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RESEARCH ARTICLE

Challenges and Opportunities of Emergency Remote Teaching: Linguistic Analysis on School Directors' Interviews

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ABSTRACT

This research delves into the experiences of primary school directors during the abrupt transition to Emergency Remote Teaching (ERT) due to the Covid-19 pandemic. Through semi-structured interviews, the organization and implementation of online classes, associated challenges, and potential improvements were scrutinized. Findings underscored a lack of preparedness, yet acknowledged ERT as a vital tool during the crisis. Recommendations included the improvement of technological support, designing a well-planned strategy, creating appropriate teaching content, comprehensive staff training, and tailoring the educational content to fit students' learning styles or special needs. A Linguistic Text Analysis approach, employing word clouds, treemaps, and sentiment analysis charts to graphically depict complex patterns in the data, enriched our understanding of the ERT transition, shedding light on subtler nuances and insights. This study contributes valuable knowledge, offering a roadmap for the future development of robust, flexible, and inclusive educational policies and practices, particularly in crisis situations. The dataset is an invaluable asset for policymakers, providing critical insights and highlighting the challenges and opportunities that arise.

Keywords: Emergency Remote Teaching (ERT), Linguistic Analysis, School Directors' Perspectives, Sentiment Analysis.

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1. Introduction

The sudden implementation of distance learning during the Covid-19 period was unexpected. In response to global educational needs, the concept of Emergency Remote Teaching (ERT) was introduced and adopted worldwide. This term, first used by [1], refers to a temporary shift in instructional delivery to an alternative mode due to a health crisis. Instead of following a complex process that requires careful planning, design, and goal setting to create an effective learning environment, this approach was a necessary and indeed a temporary solution [2]. However, in this case, the shift to distance learning was necessitated by the circumstances, rather than being a carefully planned and designed educational strategy. The shift to ERT called for crucial choices and planning that had not been considered before. As a result, the administrative tasks increased and proper management was required. More specifically, in terms of organization, the school directors were the ones who had to guide the school communities.

For these reasons, it is crucial to understand the school directors' perspectives when conducting remote teaching in an emergency. Their perspectives can provide a distinctive, in-depth understanding of the complications regarding technical difficulties, pedagogical adjustments, and the emotional health of both staff and students. All school directors participating in this research considered ERT as a potential alternative tool to prevent students from being disconnected from school during the pandemic. There is an immediate necessity to devise a robust and strategic model that can effectively operate during periods of crisis. To maximize the learning outcomes of ERT, the directors suggested that the state should provide appropriate technological support and equipment to students and train educational staff on the expanded prospects of using new technologies in a well-planned distance learning environment.

This research examined the views of elementary school directors regarding ERT in March 2020 during the Covid-19 pandemic crisis in Greece. The main purpose was to

highlight the topics that emerged, as well as the obstacles and difficulties that school directors faced during the initial stages of implementing ERT, which was then a new and uncharted territory for the entire educational community (directors, teachers, students, and parents). The following research questions were investigated:

- What practices did the school directors follow to implement ERT during the Covid-19 crisis?
- What difficulties did they identify during this process and how did they address them?
- What were the benefits and the weaknesses during the educational process in ERT?
- What do school directors suggest for improving ERT implementation?

2. Related Work

2.1. Online Education

Online education, as a method of teaching and learning, has been extensively studied and implemented long before the advent of the Covid-19 pandemic [3]–[5]. In online distance education many opportunities and challenges exist [6]–[8]. Online education involves the strategic integration of various elements to create a cohesive and effective learning and teaching environment. For online courses to function effectively, several iterations may be necessary to resolve issues and enhance the quality of the course content. There is an urgent need for context-specific policies to ensure the effective implementation of e-learning [9]. The concept of integrating digital technology into education was already a strategic focus for many national education systems even before the pandemic [10]. In order to control the spread of Covid-19, many European nations implemented a variety of measures and strategies [11]. One of them was to lock down schools and shift to online education. However, this shift was not easy for every country. In several regions, such as Scandinavia, educators and learners were already accustomed to utilizing technology in teaching and learning. For these regions, remote teaching merely accelerated the digital transformation of educational practices. The success of online lessons depended on the readiness of teachers to employ technology, the speed at which schools could hone teachers' digital skills, and the general accessibility to internet connectivity and digital tools [11].

