Textbook layout and the effectiveness of learning: an eye-tracking study on EFL textbook sample

La disposición de los libros de texto y la eficacia del aprendizaje: un estudio de seguimiento ocular de una muestra de libros de texto de EFL

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Linguodidáctica.
VOL. 4 (2024)
ISSN 2952-2013 pp. 1-20
https://doi.org/10.33776/linguodidactica.v4.8329

uhu.es PUBLICACIONES

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Abstract:

It comes as no surprise that teachers, including English as a foreign language (EFL) ones, meet a variety of students in their classrooms, as no student group is homogenous – in a typical (EFL) classroom usually there are some 'average' students and weak ones, some skilled and talented ones, together with those with special educational needs. The last group, limited to dyslexia, is of our special interest. It is because in the Polish schools the group of dyslexic students is getting bigger and bigger but teachers are still not trained well enough to successfully cooperate with them.
Eye-tracking studies involving dyslexia mainly concentrate on reading and writing in children with dyslexia. These studies show that dyslexics suffer from deficits in the area of language processing, which is reflected in their eye movements. However, dyslexics and non-dyslexics use the same textbooks at school. Modern textbooks are tools of multimedia teaching and learning. They also have very attractive layouts and visuals, which very often are not suitable for dyslexics. In our eye-tracking study, that was conducted with the help of SMI RED 500 eye tracker, we examined the eye movement patterns of 120 Polish teenagers (60 dyslexics, 60 non-dyslexics) working with 3 sets of materials imitating pages of an EFL textbook. We analysed 4 oculographic parameters (first fixation duration, fixation count, dwell time, revisit count), and one parameter unrelated to eye movements (answer correctness). The results show that with the use of proper layouts and designs, textbooks can minimise differences in the effectiveness of the work done, and results achieved, by dyslexic students compared to non-dyslexic ones. These conclusions are of great significance because they help equalise the educational chances of dyslexic students.

Resumen:

No es de extrañar que los profesores, incluidos los de inglés como lengua extranjera (EFL), se encuentren con una gran variedad de alumnos en sus aulas, ya que ningún grupo de estudiantes es homogéneo: en una clase típica (de EFL) suele haber algunos alumnos «medios» y débiles, otros con aptitudes y talento, junto con los que tienen necesidades educativas especiales. El último grupo, limitado a la dislexia, es el que nos interesa especialmente. Esto se debe a que en las escuelas polacas el grupo de alumnos disléxicos es cada vez mayor, pero los profesores aún no están lo suficientemente formados para cooperar con ellos.
Los estudios de seguimiento ocular relacionados con la dislexia se centran principalmente en la lectura y la escritura en niños disléxicos. Estos estudios demuestran que los disléxicos sufren déficits en el área de procesamiento del lenguaje, lo que se refleja en sus movimientos oculares. Sin embargo, los disléxicos y los no disléxicos utilizan los mismos libros de texto en la escuela. Los libros de texto modernos son herramientas de enseñanza y aprendizaje multimedia. También tienen diseños y elementos visuales muy atractivos, que muy a menudo no son adecuados para los disléxicos. En nuestro estudio de seguimiento ocular, que se llevó a cabo con la ayuda del rastreador ocular SMI RED 500, examinamos los patrones de movimiento ocular de 120 adolescentes polacos (60 disléxicos, 60 no disléxicos) que trabajaban con 3 conjuntos de materiales que imitaban las páginas de un libro de texto de EFL. Se analizaron 4 parámetros oculográficos (duración de la primera fijación, recuento de fijaciones, tiempo de permanencia, recuento de revisitas) y un parámetro no relacionado con los movimientos oculares (corrección de la respuesta). Los resultados demuestran que, con el uso de una disposición y un diseño adecuados, los libros de texto pueden minimizar las diferencias en la eficacia del trabajo realizado y los resultados obtenidos por los alumnos disléxicos en comparación con los no disléxicos. Estas conclusiones son de gran relevancia porque contribuyen a igualar las oportunidades educativas de los alumnos disléxicos.

Keywords:

Dyslexia, educational research, learning disabilities, reading research, special needs education

Palabras claves:

Educación especial, dificultad en el aprendizaje, dislexia, investigación pedagógica, investigación sobre la lectura

Fecha de recepción: 06 de julio de 2024

Fecha de aceptación: 07 de septiembre de 2024

1. Introduction

It should come as no surprise that teachers use textbooks in their classes to different extents, but the more experience they have in teaching, the more aware they are that they should use the textbook as a tool of instruction and not make it the object of instruction (Wakefield, 1998).

Proper textbook design can make learning attractive and can engage students in many different ways. In the majority of cases contemporary textbooks contain text and illustrations and as such they are just one of the many tools of multimedia teaching and learning (Mayer, 2009).

The problem that is addressed in our study concerns the fact that, despite modern student groups being relatively strongly differentiated in terms of special educational needs, all of them use the same English as a foreign language (EFL) textbooks, and that these textbooks do not take into account students' special educational needs. In almost all cases, the teaching and learning properties of textbooks are subordinated by publishing houses to visual appeal.

