

Retrospective Study on the Development of Children with Specific Learning Disorders during the Pandemic (COVID-19) in Greek Primary School Students

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Abstract

This is a retrospective research project, the idea of which was born by the observation of the clinical cases, which were related to the diagnosis of Specific Learning Disorders. Key to the fruition of this work was the interest to object regarded the impact of e-learning education on children with Specific Learning Disorders -most of them pupils attending primary school- in the covid-19 era.

More specifically, the aim of the research is to study the effects of e-learning education, implemented during the pandemic period, on the learning of primary schools' children with a diagnosis of Specific Learning Disorders. The material of the study came from the examinations of these children during their treatment and observation by the Child and Adolescent Service of the Byron-Kaisariani Community Mental Health Centre in the academic years 2019-2020 and 2020-2021. The total sample concerns 140 children with "Specific Learning Disorders", specifically 90 boys (64.3%) and 50 girls (35.7%). The above sample was divided into two subgroups, the first represents children (n = 73) who were assessed at the service during the academic years 2019-2021 (COVID-19 period) and who were attending e-learning education (Webex), while the second was the control group (n = 67) that had been assessed at the service before the pandemic and had been taught exclusively through face-to-face education (academic years 2017-2019). The main variable in this research was the teaching method, either "e-learning" or "face-to-face" education, while the individual variables assessed on the basis of this teaching were: "reading" (more specifically "rate"), "text comprehension", "vocabulary", "spontaneous written expression (spelling errors)", and "spatiotemporal concepts (days and months).

Keywords: Specific Learning Disorders; e-Learning Education; Face to Face Education; Pandemic; Reading Rate; Spelling Errors; Spontaneous Written Expression; Primary Education

Introduction

In 2019, humanity was unexpectedly confronted with a new virus, SARS-CoV-2, which evolved into the largest pandemic in recent decades. The outbreak of this virus brought about rapid developments, both short-term and long-term. The short-term developments concerned the impact on health, which initially attracted all the attention due to the immediate risk to public health, while the long-term developments concerned the areas of social and working life. As part of its research into the long-term effects of the pandemic, the OECD (Organization for Economic Co-operation and Development) looked at the impact on education and came to the following conclusions. On the one side, in 2020, 1.5 billion students in 188 countries did not attend in-person classes at their schools, while on the other side, the majority of students attended distance learning classes through e-learning platforms (Webex), which caused major disruption to the learning process.

The closure of schools was a result of the restrictive measures adopted by governments around the world in order to halt the spread of the virus. At the same time, there was an attempt to create a new model of education, that of "e-learning". The problems in its implementation were related to the accessibility (material and technical infrastructure) for all students and the quality of the knowledge provided. Additional problems included the inadequate training of teachers and the loss of all the benefits that students derived from face-to-face education [1].

The impact of distance learning - International research data

The COVID-19 pandemic has had a negative impact on all aspects of human activity. The model of "e-learning" was adopted worldwide, but OECD studies showed that the lower socio-economic strata did not have access to it because they could not afford the cost of "digital equipment" and internet connection. Knowing this information, it is clear that the new education model exacerbated social inequalities by excluding a large student population from educational process which, according to the Salamanca Declaration of 1994, has been defined as a public good. In particular, the results of the School Education Gateway survey, conducted between April 9 and May 10, 2020, in more than 40 countries, show that immediately after the outbreak of the COVID-19 pandemic, the majority of teachers (66.9%) were asked to teach online for the first time. In addition, many teachers had problems accessing technology (computers, software, reliable internet connection, etc.). The same survey found that the exclusive use of distance learning had a detrimental effect on students' education in the following areas:

- Less time is devoted to the learning process [2].
- Students experience intense stress [3].
- A change in the way students interact is imposed [4,5].
- The lack of motivation to learn is intensified [6].

According to an OECD report and a Harvard University study, the long-term effects of school closures will impact the economy, as students are a potential productive resource for every country. Observing the reduced skill development associated with the implementation of e-learning, according to researchers Eric Hanushek and Ludger Woessmaun (2020), it is expected that over time, these students will have a 3% lower income throughout their lives for every three months of lost effective learning time. Extending these estimates, a lost school year equates to a loss of income throughout working life of between 7% and 10%. This loss should be added to the financial losses suffered by families and the state, as schools remain closed and many working parents are forced to stay at home. The same study concludes that the long-term cost is around \$504 billion for South Africa and \$14.2 trillion for the United States.