In the case of Greece, there was a lack of a strategic plan for the systematic development of online education within schools without assuring the necessary preconditions [12]. Online education was conducted "violently" in a way that is ill-prepared for the demands of modern education, particularly in situations where traditional classroom teaching is not possible. In response to these challenges, Greece had to transit to ERT, a quick-fix solution to continue education during crises, rather than implementing a well-planned online educational policy.

This highlights the urgent need for a comprehensive strategy to develop and implement online education within Greek schools, to ensure that the education system would be prepared for any future disruptions and able to provide quality education in all circumstances.

2.2. Emergency Remote Teaching

As mentioned above, the lack of a well-prepared approach led to the adoption of ERT as a temporary solution during crises. ERT was a temporary shift in the delivery of education to an alternative model: the teaching process being conducted exclusively online emerged as a response to the Covid-19 pandemic, which made contact teaching temporarily impossible [1], [12]. There are distinguishing differences between ERT and e-learning (i.e., online teaching, online learning, or online education): a. the first word in ERT stands for emergency, a fundamental difference between ERT and e-learning, and b. in ERT, there are no planning cycles or several course implementations to allow educators to mature their course content to precision [13], [14]. More specifically, ERT is used as a quick fix when something goes wrong. During the Covid-19 pandemic, schools could not function normally. As a result, ERT was used to keep the teaching and learning process until things could return to normality. As many studies regarding ERT in Greece mentioned, critical characteristics emerged as essential for effective student learning, namely instruction and organization, facilitation and cognitive activation, and school support [15], [16]. It was the school directors who were called to adapt the operation of the schools to these new conditions.

2.3. School Directors During Emergency Remote Teaching

Shifting to ERT posed a big challenge for school directors. In the realm of learning from a distance, the development of a supportive environment plays an important role in fostering both the social and psycho-spiritual maturation of students. This is achieved by engaging them in collaborative activities, thereby stimulating their active participation and involvement. Co-creation of such environments can significantly enhance the overall learning experience [17]. This approach not only smoothens the socialization process but also contributes to the holistic development of the learners, thereby underscoring the importance of a well-structured and supportive e-learning setting. School directors had to ensure the continuity of education through the implementation and management of effective online teaching and learning strategies. They had the role of facilitating the acquisition and adoption of new digital tools and managing the fact that everyone was physically apart [18]. They also had to consider how to provide equal learning opportunities for all the students, regardless of their internet access or device availability [19]. Additionally, as mentioned in previous research, parents of students with functional diversity reported that it was urgent to form an appropriate educational environment with specially designed educational material that meets the children's needs [20]. A study [21] showed that school directors had many roles during this shift, including planning for online teaching, starting online classes, using social media, managing the online program, helping everyone to adjust, and keeping everyone motivated. Aguliera and Nightengale-Lee [22] emphasized the need to understand the experiences of students and families in different areas, who faced more educational unfairness due to the sudden shift to ERT and school closures. The authors stressed

the importance of considering local community needs in educational decisions and developing ways to address this unfairness. In another study [23], examining the leadership experiences during the 2020 Covid-19 school closures, responses from Estonian and Finnish school leaders were analyzed. The study highlighted the significance of internal communication, the provision of emotional and technological support, and leaders' self-management skills. It was suggested that a leader's pedagogical knowledge and established local collaboration structures could facilitate greatly the reorganization of teaching and learning in times of crisis. Another study identified seven key themes concerning leadership in schools during a pandemic, including the evolving nature of leadership, the effect on leaders' physical, emotional, and mental well-being, the adaptation of leadership practices, the personal traits displayed by leaders, the unevenness in learning that has accompanied the pandemic, the engagement of education stakeholders, and the ways in which Covid-19 has changed leadership practices [24].

2.4. *Linguistic Text Analysis*

Linguistic text analysis with tools like RapidMiner or NVivo can be particularly challenging when dealing with languages that use complex scripts or non-Latin alphabets, like Greek. These languages, which heavily rely on context and can be quite ambiguous, are not always well-supported by these platforms. The intricacies of the Greek language, with its complex grammar rules, the relaxed syntactic positioning rules, and semantic ambiguity for single words, can potentially lead to less accurate analysis results.