2. School textbooks

Although nowadays one of the valid research topics is the quality criteria of textbooks (Fey and Matthes, 2018), a design evaluation of textbooks is only one of the many aspects mentioned in the literature. Researchers are interested in such design aspects as graphic and typographical parameters, or picture and text composition (Behnke, 2018). However, the effects of textbooks on their end users (i.e. students, teachers, parents) have hardly been analysed and this area of research is still marginalised, although it would help identify criteria that influence the reception process (Fey and Matthes, 2018).

The majority of textbook research is devoted to theory-driven textual analyses, or document studies focused on textbook content, and there is a lack of data-driven research on textbook use (Hansen, 2018). There are some studies on textbook layout, but they are of a typographical character, for example, they concentrate on the effects of hard-to-read fonts on students' results (Rummer et al., 2015). There are some studies on textbook design in relation to textbook content, too (Holmqvist Olander et al. 2014). Researchers' attention is also paid to decoding information found in images (Testa et al., 2014), visual attention, and images (Chang and Choi, 2014; Pellicer-Sánchez et al., 2020; Serrano and Pellicer-Sánchez, 2022) presented in textbooks (Behnke, 2018; Author). The two latter studies are based on eye-tracking data and conclude that the way images and text are combined in a textbook should more effectively support learning.

A school textbook should be clear and readable – clarity is influenced by the contrast between the letters and the background, as well as the type of paper and print quality, whereas readability depends on the typeface and size of letters, the density of the written text on individual pages (related to space), the width of the lines, the distance between the lines (spacing), the boldness and the colour of letters. Printed text should have a uniform font size, the same line length and margin width, optimal line spacing, good print quality, correct paper whiteness (guaranteeing good paper and print contrast), and text compliant with the principles of safe and effective reading. The textbook should use a uniform typeface and the same font size, avoiding the use of italics, etc. The layout of illustrations and tables on the textbook page is also important (Hanisz, 2005, p. 469).

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An EFL textbook page consists of not only textual elements (units/chapters, headings, paragraphs, text boxes, etc.) that are located in various spatial relations to one another, and are distinguished typographically, but also of non-textual, i.e. visual ones (different fonts, boxes, images, etc.). Their task is to highlight the non-linear spatial organisation of the text and page. The typography of a textbook does not carry meaningful signs in a neutral way – instead, it is a contributor to the meaning of the text (Kolbeck and Röhl, 2018). A learning-friendly textbook layout should be characterised by clarity, coherence, consistency and aesthetics, as clarity and complexity do not exclude each other (Behnke, 2018).

3. Dyslexia

Dyslexia is a disorder involving specific difficulties in reading and writing (together with simultaneous normal mental development), it has a persistent character and can be explained neither by sensory deficits, cognitive difficulties, lack of motivation, nor a lack of reading instruction (D'Mello and Gabrieli, 2018). Developmental dyslexia is of neurobiological origin (Habib, 2000) and it is characterised by inadequate facilities in language processing, manifested in decoding and encoding difficulties (Nijakowska, 2010, p. 9). Among the most common causes of dyslexic reading problems is poor (i.e. below-standard) word identification ability. This is caused by print decoding impairments and is heavily related to phonological awareness (i.e. the ability to identify and manipulate spoken language units) (Nijakowska, 2010). Correct phonological awareness is important in alphabetic languages, because they are based on links between orthography and phonology (Siok et al., 2004). There are also other cognitive deficits seen in dyslexics, i.e. deficits in their short term or working memory, slow processing and incomplete automatization (Kuerten et al., 2019).

Developmental dyslexia is associated with the structure and functioning of the brain (Habib, 2000). There have been many studies of brain function and reading conducted with the use of various brain imaging techniques (i.e. He et al., 2013); neuroimaging studies of dyslexia have revealed that it results from differences in prereading abilities and in the regions of the brain which support these abilities (D'Mello and Gabrieli, 2018).

People with dyslexia often experience multiple problems in learning a foreign language. At the root of this are often difficulties in mastering their mother tongue related to language coding at a variety of levels (phonological, syntactic, semantic). The ease of acquiring a foreign language is significantly related to linguistic abilities in the mother tongue (Petrus and Bogdanowicz, 2004), however, dyslexia may be manifested differently in different languages. This is related to how dyslexia depends on the individual cognitive profile of the dyslexic student, the age of the student, his/her previous experience in learning a foreign language, his/her mother tongue, but also on the transparency of the language that the dyslexic student will learn (Bogdanowicz, 2011).

Due to the deficits seen in dyslexic students, some recommendations have been developed to help them perceive information. For example, at the stage of learning to read and write, it is recommended that large spaces be used between words (written in an appropriate font) in any exercises or materials prepared for them, ensuring the letters are completely legible. In addition, it should be remembered that text presented in one single block is illegible for people with dyslexia, therefore it should be enriched with illustrations. A text intended for reading should not be densely written.