According to a report by the European Commission (2021), the impact of e-learning, beyond the limitations that emerged in relation to its universal application, focused on the emergence of negative emotions in students, such as anxiety, sadness, dissatisfaction, and

depression due to the lack of interaction with their classmates and teachers. Physical and emotional well-being were compromised due to the inability to attend and access structured activities and support services provided in the school setting. Socialization was greatly affected thanks to the distancing and isolation measures that were in place to limit the spread of the virus. Research in the European Union also found that social inequalities were exacerbated, as students in remote or rural areas, as well as migrant and refugee children, were at risk of being excluded from online learning. Another major issue was the proportion of students with special educational needs, as they were deprived of access to supportive education programs and special therapies.

The Greek reality followed global and European dictates both in terms of the implementation of distance learning and the imposition of universal lockdown measures. In addition to the above, concerns have been raised about the quality and effectiveness of this type of education, the transfer of educational responsibility to parents, and the questioning of both the assessment process and the grading of students.

As a result of this unprecedented crisis caused by the pandemic, the educational process was limited to covering the curriculum and renegotiating issues of cooperation, support, and encouragement for students. Although teachers attended training seminars in order to respond to the new educational model, they encountered difficulties in implementing it and assessing students. In particular, it was especially difficult for them to form an opinion about their students (personality traits, abilities, and weaknesses), especially for those in the early grades of elementary school.

Naturally, the assessment process is being questioned because written exams cannot be considered objective, not only because of problems that arose during the online connection, but also because they were often done with the help of parents or books. This situation led many teachers to assign tasks that focused more on information retrieval, critical thinking, time management, and abstract reasoning rather than preparation for the next lesson. However, even in this case, parental involvement was greater than expected, with the result that the students' ability in such activities was not clearly apparent. Furthermore, this approach often seemed to shift the burden of education to the home environment and, more specifically, to the parents themselves [7,8].

This study

By studying international research data and taking into account the learning profile of primary school children in the context of clinical practice, the idea arose to investigate the corresponding data in the Greek context. More specifically, we looked at the effects of "e-learning" during the pandemic on the learning profile of children diagnosed with learning disorders who were attending primary school during the two major lockdowns. Taking into serious consideration data from international studies showing that children with learning disorders were more affected than their typically developing peers, because, on the one hand, they were deprived of the help provided by the school through their participation in supportive educational programs (participation in the integration department, Specific Educational Program), while on the other hand, many of them were forced to interrupt the special therapeutic interventions they were following (e.g. speech therapy, occupational therapy, etc.) [9].

Aim of Research

The aim of this retrospective study is to investigate the impact of "e-learning" on students with Specific Learning Disorders who were enrolled in primary education during the academic years 2019-2020 and 2020-2021. The data on these effects emerge from a thorough comparison with a corresponding group of students who attended "in-person" education in the period before the pandemic.

Research Hypotheses

The research hypotheses are as follows:

- It is expected that children who attended “face-to-face” education will have a faster reading rate than those who attended “distance learning”.
- It is expected that children who attended “face-to-face” education will have fewer vocabulary deficits than those who attended “distance learning” (comparison of vocabulary analysis).
- It is expected that children who attended face-to-face education will have a more complete understanding of the text than those who attended distance learning.
- It is expected that children who followed “face-to-face” education will have fewer spelling errors than those who followed “distance learning”.
- It is expected that children who attended face-to-face education will have fewer deficits in the concepts of space and time than those who attended distance learning.

Methods

Participants and procedure

The study material is part of the clinical population that resulted from the examination of children with learning disorders at the Child and Adolescent Mental Health Service of Byron-Kaisariani during the academic years 2019-2020 and 2020-2021. It concerns 140 children with “learning disorders”, specifically 90 boys (64.3%) and 50 girls (35.7%). All children are primary school students. The sample was selected using the logical or judgmental sampling method, i.e. all participating children have specific characteristics (they attend primary school, normal mental capacity) with the sole selection criterion being the existence of specific learning disorders.

The above sample was divided into two subgroups for the purposes of the study. The first subgroup represents children ($n = 73$) who were assessed at the service during the academic years 2019-2021 (COVID-19 period) in order to investigate the causes of their difficulties, and who were attending primary education via distance learning (Webex), while the second is the control group consisting of a corresponding clinical sample ($n = 67$) that had been assessed at the service before the pandemic and had been taught exclusively through face-to-face education (academic years 2017-2019).

Children with mental disabilities were excluded from the overall clinical sample through cognitive testing, while those with severe pre-existing psychopathology were excluded through child psychiatric assessment.

