Legibility in Children's Reading: The Methodological Development of an Experiment for Reading Printed and Digital Texts

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Abstract. The aim of the present article is to address a number of essential questions regarding children reading printed and digital texts. The objective is to develop a methodological procedure with children in the 3rd year of the 1st Cycle in Municipal Schools in the city of João Pessoa, in Paraíba, Brazil. The experiments have been produced to be implemented in schools. In Brazil, the subject of digital artifacts is still regarded as being precarious; however, the children surveyed have experience with digital artifacts and digital reading.

Keywords: legibility, children's reading, experiment for reading.

1 Introduction

The present article presents part of an ongoing research project, which with experimental activities, sets out to assess the manner in which children read printed and digital textbooks.

The general aim of the research is to: develop an experimental methodology for children in the 3rd year of the 1st Educational Cycle in Brazilian state schools, in order to analyse the legibility of printed and digital texts (especially the use of infant fonts and of cursive style calligraphy) so that in the future, with the obtained results, this may contribute to the creation of favourable conditions for reading children's textbooks.

Although there are few studies regarding legibility in children's printed books, for Brazilian readers, this study has elected to focus on two types of reading (printed and digital). The main reason for this particular choice is that the Brazilian state school education authorities are increasingly adopting digital media, however printed artifacts will continue in use for a long time to come.

According to the Ministry of Education (MEC), with the aim of enabling all students to access technology, in 2012 the Federal Government distributed 600 thousand tablets to 58 thousand high schools, which were part of the Proinfo programme [8]. Moreover, according to government sources, once teachers and students have signed a liability waiver, they will be allowed to take their tablets home.

A. Marcus (Ed.): DUXU/HCII 2013, Part II, LNCS 8013, pp. 219–228, 2013.

Therefore, there is strong evidence to suggest that the use of digital artifacts in Brazilian classrooms is becoming a reality. Thus, research on legibility involving both children and digital books has become indispensable, in order to discover the real needs of children with regard to reading texts in these types of media.

2 Some Questions

A number of questions warrant special attention and should serve to support the development of this study (Figure 1)**: If children are becoming increasingly familiar with digital texts, does this signify that the use of infant fonts (Figure 1) will no longer assist in improving children's reading skills?**

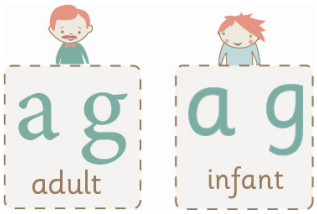

Fig. 1. Adult and infant fonts. (Source: Author)

With the frequent use of digital reading both in schools and in the everyday lives of those learning to read, would it be correct to state that cursive style calligraphy is no longer favourable to reading? Especially since, in the first cycle (1st to 3rd years) of Brazilian state schools, children still learn to read and write with the cursive style (Figure 2).

Fig. 2. Cursive style fonts. (Source: Authors)

3 Typography for Children

The main issue raised by researchers [15], [16] is that, decisions regarding parameters for children are made by adults, whether educators, with no particular knowledge concerning the design of letters, or designers, who tend to focus on aesthetic issues rather than the perception and interests of children.

There are a number of studies related to the specific development of types for children's learning, such as regular fonts that accompany the natural forms of the letters. [5]

Miranda & Vasconcelos, in their research of collecting and analysing textbooks, indicated that two problems were observed regarding the typography adopted for textbooks, such as: the use of different types, with or without serifs, as well as many variations of upper and lowercase, italics, amongst others. [9]

3.1 Legibility

This study has adopted the consensus that the term legibility refers both to the form of the letters, i.e., to recognising an individual font, as much as to the spacing between the lines, the letters and the words, which is related to the empty spaces between the lines, the letters and the words. There is also a relationship with the speed of reading, environmental factors, such as tiredness of the reader, as well as cultural aspects and the reader's skills and experience [17], [6], [3], [2], [12].

When the target is children, more specific features become involved, such as wider spacing, larger sizes of typographic font, and other determinations. It is recommended that the different needs of children and word spacing should be taken into account and a justified text should only be employed if it is absolutely necessary. In research with young readers the importance of consistent spacing is extremely relevant[16].

4 Digital Reading

Reading e-books is far more dynamic than reading printed books. The e-book may contain several layers, arranged in a pyramid. Readers can either read superficially or may explore the content more extensively. [4]

The relationship that a digital book proposes, even if virtual, promotes learning, as it allows the reader to act on the content, thus enabling a dialogue with the text [13].