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Sentences and titles written in capital letters should be avoided (words become similar to each other because they start and end at the same height). Presentation slides prepared for people with dyslexia should be devoid of unnecessary words, but should contain bullet points (instead of sentences), charts, diagrams (instead of text), and should be printed on colour paper (e.g. cream). It is also necessary to choose the colours of materials in such a way so as to reduce the contrast between the print and the background (Evans, 2001). The paper should be cream or a natural shade of white (not snow-white), matte, and in addition thick enough so any print on the reverse side does not show through. The text should not be surrounded by complicated graphic elements (Mitchell and Wightman, 2012, p. 344–345).

Students with developmental dyslexia learn visually and they acquire the material without finding links in it, on a random basis. The visual behaviour of such students is often subjected to eye-tracking research (i.e. Hyönä and Olson, 1995; Rello and Ballesteros, 2015; Kim et al., 2018, 2014; Andresen et al., 2019). From the point of view of the eye movements of dyslexic people, the most important observations have been made so far by Rayner (1998). According to him, people who read efficiently and fast perform shorter fixations, longer saccades, and the number of regressions (i.e. backward movements of the eye) is lower than in the case of people reading slowly. Moreover, people with dyslexia, as well as people who read slowly or are learning to read, perform longer fixations, shorter saccades, more fixations and regressions, irrespective of the transparency of different languages (these conclusions are also confirmed in more recent studies, e.g. De Luca et al., 2002; Hutzler and Wimmer, 2004). Although the results of research on how people with dyslexia read are often contradictory, it seems unquestionable that these people suffer from deficits in the area of language processing, which are reflected in the movements of their eyes.

When it comes to research on the perception of visual scenes (an EFL textbook combines a textual and visual message), the following conclusions are relevant from the point of view of this study: firstly, the eyesight of a person looking at the visual scene very quickly goes to a part that does not match the whole (Friedman and Liebelt, 1981); secondly, eyes focus more on important or interesting areas, and often also for a longer period of time. It has been proved that the perception of information takes place all the time during acquisition of the visual scene – the scene is understood at the beginning, but useful information from a given scene is acquired only after preliminary fixations (Rayner, 1998); thirdly, relevant information is acquired much better during fixation on given fragments of the visual scene than on fragments of the text (Rayner and Pollatsek, 1992). There are also eye-tracking studies related to the processing of multimedia information by dyslexic students (Knoop-van Campen et al., 2019, 2018; Knoop-van Campen, 2022).

4. The eye-tracking study

4.1 Research questions and hypothesis

The aim of our research is to verify whether some elements of the graphic layout of textbooks (on EFL textbook sample) are necessary and stimulating for students (here: Polish students). On the basis of eye-tracking study results we wanted to check if: (1) it is possible to identify a textbook page layout which, to the greatest extent, stimulates a student's ability to work with the textbook; (2) it is the EFL textbook layout that determines how the student works with the textbook, and the way they learn.

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To answer the above, we decided that the textbook material (i.e. set 1, set 2, and set 3) was our independent variable, whereas the visual attention on different areas of interest (AOIs) were dependent variables. The dependent variables were characterized by the four eye-tracking measures, described in section 4.2.4. We assumed the influence of the set type on the dependent variables.

We hypothesise that it is possible to influence and stimulate the way school students, both dyslexic and non-dyslexic, work with school textbooks by designing their layout in a proper way and one adjusted to their needs. As a consequence, it is possible to improve students' results.

4.2 Method

4.2.1 Participants

The total number of participants whose results were analysed in this study was 120, of whom 60 were dyslexic and 60 were non-dyslexic. The 120 participants were randomly divided into 3 equal groups (each consisting of 20 dyslexics and 20 non-dyslexic students) working with 3 different sets of layouts. All of the participants were Polish and had at least a B1 level command of English (according to the CEFR). They were also in the 2nd and 3rd grades at secondary school. By "dyslexic students" we mean those who had an official certificate from a psychological-educational counselling centre confirming their dyslexia. We did not analyse the origin of their dyslexia as the origin was of no significance to the study.

In the first group, the one working with set 1, the participants were aged 16–21 (M_{age}=18.15). In the second group, the one working with set 2, they were aged 15–20 (M_{age}=18.25). In the third group, the one working with set 3, they were aged 16–20 (M_{age}=18.05). The sex of the participants was not considered.

4.2.2 Materials

In this study, the stimuli were 3 sets of textbook material, hereinafter called the "sets". All three of them were imitations of the *Reading* section of an EFL textbook for Polish secondary school students. Set 1 (Fig. 1) mirrored a real EFL textbook page (Evans and Dooley, 2014, p. 6–7) in the colours used and where parts of the section were located. What is more, the content of the set was also taken from another, also real, EFL textbook for Polish secondary school students (Quintana et al., 2011, p. 141).