Participation was voluntary, with the consent of the parents and within the framework of clinical practice, following the diagnostic process that included psycho-pedagogical, psychological, child psychiatric, speech therapy assessment, and occupational therapy as appropriate, as well as a detailed individual developmental history and school history. With regard to the individual developmental history, emphasis was placed on the existence of perinatal problems, which have been found to be associated with the development of Specific Learning Disorders [10].

A descriptive analysis and processing of the data was carried out in three phases. In the first phase, all the characteristics included in each child's individual file were recorded, relating to demographic data (gender, school grade, area of residence, parents' educational level, and parents' occupation). In the second phase, the data recorded in the first phase were processed and the children's cases were classified according to the demographic and specific characteristics that emerged from their assessment (diagnostic process), taking into account the variable of the mode of education (“e-learning” and “face-to-face”). In the third phase, the above characteristics (as recorded in the second phase) were analyzed based on correlations and percentage ratios.

Instruments

The psycho-pedagogical assessment aimed to check for the existence of Specific Learning Disorders (SLD) in all three areas of learning (reading and text comprehension, spontaneous written expression, and numerical abilities). Specifically, three different texts were used to assess reading and text comprehension, depending on the age and grade of each child, which were selected because they are standardized diagnostic tools of the Medical-Educational Service of Byron-Kaisariani [11,12].

The reading aloud of the text is recorded and the following are taken into account: the recognition of letters, consonant clusters, and diphthongs (those that are not recognized are noted), syllabification, and reading rate, which is characterized as: normal, slow, fast, steady, and variable. In addition, during the reading of the text, particular characteristics are observed and noted concerning the manner of reading, the movements of the reader's (child's) body, the use of hands or objects (e.g. pencil) as guides, as well as the distance and position of the reader's (child's) body. Reading errors are also recorded (syllabification, mispronunciation, omission, substitution, reversal, addition, repetition, omission of punctuation marks, and skipping lines).

Vocabulary is checked, unknown words from the text are noted, and the definitions given by the child to the vocabulary requested by the examiner are recorded. The definitions are characterized as: accurate, expected, incorrect and circumlocutory, while ignorance of words and conceptual confusion are also assessed. Performance in terms of text comprehension is recorded and characterized as: complete, incomplete, fragmentary and none, while it is also noted whether there is any addition of information, causal correlation of information in the text, or whether the reader (child) understands only when the text is read by a third person (examiner) and at what level (absolutely, incompletely, fragmentarily, or not at all). In addition, the ability to reconstruct the meaning of the text (narrative ability) is assessed in relation to the following parameters: a) form (flowing or answering questions), b) identification of subjects, c) identification of spatiotemporal parameters, and d) how sentences are connected (paratactic, causal, temporal, hypothetical, antithetical, or using periphrases). Spontaneous written language records errors found at the level of letter, syllable, word and sentence writing, confusion between lowercase and uppercase letters, complete or partial inability to follow grammatical, orthographic and syntactic rules. Such errors include: misplacement or absence of accent marks, omissions (of letters, syllables, words), substitutions (of letters, syllables, words), inversions (of vowels, consonant clusters, syllables), additions (of letters, syllables), repetitions (of letters, syllables, words), word fusions, non-use or incorrect use of punctuation marks, and spelling errors [10].

In the assessment of numerical abilities, errors related to weakness or confusion are recorded: recognition, writing, and understanding of numbers, symbols, or arithmetic terms, arrangement and management of arithmetic operations, selection (incorrect or random) of arithmetic operations to solve problems.

The psychological examination was conducted using the Wisc III psychometric tool for children and aimed to assess each child's mental potential.

Results

The main variable in this study was the teaching method, either "e-learning" or "face-to-face" education, while the individual variables assessed on the basis of this teaching were: "reading" (more specifically "speed"), "text comprehension", "vocabulary", "spontaneous written expression (spelling errors)", and "spatiotemporal concepts (days and months)", as determined by the psycho-pedagogical

* (The Wisc-iii version was used instead of the Wisc-v because the "in-person education" group had been assessed using the Wisc-iii-reasons for compatibility of results-use of the same psychometric tool).

assessment. The independent variables used were the children's "gender", "grade level", "parents' educational level (father-mother)", and "parents' occupation (father-mother)." Based on the correlations that took place, in the context of the descriptive analysis of independent variables, namely: "parents' educational level" and "parents' occupation", it was not found that the results of the study were significantly affected.