In previous stages of this research, both semantic and descriptive analyses were conducted on the dataset [25]. However, to further enrich our understanding and to delve deeper into the nuances of the data, the current aim is to perform a different type of analysis, i.e., linguistic analysis. Content analysis is a systematic method that identifies, quantifies, and interprets the significance, meanings, and relationships of specific words, themes, or concepts within a dataset. This technique provides a structured approach to data analysis, by quantifying the frequency of words or themes to gauge their relative importance [26]. The thematic analysis seeks to identify and describe the main topics that emerge from the data, providing a more nuanced understanding of the content [27].

In this research, linguistic text analysis is employed, encompassing content, thematic, and sentiment analysis methods, and focusing on the underlying meanings and messages conveyed through the text. Data analysis principles, including coding, inter-rater reliability, and thematic analysis, are applied to our qualitative data [25], [28].

2.5. *Sentiment Analysis*

Sentiment analysis is a Natural Language Processing (NLP) technique, that focuses on capturing the emotional tone in a body of text. This process is particularly useful for monitoring sentiment towards specific themes or topics. By analyzing the language used in interviews, reviews, or other forms of text, sentiment analysis can provide valuable findings into the prevailing mood or attitude towards the subject under consideration [29], [30].

Using sentiment analysis, we classify words in the text data as either positive or negative. This approach involves examining the words in the context of their use and determining their polarity, i.e., the sentiment they express. This sentiment could be positive, moderately positive, negative, or moderately negative. The goal of this process is to understand the attitudes, beliefs, and feelings reflected in the text dataset.

3. Methodology

3.1. *Sample*

Table I provides information on the demographic and professional characteristics of the sample: 15 school directors in Primary Education schools, with ages ranging from 40 to 62 years. The gender distribution is not balanced, reflecting the gender imbalance and highlighting the lack of diversity in the leadership roles in the educational sector (10 males and 5 females). Years of service as a school director vary significantly, with a range from 1 to 15 years, indicating a mix of both relatively new and experienced directors. Geographical distribution is also diverse, representing urban, suburban, and rural areas in both mainland and island regions. The majority of the directors were based in mainland urban areas. In adherence to ethical and research deontological principles, the names of all the participants involved in this study were pseudonymized ensuring confidentiality and anonymity [31].

3.2. *Data Collection*

In the current research, the views of 15 school directors were collected through semi-structured interviews, since it was indicated by other researchers in the same field as more flexible and resulting in rich and authentic data, to reveal their authentic experiences and practices during the ERT process [27], [32]. Semi-structured interviews were also used to explore teacher perspectives on ERT in science and art centers [33]. Similarly, semi-structured interviews were utilized to delve into the experiences of public-school teachers in the United States during the pandemic [34].

TABLE I: Profiles of School Directors

Name	Age	Gender	Years of service	Region	Area
John	50	Male	5	Mainland	Urban
George	52	Male	1	Mainland	Suburban
James	62	Male	12	Island	Urban
Michael	45	Male	7	Mainland	Rural
Jennifer	54	Female	3	Mainland	Urban
Robert	40	Male	4	Mainland	Urban
Maria	49	Female	7	Mainland	Urban
David	57	Male	5	Island	Rural
Elizabeth	56	Female	1	Mainland	Urban
Sarah	55	Female	8	Mainland	Urban
William	51	Male	10	Mainland	Urban
Joseph	52	Female	6	Mainland	Rural
Thomas	50	Male	2	Island	Suburban
Daniel	45	Male	15	Mainland	Rural
Andrew	48	Male	2	Mainland	Urban

A descriptive qualitative study used semi-structured interviews to understand an English teacher's perspective on English as a Foreign Language (EFL) students' speaking performance during the pandemic [35]. In our research interviews were carried out in strict adherence to the health protocols established for Covid-19. The average duration of the interviews was 45 minutes and they took place via Skype, telephone, or face-to-face meetings with the interviewees. A Modern Greek dataset of qualitative humanistic-linguistic data (consisting of 18,243 words) was created. Data collection took place from June to August 2021.

3.3. Tool

Although the NVivo software offers all the capabilities needed to perform this specific type of analysis, RapidMiner was also used because it allows the creation of models by automated machine learning and offers more accurate preprocessing capabilities. Using RapidMiner alongside NVivo can provide an additional layer of validation to the linguistic text analysis. Its advanced data mining capabilities can cross-verify findings and ensure robustness in the research outcomes.