In each set seven areas of interest (AOIs) were named (AOIs are the parts of the stimulus a researcher is especially interested in). They are the same in every set and are as follows (Fig. 1–3): four pictures (photo 1, photo 2, photo 3, photo 4, located in the text in set 1 and 2, and outside the text in set 3) and 3 boxes (box 1, box 2, box 3) that changed form and location in sets 2 and 3 (box 1 and box 2 changed location, form and shape, while box 3 changed into task 6 and became just another exercise in the right-hand column).

Set 1 (Fig. 1) consisted of five exercises (two on page 6 and three on page 7), and a text (divided into four paragraphs with a photo in each of them) across the middle. There were also three boxes in the bottom right of the second page.

Set 2 (Fig. 2) was the same as set 1 from the point of view of the content, although there were two changes. Firstly, the colours used were changed to more friendly ones suitable for dyslexic students

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Figure 1. Set 1 with 7 AOIs.

Own material.

(according to the suggestions given in the literature, e.g. Evans, 2001; Bogdanowicz, 2011; Mitchell and Wightman, 2012). Secondly, the task given in set 1 in the right-hand bottom box (box 3) on page 7 was changed into the last exercise in set 2, also called box 3 there, so as to make the data in it more readable.

Set 3 (Fig. 3) was the same as set 2 except for the location of the pictures. In set 3 they were located in the upper left-hand corner, whereas in the two previous sets they were located within the paragraphs of the text itself.

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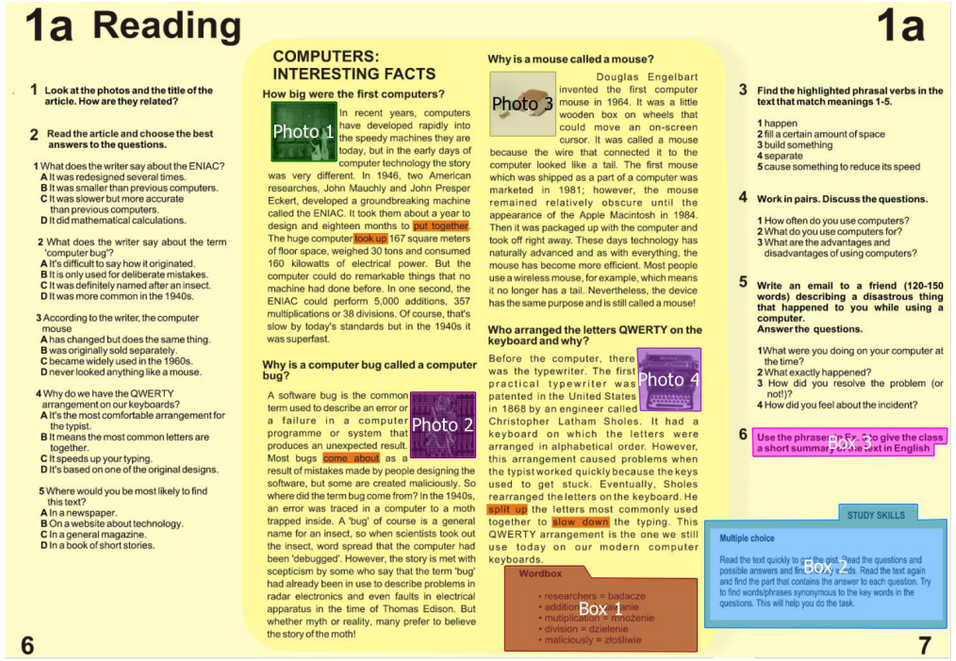
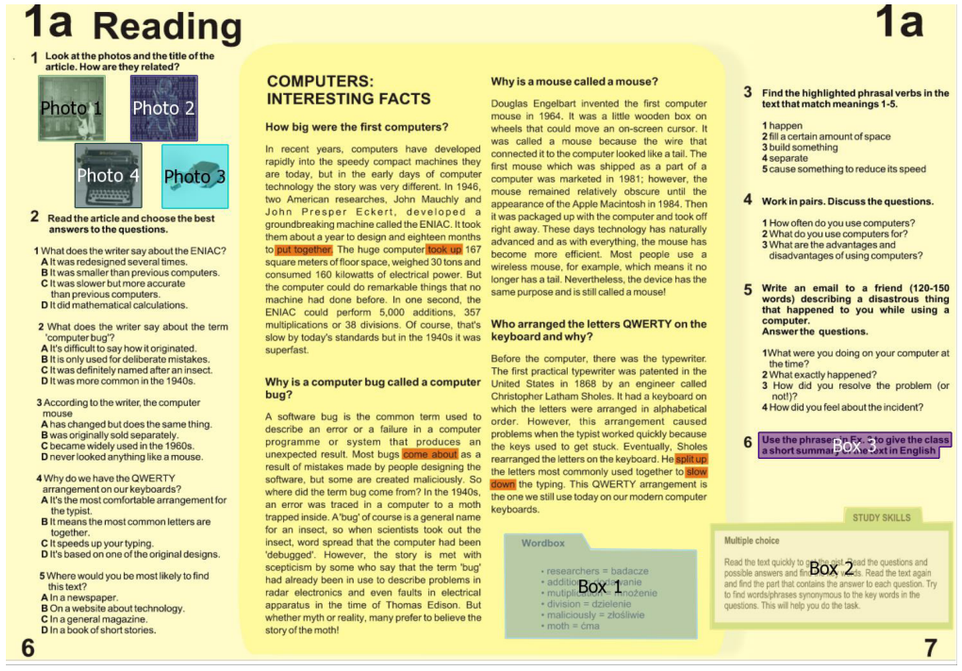
Figure 2. Set 2 with 7 AOIs.