However, other aspects should be considered when reading on the web. Inappropriate reading through hypertexts may cause the hyperreader to lose concentration, since it is possible to become lost in the midst of so many nodes and links, which may then cause the reader to become distressed and therefore abandon the text. [18].

It may be perceived that there is a greater freedom in reading digital artifacts. However, Xavier indicates that this freedom is not ideal, since it is the e-text producer who decides whether to make links with other hypertexts available or not (XAVIER, 2002: 173). [19]

Certain disagreements exist among researchers regarding the legibility of text in digital artifacts. Some authors (ALMEIDA,[1]; ROUET[14]; NIELSEN [11]) emphasize that reading digital artifacts may be considered more tiring, and results in lower levels of comprehension. Others (VENKITESHWAR M. SUBBARAM [18]; Muter & MARUTTO [10] on the whole, do not confirm that reading on a screen is necessarily slower or more tiring than reading printed material.

5 Methodological Development

Specifications for the implementation of the experiment were prepared from visits to four municipal schools in the city of João Pessoa, in the state of Paraíba, Brazil.

The expectation was to encounter children who were just beginning to read. However, the ideal situation would involve children who were already able to read whole words and not syllable by syllable. According to the teachers surveyed, this stage of reading would be expected in the 3rd year of the 1st Cycle (In Brazil, the State School

Education system is divided into Cycles. In the first cycle, which is the research object of this study, pupils are not allowed to fail. Thus, in any same year it is possible to encounter pupils from different levels attempting to achieve reading.) in Brazilian state schools, with children aged eight years. Below is a brief description on each school visited:

- **1st School: Colégio Frei Albino (Municipal school from 1st to 5th year)**

At this school, the average number of pupils per class is 25. The mean age in the third year is between 7/8 years and in the 4th year is 9 years. However, it is important to highlight that age differences can exist in the same year, and it would be essential to triage in order to conduct the legibility study, so that no discrepancies appear in the results.

One important aspect cited by the teachers, is that textbooks are supplied by a number of different publishers across the country, and it is left to the teachers to select books for the children from a government provided list. Teachers may select books from different publishers for the same year.

It should be emphasized that photographs were taken of various books from several different publishers in order to assess the relationship of the text on the pages of the different publications, as well as to decide if there are any major differences between one publisher and another with regard to layout. Below is an example (Figure 3):

Fig. 3. Example of a page from a 2nd year book. (Source: Author)

With regard to the picture below, it is important to mention the views put forward by teachers, and which were unanimous. In the 1st year, children learn to write in uppercase and soon after begin to develop the act of reading and writing with cursive letters. However, soon into the 2nd year, books feature lowercase typography. Teachers reported that pupils encounter great difficulties in reading and writing with this type of letter, since they are accustomed to uppercase, cursive letters. One further highlighted aspect was the whiteboard on which teachers write in the classrooms, and that directly influences the manner in which the children read and write. As in the example below (Figure 4):

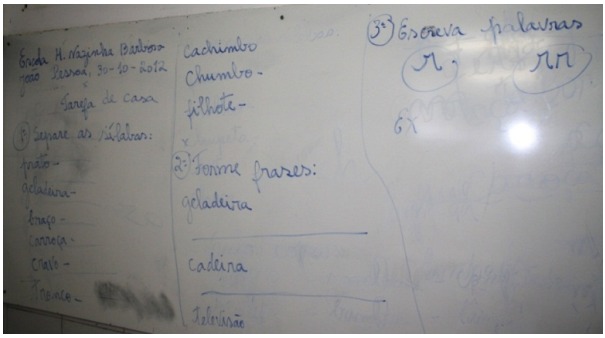

Fig. 4. Example of a whiteboard for a 2nd year class where the teacher is using cursive writing. (Source: Author)

With respect to digital reading, teachers have reported that the Government has not yet supplied the tablets. However, according to teachers, students have daily experience with computers in the computer lab at school, with many different activities, and all students have access to computers at home, therefore illustrating the facility with which pupils have contact with the digital artifact.

- **2nd School: Escola Municipal de Ensino Fundamental Nazinha Barbosa**

At the second school, the average number of pupils was the same as the first, 25 per class. The teachers surveyed reported that second year students tend to read syllable-by-syllable and with no fluency. This fluency then appears during the 3rd year, when they are able to read short lines with little difficulty. Many of the aspects cited were very similar to those of the previous school.