3.3.1. RapidMiner[1]

RapidMiner is a data science platform that offers an integrated environment for data preparation, machine learning, and predictive analytics. Its standout feature is text analysis, leveraging advanced algorithms to extract valuable insights from unstructured data, making it an indispensable tool [36]. In this research, RapidMiner was used to analyze the text of interview transcripts.

3.3.2. NVivo[2]

NVivo is a powerful software for qualitative data analysis. It enables researchers to organize, analyze, and visualize complex data from diverse sources. With features like text analytics, sentiment analysis, and thematic coding, NVivo transforms raw data into meaningful insights, and classify and sort data in ways that enable the identification of topics and patterns. Its integrative and systematic approach to qualitative analysis has made it a preferred choice among scholars in various disciplines [37]. In this research, NVivo was used to perform topic analysis, extract sentiment, and create word clouds and treemaps.

3.4. Method of Analysis

A text analysis pipeline, designed to analyze interview transcripts stored in an Excel file was implemented in RapidMiner (Fig. 1). First, it starts by reading an Excel file, consisting of 1,181 lines. The interview text was segmented into periods (text segments ending in full stop, exclamation mark or question mark). Each line represents a segmentation into periods, with each period containing distinct statements or points made by the interviewees. After reading the Excel file all data was converted into text with the operator "Nominal to Text". Then a series of text processing steps followed (see Fig. 2): transforming to lower case, tokenization (unigrams), and filtering out punctuation and stopwords to reduce noise and improve computational efficiency. Tokens were also filtered based on their length (minimum length: four characters). The processed text was then converted into a word vector; a mathematical representation of the words. This word vector was transformed into a dataset, sorted by the frequency of words across the interviews (see Fig. 1). Finally, the top thirty most frequent words were selected. This process helps to identify the most common themes or topics discussed in the interviews.

In order to perform a comprehensive thematic analysis, three key themes were identified and formed:

- Material and Technical Conditions
- Educational Dimension
- Psychological-Emotional Dimension

The pie chart below (Fig. 3) represents the frequency of the following three topics discussed by the school directors during the interviews.

The topic of "Material and Technical Conditions" was discussed most frequently, indicating that it was a significant concern or focus area for the school directors. The "Educational Dimension" topic was the second most frequently discussed, suggesting that aspects of learning and instruction were also important to the directors. "Psychological-Emotional Dimension" was discussed less than the other two topics, but it was still a notable part of the conversation, indicating that mental and emotional factors were also considered in their discussions.

4. Results

The text data was analyzed using NVivo software to tag parts of speech expressing sentiment. The sentiment score was discretized into four categories: *Moderately Negative, Very Negative, Moderately Positive, and Very Positive*. In Table II the total number of words used by each participant is presented. A summary of the data, including the sum, median, minimum, and maximum values for each director is also provided. The total number of words used across all interviews was 18,243, while the median number of words used per interview was 1,206 (min: 958 – max:1,531).

4.1. Word Cloud

Word clouds visually represent the most frequent words or phrases in a dataset. The size of each word in the cloud corresponds to its frequency, making it easy to identify key themes. Most frequent words are displayed in larger fonts. Using word cloud analysis offers valuable insights that can guide decision-making and strategy planning. Following the initial analysis, a word cloud was generated to further distill and visualize the key themes based on their frequency in the dataset. This graphical representation uses varying sizes and colors to denote the frequency of words—the larger and more vibrant the word, the more often it appears in the data. This method allows for an immediate understanding of the most prevalent themes or topics within the dataset. Some of the most frequent words represented in Fig. 4 are: *students, parents, teachers, school, lesson, personal computer, problems, home, tablet*.

[1] https://rapidminer.com/
[2] https://lumivero.com/products/nvivo-transcription/