Own material.

Figure 3. Set 3 with 7 AOIs.



Own material.

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4.2.3 Procedure

After signing a written consent form, participants were seated in front of a monitor with an eye tracker, where 9-point calibration and validation were performed. The test began with a few questions to elicit personal information. The participant was given general instructions of what they would be expected to do and then a randomly chosen set was displayed on the monitor and the participant heard the first task. They were supposed to read the given text and complete the sentences in exercise 2 with the proper ending out of four given (a, b, c, d). When the task was completed a second one was heard. This time the participant's task was to match the words that were highlighted in the text with their definitions given in exercise 3. There was no time limit.

After completing the tasks, the participant had to answer six open-ended questions related to the layout of the set (the questionnaire's questions were the same for all three sets).

4.2.4 Eye-tracking measures

Participants' eye movements were recorded with the SMI RED 500 eye-tracking system with a sampling rate of 250 Hz. Participants sat in front of a 21-inch monitor at a distance of about 60 cm. SMI BeGaze 3.7 software was used for fixation and saccade detection and raw data cleaning. For statistical analysis and data preparation, IBM SPSS Statistics was used.

The following eye-tracking measures were used to analyse the results:

- first fixation duration, i.e. the duration of the first fixation at a particular AOI; this reflects the time taken to recognize and identify a part of the stimulus image (Holmqvist et al., 2011).
- fixation count, i.e. the number of fixations in each trial correlated to total dwell time (Holmqvist et al., 2011). The higher the number of (overall) fixations, the poorer the search capacity of a participant or the poorer the structure of the stimuli. On the other hand, more fixations on a particular AOI may indicate that the AOI is more important and/or more noticeable to the participant than the others (Poole et al., 2004).
- dwell time, i.e. one visit (measured from entry to exit) to an AOI. This is a sum of all the fixations and saccades in a particular AOI (Holmqvist et al., 2011).
- revisits (revisit count), i.e. a transition to an AOI that has already been visited (Holmqvist et al., 2011).

4.2.5 Data analysis

In our study, the textbook material (i.e. set 1, set 2 and set 3) was our independent variable, while visual attention expressed by eye-tracking parameters in relation to different areas of interest (AOIs) were the dependent variables.

The normality of all dependent variables was assessed. The Shapiro-Wilk test indicated that none of the dependent variables has a normal distribution. Assessments of the statistical significance of the results were made using the non-parametric Kruskal-Wallis test. All analyses were performed with IBM SPSS software.

The areas of interest that are analyzed in this study are similar in size as well as shape. For this reason, modeling of the values of the oculographic parameters, adjusting them to a size criterion, was not used (Rets, 2021).

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4.3 Results

The results of the study are presented according to the above mentioned eye-tracking parameters and, finally, the correctness of the given answers.

4.3.1 First fixation duration

The collected data on FFDs (table 1) is statistically significant: $X^2(2)=13.612$, $p=0.001$.

Table 1. Eye-tracking index of first fixation durations [s] for dyslexic and non-dyslexic participants in the areas of interest (AOI).

	D			ND		
AOI	S1	S2	S3	S1	S2	S3
Photo 1	4.04	3.20	2.99	4.04	3.10	3.44
Photo 2	4.19	3.85	3.01	3.73	4.27	3.79
Photo 3	3.43	3.72	2.87	3.16	3.64	1.47
Photo 4	4.57	4.08	2.79	3.44	3.93	4.51
Box 1	1.23	6.30	4.46	1.42	4.46	5.08
Box 2	5.78	2.43	2.71	4.16	3.54	2.62
Box 3	0.90	1.14	0.96	0.40	1.10	1.06

Note. D – dyslexic, ND – non-dyslexic, S1 – set 1, S2 – set 2, S3 – set 3.
Own elaboration.

Table 1 shows that in the case of dyslexic participants the average FFD is shorter for every photo in set 3 compared to the two other sets (there is no such relation in the case of non-dyslexic students). This observation is crucial as it means that in the case of dyslexic students photos located in the text can increase unnecessary (visual) inattention and distraction.

Substantially longer FFDs on box 1 in sets 2 and 3, for both dyslexic and non-dyslexic participants, should also be emphasised (in sets 2 and 3, box 1 was located closer to the text that was read and its design as well as the content were modified).

However, FFDs on box 1 in the group of dyslexic students were highest in set 2, not set 3. The opposite relation was found in set 3 in the case of non-dyslexic students.

The changes in the form or location of the boxes in set 2 and set 3 resulted in a decrease in FFDs. That means they became less visually attractive. However, in set 3 the change to box 3 resulted in an increase in FFDs in the group of non-dyslexic students.