During the 2nd year, lowercase typography begins to appear, and is one of the teachers' most common complaints. However, by the third year, lowercase typography has become more familiar to the young readers.

- **3rd School: Escola Estadual Dona Alice Carneiro**

Until this point, visits to collect data had taken place at municipal schools. However, in order to verify the reading conditions of schools under the state authority of Paraíba, a visit was undertaken to Escola Estadual Dona Alice Carneiro.

Once again, teachers reported similar conditions to those working in the municipal schools: an average of 20/25 pupils per class; difficulties during the 2nd year with lowercase; computer lab facilities provided by the school and that children have experience with computers and digital reading both in school and at home and the manner in which the teacher writes on the whiteboard has significant influence on how children learn to read and write.

However, teachers reported that the schools run by the state government receive less financial support, which was the justification for the shortage of textbooks in the school.

- **4th School: Escola Municipal Silvana Oliveira Pontes**

This school is located in the district of Cabedelo, in the metropolitan region of João Pessoa.

This school also presents some of the previous occurrences encountered in other schools: teachers are permitted to select textbook publishers, therefore, in any one year there may be books from different publishers. The average number of pupils per class is 20. Teachers reported difficulties encountered by 2nd year pupils in relation to lowercase, and that from the 3rd year these children manage to stop reading syllable by syllable. In the 3rd year, children present a mean age of 8 years, which refers to the research object of this study. This school does not have a computer lab on its premises.

6 The Digital Textbook

Although most of the schools surveyed do not have digital textbooks, it is perceived, based on the opinions of teachers, that children interact with computers both at school and at home.

In Brazil, a number of publishers already offer digital textbooks. The aspect of the page in a digital book has continued the same as in the printed book. There has merely been a shift from one medium to another. Therefore, both the font and page layout have remained similar to printed books. Hence, when conducting the reading study with children, the tests will be the same, and the only change will be from one medium to another (from printed medium to digital). Below is a sample page from a digital textbook for the 2nd year of the 1st cycle (Figure 5).

Fig. 5. Detail of text from a 2nd-year digital textbook. (Source: Author)

7 Methodology

At the schools visited (4 in total) the average number of pupils per class is 20/25. Therefore, it was decided that the number of participants for each variable would be 25 pupils. There is a total of 2 variables: infant fonts and cursive style calligraphy.

The study groups have been divided as follows: Group 1: Digital text with infant fonts, Group 2: Printed text with infant fonts; Group 3: Digital text without infant texts; Group 4: Printed text without infant texts; Group 5: Digital text with cursive style calligraphy; Group 6: Printed text with cursive style calligraphy; Group 7: Digital text without cursive style calligraphy and Group 8: Printed text printed without cursive style calligraphy.

The assessment methods selected for the experiment are: quantity of work, errors and the opinions of readers. Below is a brief explanation of each methodological tool:

Quantity of Work: This technique may be summarized as the measurement of a reading performance through the amount of text read in a given time. Following this, questions are posed in order to assess comprehension of the text. From all tests involving legibility, this comes closest to what could be considered ideal, by demonstrating greater validity, assessing the effect of typographical aspects in real situations. [7]

Errors: Counting and analyzing the errors are also assessment criteria used in studies that seek to measure legibility [15].The number of errors is important in methodological development to reveal where and when children experience most difficulty in reading. **Opinion of the readers:** Generally, in qualitative research, the opinion of the research participant is sought through interviews or questionnaires [15]

The texts for the tests were created from the textbooks used in schools. The layout of the texts will be taken into consideration and maintained, so that they remain very similar to blocks of text in the books. All the following variables will be maintained: (a) line and body size; (b) spacing, (c) the text-figure relationship, and (d) word complexity. Below is an example of text that each group will receive during the tests. Each group will receive a reading card. The printed text reading groups will receive the text printed in black on A4 paper, and the digital screen reading groups will receive a slide with black text on a white background.

Group 1: Digital Text with Infant Fonts: The typography chosen for this first reading card was Primary Infant Sassoon. This is a typography created specifically for children, with infant fonts (Figure 6).

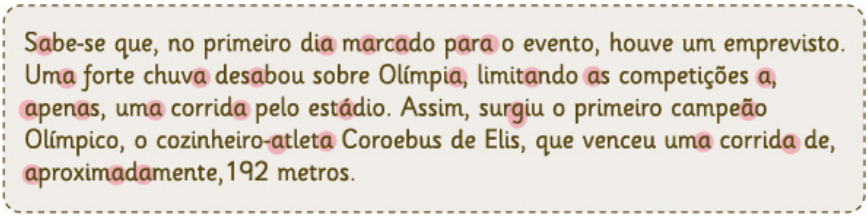

Fig. 6. Example of the reading card for Group 1. (Source: Authors)

Group 2: Digital Text without Infant Fonts: The typography chosen was Times New Roman, in many children's books, as well as the internet and digital books, this font is often used for reading (Figure 7).

