adaption and the various features of the user profile. This will be tested by end-users using the Single-Case Design (SCD) methodology.

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## Methodology

The main issue about disabilities is the important heterogeneity between profiles, hence the consequences on the reliability of the statistical evaluations of software,

hardware and other solutions implemented. For instance, the tiredness and fine motor skills difficulties will vary a lot among people with dyspraxia. Added to this, the high comorbidity in these specific population is another problem researchers may face in randomized trials. For these reasons, it can be difficult to obtain significant results when using classical statistical analyses, as the large inter-individual variation is responsible for the excess of within variance inside the experimental group. To address this issue, there is a methodology called Single Case Design (SCD), as mentioned above. These types of design are not in opposition to classical randomized design, but rather complementary. To sum it up, each participant are at the same time the control "group" and the experimental "group". [1] define SCD as "experimental, rather than correlational or descriptive" and whose goal is to show "causal (...) relationships between independent and dependent variables". They are designs often used in special education, due to the suitability of the procedure to assess the effectiveness of the independent variable, in a participant centered manner. That is why dependent variables in SCD are mostly behaviors, for instance self-injuring behaviors. The independent variables, (i.e. what is evaluated), are called interventions and need to be actively manipulated in the experiment. To evaluate if an intervention is effective, the experimenter has to follow a precise procedure depending on the type of SCD, and meet standards set by experts of SCD [1, 2, 3, 4]. Even if some features may differ depending on the type of design, some other are to apply in every case. The basic procedure of a SCD consists in first a baseline phase (Phase A), where the experimenter measure the performance of each participant without the intervention, then apply the intervention and measure again the performance (Phase B). The phases are measured over time. This basic design is called the AB Design. Every other type of SCD requires a baseline phase and an intervention phase. The analysis of SCD is done in two steps: (1) with visual analysis and (2) with statistical analysis. According to [5], visual analysis can not be replace by any other type of analysis to represent changes in dependent variable in a comprehensive way, but "quantitative metrics can be helpful for summarizing data characteristics". The process of visual analysis have to be very well understood by SCD researchers and requires to follow correctly the guidelines and standards[6, 7], and not every data analysis techniques are appropriate depending on the data[8]. We plan to use a specific design of SCD, called Alternating Treatment Design. This design allows to compare two or more interventions in a rapidly alternated manner. We want to compare the different adaptations using SCD to see if we can find any trends in the results. In our case, we want to know which are more facilitating for dyspraxic children in terms of right answers, speed of response, but also to study their strategies when answering. We also want to assess their preferences about the different adaptations. The goal is to understand what are the abilities and the limitations of these children in order to better adapt all the various types of exercises of textbooks. In the long term, this work aims to provide resources and a "user"

template that could be re-used in other accessibility contexts, in particular in school contexts, and that could be overall applied not only to dyspraxic and visually deficient children, but to any that face difficulties at some time. At the time of the AAATE Conference, the two models from the analyze of the textbooks transcription activity as well as initial results from SCD about assessment of one of our exercise adaptations for dyspraxic people will be presented.

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