4.3.2 Fixation count

The fixation count shows the average number of fixations on particular AOIs (table 2).

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Table 2. Eye-tracking index of fixation counts for dyslexic and non-dyslexic participants in the areas of interest (AOI).

	D			ND		
AOI	S1	S2	S3	S1	S2	S3
Photo 1	108	105	45	76	118	59
Photo 2	96	71	33	63	59	44
Photo 3	187	167	30	124	130	36
Photo 4	69	68	41	72	79	63
Box 1	41	240	330	26	270	343
Box 2	405	41	90	176	57	45
Box 3	20	8	8	3	6	5

Note. D – dyslexic, ND – non-dyslexic, S1 – set 1, S2 – set 2, S3 – set 3.

Own elaboration.

All the data on fixation counts is statistically relevant as $X^2(2) = 43.225$, $p<0.001$. The data, as presented in table 2, shows two very important tendencies, i.e. a decrease in the fixation count for the photos, box 2 and box 3, and an increase in the fixation count for box 1. In the case of the photos, it is noticeable in both groups of participants, i.e. dyslexic and non-dyslexic ones, that placing the photos within the text (sets 1 and 2) is unfavourable from the point of view of fixation count. Such a location helps increase the visual attention paid to them and dyslexic students especially are susceptible to it. These are, though, dyslexic students who easily lose concentration because of this, among other ways. The consequence of all this may be greater distraction, inattention, losing the thread of what is being discussed, etc. and that may result in the task being completed less well. On the basis of all this, it seems that the best location for the photos is to remove them from the text to be read, as was done in set 3.

What is more, the changes made to the parameter for box 1 should be emphasised. In sets 2 and 3, box 1 was moved closer to the text and its content was modified in such a way so as to make it more useful for the students, especially those dyslexic ones. All these changes the fixation count for box 1 in sets 2 and 3 to sharply increase in both groups of participants.

Another difference that should be noticed is one between set 2 and set 3. It seems that placing the photos outside the text caused a change in the visual attention destination – now, the only graphic element in this area is box 1 and only it draws visual attention there. On the basis of this, it can be concluded that it is possible to consciously steer and control students' attention through proper location of different parts of their EFL material.

It should also be noticed that there was a significant decrease in the number of fixations on two other boxes, especially box 2.

Data for box 2, however, proves the observation about the importance of consciously locating the parts of any material – the further something is from the text to be read, the fewer fixations on it. This is a very important conclusion – the difference in the number of fixations on box 2 in set 1 (in the

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group of dyslexic and the group of non-dyslexic students) is rather big, as the dyslexic pupils fixated 2.3 times more than the non-dyslexic ones.

In set 2 and set 3, box 3 transformed into an ordinary exercise, presented in a standard form that was identical with the rest of the activities. The consequence was a decrease in the number of fixations. This decrease further proves the conclusion that has already been made about the need for conscious use of graphic elements and colours in textbooks. There is no need to highlight parts that are not of major importance on a particular textbook page (this is the case with box 3 – its content was just a task to be completed orally). Eye-tracking data shows that such highlighting is the reason for the student's distraction. In the case of dyslexic students, it can aggravate their inattention and distraction, which should naturally be avoided.

4.3.3 Dwell time

Data on dwell time confirms the previous observations. It is statistically relevant as $X^2(2)=41.643$, $p<0.001$ (table 3).

Table 3. Eye-tracking index of dwell time [s] for dyslexic and non-dyslexic participants in the areas of interest (AOI).

	D			ND		
AOI	S1	S2	S3	S1	S2	S3
Photo 1	25.49	24.66	8.77	17.30	24.62	13.97
Photo 2	23.23	13.97	7.16	15.35	12.58	10.25
Photo 3	56.69	43.27	5.07	31.75	32.44	7.98
Photo 4	16.37	17.44	7.88	17.25	17.40	13.92
Box 1	9.13	83.72	102.78	5.33	83.11	109.18
Box 2	135.71	9.02	23.33	44.51	12.09	9.88
Box 3	4.99	1.41	1.46	0.96	1.10	1.43

Note. D – dyslexic, ND – non-dyslexic, S1 – set 1, S2 – set 2, S3 – set 3.

Own elaboration.

In set 1, dwell time on a particular AOI in the group of dyslexic students was definitely the longest for box 2 and then for photo 3. In the case of non-dyslexics, the dwell time on box 2 and photo 3 was longest, too, but at the same time it was definitely shorter in comparison to that for dyslexic students. This means the latter group were more susceptible to looking at these two graphic elements. It should be remembered that interest in photo 3 was definitely influenced by its location (the upper left-hand corner of the third paragraph, so it was surrounded by text from 3 of its 4 sides – such a location for the picture increases the probability of focusing one's eyes on it).