As shown in [diagram 1](#), the dependent variable "e-learning" and the variable "slow reading rate" show a positive correlation with the independent variable "gender." Specifically, 43.75% of boys who participated in the "distance learning" process have a slow reading rate, while only 28% of girls do. Furthermore, if we compare the above percentages with those of boys and girls who attended "face-to-face" education, the percentage for boys is 38.10% and for girls 64%. The measurements show that boys have more difficulty than girls in mastering reading (decoding rate), and this is despite the fact that the majority of the students assessed are in grades 4 to 6 of elementary school, where, in theory, the mechanism of reading has already been mastered [13].

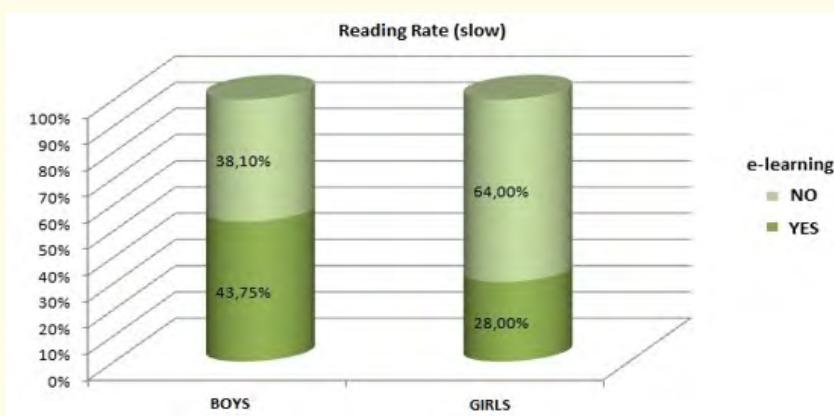


Diagram 1: Recording of reading rate between distance learning (e-learning) and face-to-face learning.

With regard to vocabulary, there is a tendency for children with "face to face" education (82.1%) to have a more enriched vocabulary than those who attended Webex (80.8%). Perhaps the correlation would have been clearer if our sample had been larger (See [table 1](#)).

Vocabulary	e-Learning	Percentage	Face to face	Percentage
Expected Data	59 (73)	80,8%	55 (67)	82,1%

Table 1: Recording of vocabulary percentage between e-learning and face-to-face learning.

Our research hypothesis regarding text comprehension is not verified (See [table 2](#)). Nevertheless, it appears that children who participated in "e-learning" tend to have poorer comprehension (61.6%) compared to those who participated in "face-to-face" education (59.7%).

Comprehension	e-Learning	Percentage	Face to face	Percentage
Absolute	23 (73)	31,5%	15 (67)	22,3%
Deficient	45 (73)	61,6%	40 (67)	59,7%

Table 2: Recording of text comprehension rates for e-learning and face-to-face learning.

There is a positive correlation between the variables “e-learning” and “spelling errors” among the two sample groups, with students who participated in “e-learning” show spelling errors at a rate of 83.5% compared to students in “face-to-face” education, whose rate is 80.5% (See **table 3**). Therefore, e-learning students seem to have greater difficulty in mastering and applying spelling and grammar rules than their classmates who attended “face-to-face” education.

Spelling errors	e-Learning	Percentage	Face to face	Percentage
Boys	43 (48)	89,5%	32 (42)	76,1%
Girls	18 (25)	72%	22 (25)	88%
Total	61 (73)	83,5%	54 (67)	80,5%

Table 3: Recording of the percentage of misspelling in written language between e-learning and face-to-face education.

In addition, **diagram 2** shows the errors that fall under written expression, demonstrating once again the decisive role played by the independent variable “gender.” In the sample as a whole, boys, compared to girls, have more difficulty at all levels of spontaneous written expression (spelling disorders, spelling errors, syntax, and content).

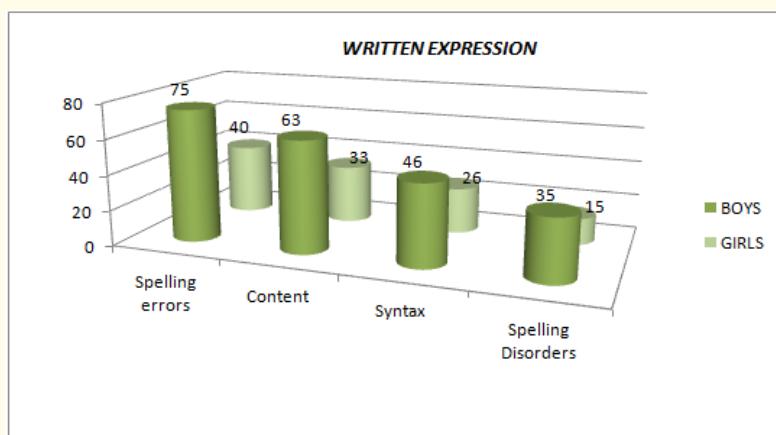


Diagram 2: Recording of error rates in spontaneous written speech by gender in the total sample.