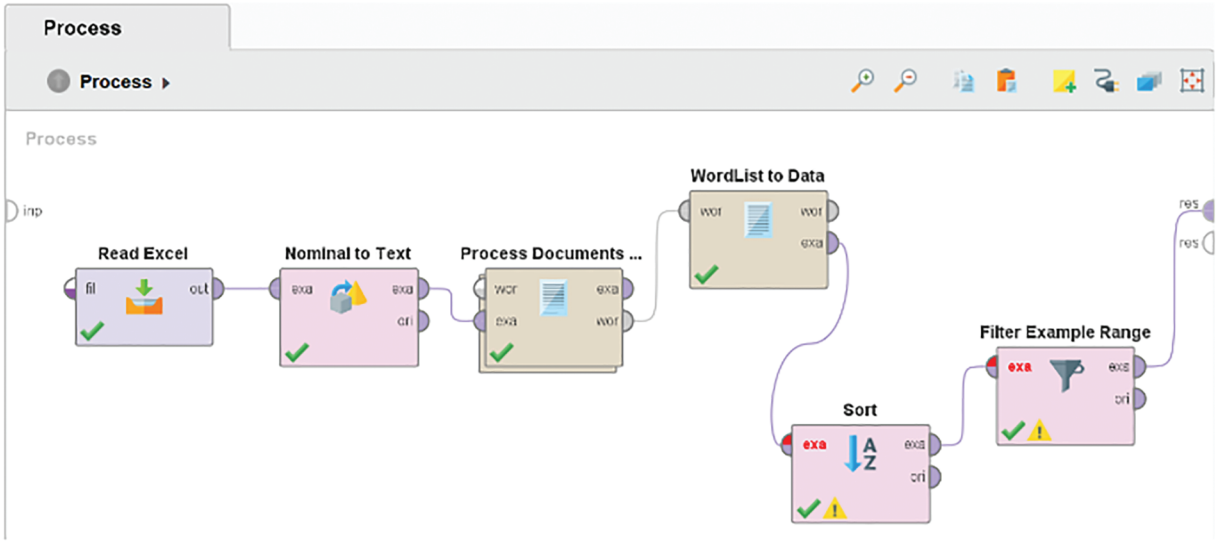

Fig. 1. RapidMiner process—identifying the most frequent words in the dataset.

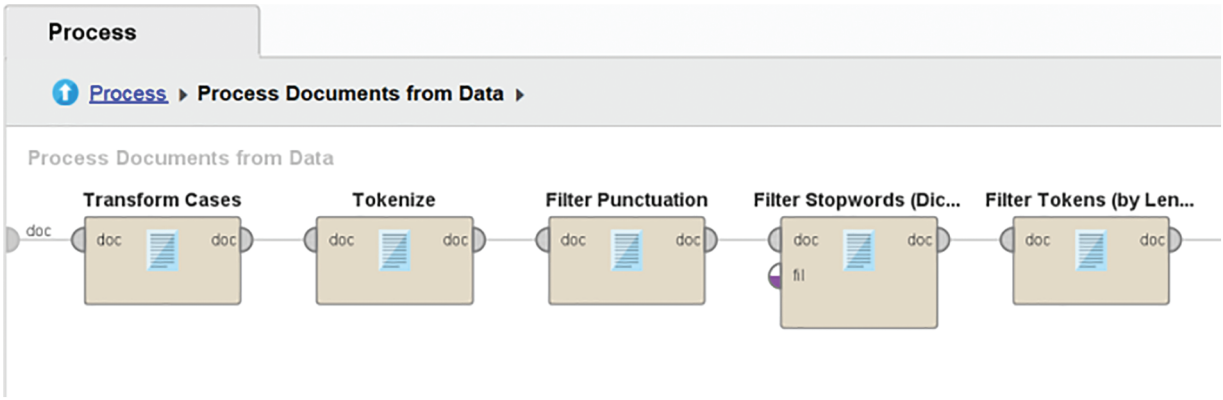

Fig. 2. Text preprocessing and cleaning workflow in RapidMiner.

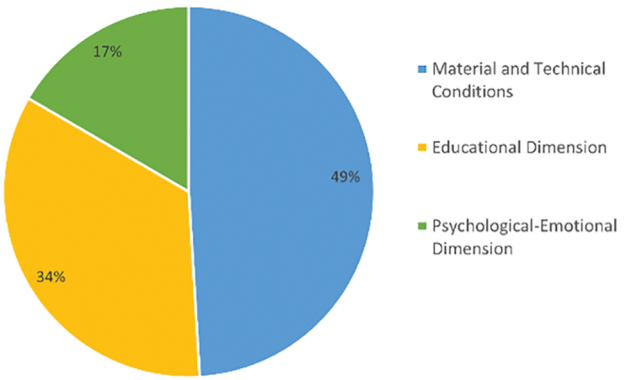

Fig. 3. Topic analysis.