For the photos in all three sets, the dwell time was shorter in every subsequent set in the case of dyslexic students. This may be reason to conclude that they were the most visually attractive thing in set 1, which was very colourful itself; they were a bit less attractive in set 2, which was not that vivid, was

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more subdued; and they were least attractive in set 3 where the photos were located outside the text area. In set 3, dwell time was slightly longer in the case of two photos located in the upper left-hand corner of the material (but they were still closest to the text), although the dwell time was the shortest compared to the other two sets. However, the photos that drew the most visual attention in set 3 were located closest to the left margin of the page and, at the same time, were further from the text.

Surprisingly, in the group of non-dyslexic students, photo 1 turned out to be less attractive in set 1 (its location remained the same).

4.3.4 Revisit count

The last parameter is the revisit count (table 4).

Table 4. Eye-tracking index of the revisit count for dyslexic and non-dyslexic participants in the areas of interest (AOI).

	D			ND		
AOI	S1	S2	S3	S1	S2	S3
Photo 1	61	66	16	49	79	29
Photo 2	60	43	15	37	32	20
Photo 3	117	106	12	79	83	18
Photo 4	40	38	21	40	47	33
Box 1	18	73	97	3	87	97
Box 2	154	16	24	61	30	15
Box 3	5	1	2	0	0	1

Note. D – dyslexic, ND – non-dyslexic, S1 – set 1, S2 – set 2, S3 – set 3.

Own elaboration.

Data on the revisit count is statistically relevant as $X^2(2)=16.436$, $p<0.001$. In set 1, the biggest number of revisits was for photo 3 in the group of dyslexic students. A similar thing happened with photo 2. In the group of non-dyslexic students, the biggest number of revisits was for photo 3 and photo 1 in set 2, though. When comparing the data for all the photos, it is easily noticeable that the smallest average number of revisits in both groups of students was for the photos in set 3. On the basis of this, it can be concluded that the location of photos is of great (unconscious) importance to students (both dyslexic and non-dyslexic ones). So, once again, it is proved that locating photos outside a read text changed the values of eye-tracking metrics, and, as a consequence, weakened visual interest in these AOIs.

Table 4 also shows a change in the number of revisits by both dyslexic and non-dyslexic students to box 1, i.e. a very important AOI, and to box 2, i.e. an unimportant one. In the case of box 1, moving it closer to the text that was read caused a decrease in first fixation duration, but it also increased the number of revisits to this AOI. And that was precisely the aim of the changes made to the sets.

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Similarly, moving box 2 further from the text resulted in a decrease in visual interest in it. This can be seen in the revisit count regarding it.

One important observation that must be made relates to the bigger number of revisits to box 1 in the case of set 3, in comparison to set 2. It is not clear why there is such a difference between sets 2 and 3 if, in both of them, box 1 was situated in the same part of the set and it looked exactly the same. The only difference between set 2 and set 3 was the location of the photos. This might have caused more visual interest (and more fixations) on the only graphic element, i.e. box 1, in this part of the page (when the photos were taken from the text there was no other graphic element nearby except for box 1) in set 3. However, a more important observation is not the difference between set 2 and set 3, but the different results for set 1 and the two other sets.

4.3.5 Correctness of the answers

All the above eye-tracking metrics are important from the point of view of the difference in the spread of visual attention in both groups of students as regards different parts of the sets, depending on their design and layout. But the most significant consequences of the changes introduced to set 2 and set 3 are shown in table 5.

Table 5. The average correctness of the answers [%] by dyslexic and non-dyslexic participants.

	D			ND		
	S1	S2	S3	S1	S2	S3
% of correct answer	66	69.5	69	77.5	64	68.5

Note. D – dyslexic, ND – non-dyslexic, S1 – set 1, S2 – set 2, S3 – set 3.

Own elaboration.

Table 5 shows changes in the percentage of correct answers depending on the set. In set 1 the difference between the number of correct answers given by dyslexic students and non-dyslexic ones is significant (more than 11.5%; dyslexic students gave more incorrect answers). In set 2 a difference also is seen but this time it is non-dyslexic students who gave more incorrect answers. What is more, the difference itself is smaller at 5.5%, which is half that in the case of set 1. In set 3, however, the difference is almost non-existent – at only 0.5%, and in favour of the dyslexic students. However, in the case of non-dyslexic students there occurred a fall in the number of correct answers in set 3 compared to set 1.

These results are of great significance. They show that the layout and graphic elements of EFL material cannot just influence the final educational results, but also equalise the chances of dyslexic and non-dyslexic students.

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5. Discussion

The present study verified whether changes in the layout and location of some parts of an EFL textbook page could influence the way dyslexic and non-dyslexic students work with it. As a consequence, it verified if it is possible to stimulate the process of how the material is perceived by these students. The results of the study provide supporting evidence that the way a textbook page is designed influences the way school students, both dyslexic and non-dyslexic alike, work with it.

5.1 The influence of layout changes on eye movements

The three sets presented above differed only from the point of view of their layout, but not their content. The collected and analysed eye movement data proves that changing the location of the pictures as well as the boxes is of great importance from the point of view of the visual behaviour of the students.