Our final research hypothesis, which falls under the possible deviation in the acquisition of spatiotemporal concepts, is not only not verified, but on the contrary, the percentages for both categories of students are found to be identical (See **table 4**). This result is inconsistent with the initial clinical observation.

Spatiotemporal concepts	e-Learning	Percentage	Face to face	Percentage
Days	69 (73)	94,5%	63 (67)	94,02%
Months	41 (73)	56,1%	38 (67)	56,7%

Table 4: Recording of the percentage of mastery of spatiotemporal concepts between e-learning and face-to-face learning.

Discussion and Conclusion

This retrospective study attempted to capture the possible effects of “e-learning” on the acquisition of academic skills by students with SLD, using a corresponding sample of students who attended “face-to-face” education. The parameters studied and the corresponding correlations that emerged were: reading in terms of rate, vocabulary, text comprehension, written expression (spontaneous written speech in terms of spelling errors), and the acquisition of spatiotemporal concepts (days and months) during their primary education.

With regard to the dependent variable “e-learning”, there appears to be a positive correlation between the variable “slow reading rate” and the variable “gender”. This means that these students lag behind in terms of reading rate, even though most of the students evaluated in the context of “e-learning” were in grades 4 to 6 of primary school, where they are considered to be experienced readers and the reading mechanism has already mastered [13]. Furthermore, vocabulary processing does not appear to be linked to reading rate, contrary to previous research data that concluded that there is a correlation between the reader’s vocabulary and reading rate [14].

In terms of comparing the vocabulary already acquired, there is a tendency for students who received “face-to-face” education to be slightly ahead (82.1%) of those who underwent “e-learning” (80.8%). Perhaps a stronger correlation would have emerged if our sample had been larger. Vocabulary is considered an important predictor of difficulties in understanding text, especially for students in the final grades of primary education [15]. This is confirmed as a trend (small positive correlation), because students who participated in “distance learning” have a lower vocabulary percentage (80.8%) and therefore a higher percentage of deficits in text comprehension (61.6%), compared to those in “face-to-face” education, where the vocabulary percentage is 82.1% and the comprehension deficits are 59.7%. This finding is fully consistent with the conclusions drawn from a review of the international literature [16,17].

Subsequently, focusing on the study of findings related to written expression, and more specifically, adherence to spelling rules during the development of spontaneous written speech, a positive correlation is confirmed between the variables “e-learning” and “spelling errors”. It appears that among the two sample groups, students who attended “e-learning” show spelling errors at a rate of 83.5% compared to students in “face-to-face” education, whose rate is 80.5%. Taking into account the differences identified in vocabulary acquisition, this finding is consistent with the international literature, which argues that students with a larger vocabulary are able to more easily remember the connection between the meaning of a word and its spelling [18,19]. Similarly, the percentages in Vocabulary are 82.1% for children with “face to face” education and 80.8% for those with “e-learning”.

Incidentally, it would be useful to note that when investigating the types of errors that appear in written expression, the most frequent of these -in our overall sample- was non-compliance with spelling rules (spelling errors) at a rate of 82.1%. This is justified by the general complexity of the Greek language at the phonological and morphological level [20]. An additional finding is the correlation of “types of errors” in written expression with the independent variable “gender”, which confirms that boys lag behind girls in their written expression or exhibit SLD in written expression [21,22].

Finally, an important parameter that was studied by comparing the sample groups was the degree of mastery of spatiotemporal concepts (days and months), always in relation to the teaching method applied. In this case, the initial clinical impression that students receiving “e-learning” would be more disorganized in relation to spatiotemporal concepts is not confirmed. Instead, the percentages for both groups of students (“e-learning” and “face to face”). One possible interpretation for this result is their grade level, as these are children in grades 4 to 6 of elementary school, which explains that they have already mastered these concepts at an earlier stage of development [23]. However, their disorganization is not so much related to the acquisition of spatiotemporal concepts as to the changes in their daily lives (confinement, separation from the school environment, management of the entire learning process within the family home, separation from classmates and friends) in conjunction with psycho-emotional parameters [24].

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