TABLE II: Participant Word Usage and Sentiment Polarity

Name	Words per interview	Moderately negative	Very negative	Moderately positive	Positive
John	1417	11	4	5	2
George	1275	11	6	4	1
James	1477	5	2	7	3
Michael	975	4	1	5	3
Jennifer	1531	8	1	7	2
Robert	1142	14	4	6	1
Maria	1374	7	5	7	2
David	1145	8	6	4	3
Elizabeth	1238	27	16	7	2
Sarah	1206	15	5	5	1
William	1128	24	3	9	3
Joseph	1037	20	3	3	1
Thomas	1345	12	5	5	1
Daniel	995	7	1	2	1
Andrew	958	9	6	5	2
Sum	18243	182	68	81	28
Median	1206	11	4	5	2
Min	958	4	1	2	1
Max	1531	27	16	9	3

4.2. *Treemap*

Besides word clouds, the key concepts can be quickly identified with treemaps. A treemap is a powerful visualization tool that provides a hierarchical view of our data. It is particularly useful for representing the most frequently valuable words in a dataset and highlighting the correlation between them. Each word is represented by a rectangle. The size of the rectangle corresponds to the word's frequency. The "neighbors" of each rectangle reveal the correlation between the main concepts (Fig. 5).

Derived from linguistic analysis, some of the most characteristic comments of the school directors in the

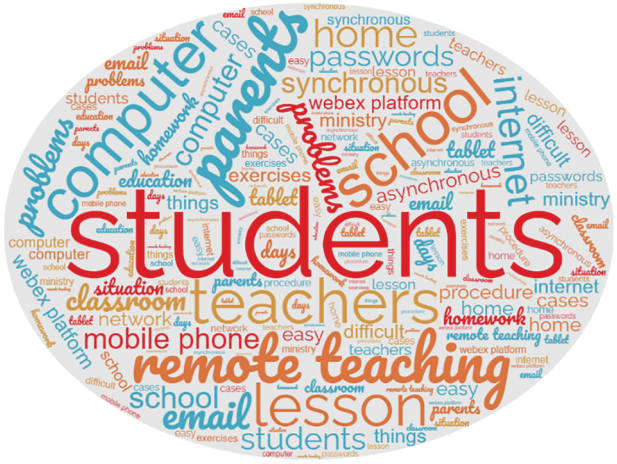

Fig. 4. Word cloud visualization of the most frequent terms.

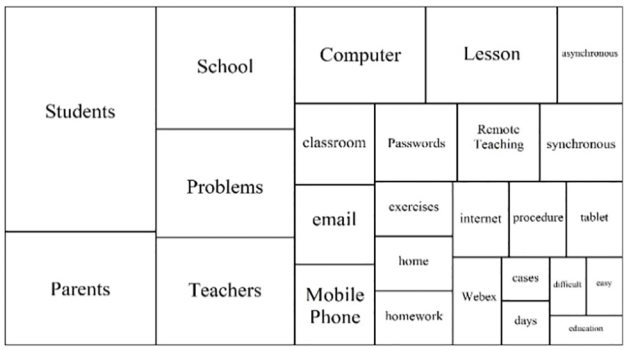

Fig. 5. Treemap-revealing key-concepts.

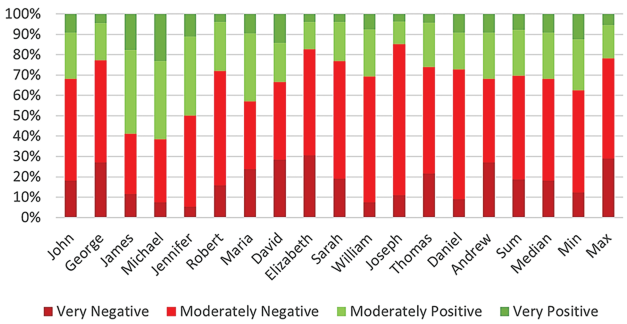

Fig. 6. Sentiment score by participant.

interviews are presented in Table III. Data are presented depending on the topic in which they are mentioned, as well as the Positive or Negative sentiment they expressed.

4.3. *Sentiment Analysis*

4.3.1. *Sentiment Score by Participant*

Fig. 6 provides a vivid representation of the sentiment polarity expressed by each participant in the research. The bar for each director is divided into four segments, each representing one of the sentiment categories. The percentage that each segment occupies within the bar visually illustrates the proportion of each sentiment to the overall sentiment composition (for example: the number of negative sentences in the interview to the total number of emotional sentences in the interview). The length of each segment within the bar corresponds to the proportion of the total sentiment that falls into that category.