In the case of the photos, it turned out that if they are located in the text that is to be read they attract the attention of the reader. This was reflected mainly in dwell time and revisit parameters. The latter accords with prior observations that unusual or different parts of a scene attract the visual attention of the viewer (Friedman and Liebelt, 1981; Rayner, 1998). For dyslexic students any additional and unnecessary activity of that type may result in inattention and distraction and missing the gist of the text that is being read. As a consequence, this may influence the final results achieved by such students. If the photos are moved away from the text area, they do not distract the readers as much and this may be the factor that helps them complete the task without any significant disturbances. What is more, the fact the photos were only moved but not removed is important because the textbook page is still enriched with illustrations, which is advisable in the case of dyslexic students (Evans, 2001). However, they are not distractors *per se* any more.

In the case of the boxes, it was proved that the further from the text the box is located, the less visual attention is paid to it. If the box is not relevant to the task (as was the case with boxes 2 and 3) then it is better to decrease the level of attention paid to it. However, in the case of important boxes that are relevant to the task (as was the case with box 1) the more attention, the better. This is especially important in the case of dyslexic students for whom this type of help can be of great importance (box 1 provided useful information on the meaning of selected words). The fact that the change of location (i.e. moving it closer to the text that was read) increased the number of fixations on it confirms the suggestions for dyslexic students aimed at helping their perception of information (Bogdanowicz, 2011). It is also helpful for non-dyslexic students.

5.2 The influence of layout changes on the correctness of answers

A visible implication of the changes introduced to the EFL textbook page, but one that requires further analysis, was their impact on the correctness of the answers given by the dyslexic students.

The smallest number of correct answers given by dyslexic students in comparison to the non-dyslexic ones was found in set 1. It seems that the more colourful and visually attractive the textbook page, the more difficult it is for dyslexic students to work with it. Similar conclusions were drawn by Evans (2001).

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A lack of photos in the text area (in set 3) resulted in a slight decrease in the number of correct answers given by dyslexic students. This time their results were as good as the results of non-dyslexic students. That means a conscious change made to the layout can equalise their educational chances with those of non-dyslexic students, although the latter gained the best results while working with set 1.

5.3 Stimulating both groups of students

The above results are of huge importance from the social point of view as they show that wise and conscious planning of the textbook layout can support particular groups of students in their work with the textbook, as well as with their final results. However, further work is needed to understand how to increase the results of dyslexic students and avoid decreasing those of non-dyslexic students at the same time.

6. Conclusions

The results of our study support the assumption that the way the textbook material is planned and designed on the page of the textbook is significant from the point of view of the way dyslexic and non-dyslexic students work with it and, finally, from the point of view of the results they achieve.

On the basis of the above eye-tracking study, the research questions should be answered in the following way: (1) yes, on the basis of eye-tracking study results, it is indeed possible to indicate the textbook page layout which to the greatest extent facilitates (stimulates) a student's way of working with the textbook – in our case it is set 3; (2) yes, the EFL textbook layout determines how the student works with the textbook, and, as a consequence, how they learn. However, it should be how the student works that determines the textbook layout.

It can be said that the conscious design of such an EFL textbook page to some degree can be a help and/or a distractor. What is more, wise planning can stimulate the final results of dyslexic students especially, making them become as successful as non-dyslexic ones. This is a crucial conclusion of immense social value.

However, adapting textbooks for the optimal use by dyslexic students cannot happen at the cost of the non-dyslexic students' disadvantage, as it turned out in sets 2 and 3, comparing to set 1. A colourful, contrastive and visually attractive piece of textbook material draws and keeps student's involuntary attention, which is very important in the process of teaching and learning (Dakowska, 2001), as cognitive processing is supported by visually appealing learning materials (Mayer and Estrella, 2014). Comprehension may be fostered by well-designed learning materials (Park et al., 2015, Plass et al., 2013). They may as well reduce the difficulty of learning tasks (Um et al., 2011). On the other hand, some suggest avoiding decorative elements to reduce cognitive load (Chandler and Sweller, 1991). The problem in the case of non-dyslexics' advantage should be further analysed, as the decorative elements in some groups are not only distractors (Magner et al., 2014), but may support learning if learner characteristics and their learning goals are taken into account (Behnke, 2018). The example is box 1 which, when placed closer to the text area, facilitates the text reading, as well as photos which are an important part of the material. However, the influence of their location

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in the materials should be considered. The colours used also need more consideration as the ones suggested for dyslexics (cream or yellowish background instead of snow-white etc.) were not so welcome by both groups of participants as they are used to the snow-white ones (questionnaire results, not analysed in this paper). Therefore, further eye-tracking studies (but also questionnaire-based ones) on both dyslexics and non-dyslexics are needed as to make their learning chances equal, but not at each other's cost.

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Financing

This study was partially supported by the research grant No. 206428/E-343/S/2017-1 "Kształtowanie kompetencji językowych u uczniów z dysleksją rozwojową" [Shaping language competence in students with developmental dyslexia] from the Polish Ministry of Science and Higher Education for the year 2018.

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