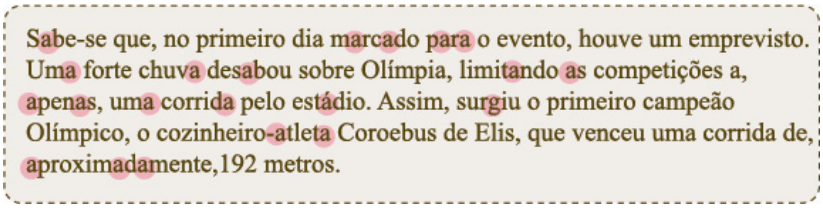

Fig. 7. Example of the reading card for Group 2. (Source: Authors)

Group 3: Printed Text with Infant Fonts: Group 3 has the same reading card as Group 1. The only change will be from the digital medium to the printed, as undertaken with the analysed books.

Group 4: Printed Text without Infant Fonts: Group 4 has the same reading card as Group 2.

Group 5: Digital Text with Cursive Style Calligraphy. The font chosen for the calligraphy style was Cursive Standard. This font is very similar to the teachers' handwriting and is the same as that which the children learn in the first phase of the 1st Cycle in Brazilian state schools (Figure 8).

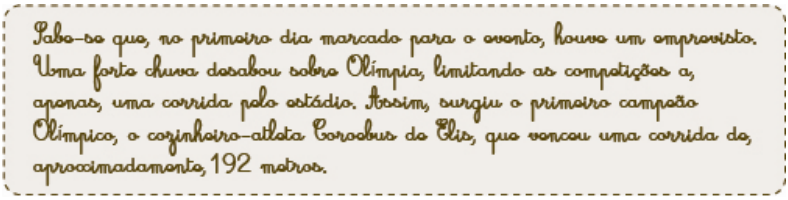

Fig. 8. Example of a reading card for Group 5. (Source: Authors)

Group 6: Digital Text without Cursive style calligraphy. The chosen font was Arial. This is one of the most used fonts in books and on the internet. Arial is most commonly used in children's textbooks. This typography does not present infant fonts (Figure 9).

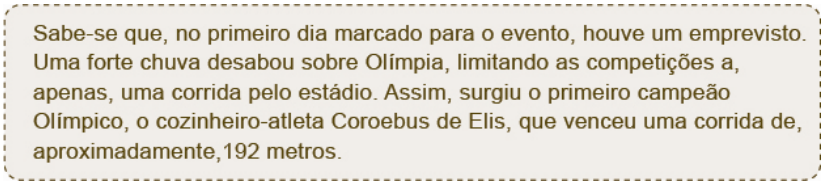

Fig. 8. Example of a reading card for Group 6. (Source: Authors)

Group 7: Printed Text with Cursive Style Calligraphy. The font used is the same as in Group 5. The only change will from the digital medium to the printed.

Group 8: Printed Text without Cursive Style Calligraphy. The font used is the same as in Group 6. The only change will from the digital medium to the printed.

Digital reading will be carried out in the school's computer lab on desktop computers. The most appropriate manner would be to conduct the experiment with tablets, however, the government has not yet provided them to schools in João Pessoa.

8 Conclusions and Final Considerations

In Brazil, many aspects in the education system are different from other countries, such as the UK, where most experiments involving children and legibility are conducted. It was perceived from the school visits, that a number of difficulties must be addressed in order to obtain satisfactory results from the studies involving legibility. Among these difficulties are: choosing schools with favorable testing conditions, such as classrooms with children of the same age; finding schools that have books for all pupils in the same classroom and schools that have good computer labs in order to perform the tests with digital reading.

With reading on digital artifacts, some authors have highlighted that legibility decreases. Tests with digital reading may prove whether this is true or not. **Is the experience of children with computers and consequently with digital reading, a way of indicating that there is no difference between reading printed or digital texts?**

With regard to the questions raised at the beginning of this article, only an experiment with children may indicate whether the use of infant fonts or cursive style calligraphy presents any difference in children's reading performance, and therefore if it is liable to affect their learning process in relation to the texts.

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