TABLE III: The Most Characteristic Positive and Negative Comments

Topic	Positive comments	Negative comments
Material and technical conditions	"Teachers had developed technology skills and learned how to do their lesson differently"	"There were many technical issues", "the most frequent issues were technical ones", "there is no ERT without ensuring that all students have the devices to attend classes"
Educational dimension	"We had good participation in the courses and students did not miss their lessons", "the educational process continued"	"Repeating the curriculum that had already been taught", "difficulty in adapting to the new circumstances, they missed many opportunities" "students with special educational needs could not follow"
Psychological-emotional dimension	"Felt happy that we have responded to the needs"	"I was feeling a heavy burden", "I was in shock and panicked", "parents who were concerned and worried", "teachers felt anxious"

The *Moderately Negative* segment is the longest in most of the cases, indicating that this was the most frequently expressed sentiment in his interview. The *Very Positive* segment is the shortest in most cases, showing that this sentiment was expressed less frequently.

This kind of visualization allows for the comparison of the sentiment polarity of each director presenting not only the overall sentiment, but also the balance between positive and negative sentiments. This can provide valuable insights into the emotional tone of the interviews and reveal patterns or trends in the directors' attitudes and perspectives.

4.3.2. *Sentiment Score by Topic*

Data from all the interviews were labeled and each sentence was categorized to the corresponding topic (see Section 3). Each segment of the conversation was analyzed allowing for a comprehensive and structured overview (Fig. 7). This visualization allows us to compare the sentiment polarity in each of the three topics. It shows the overall sentiment for each topic and the balance between positive and negative sentiments.

In the "*Material and Technical Conditions*" bar, the segment *Moderately Negative* is the longest as it was the one occurring most frequently, indicating that this was the most frequently sentiment expressed for this topic.

The segment for *Very Positive* sentiment is the shortest, showing that this sentiment was expressed less frequently.

For the topics "Educational Dimension" and "Psychological-Emotional Dimension", the *Moderately Negative* sentiment occurred most frequently. The *Very*

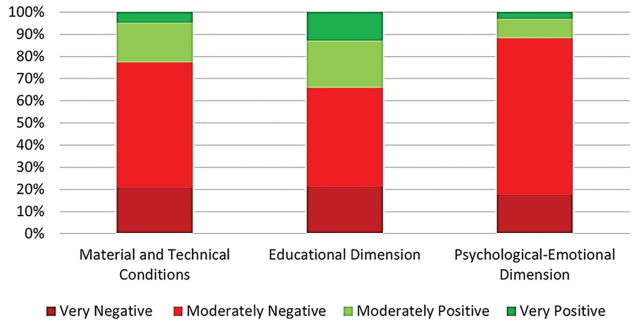

Fig. 7. Sentiment score by topic.

Positive sentiment is the shortest bar, as this sentiment was less frequently expressed among all three topics.

This type of analysis can provide valuable insights into the emotional tone associated with each topic and potentially reveal patterns or trends in the sentiments expressed. It reveals how sentiments are distributed across the three topics. Sentiment analysis provides a rich, multi-dimensional view of the emotional content of the interviews, offering valuable insights that can inform decision-making and strategy development.

5. Discussion

As already shown in the graphs, very important conclusions can be drawn. Linguistic analysis charts helped to understand some of the themes that emerged, identifying overused words or phrases, visualize relationships and discover the sentiment of each participant and discover valuable insights into the emotional tone associated with each topic. All the results agree that there was an overall negative impact of the online lessons. School directors reported that they struggled with the lack of face-to-face interaction, contributing to an atmosphere of detachment and disengagement.

Furthermore, persistent technical issues and inequities in access to reliable technology and Internet access, psychological and emotional problems, with issues like isolation, stress and anxiety, have increased the challenges associated with online lessons and contributed to the overall negative impact perceived in the digital learning experience.

Such insights can inform decision-making and strategy development, highlighting areas where intervention may be necessary or beneficial while tailoring the content to better meet the students' needs and improving learning outcomes in case ERT applied in future crisis periods.

In Greece, there is an urgent necessity to integrate digital technology into the educational landscape more effectively, as many other countries did even before the Covid-19 period [10], [11]. Better preparation and creation of appropriate teaching content could expand the possibilities of using new technologies in a well-planned distance learning environment.

6. Conclusion

The transition to ERT presented numerous challenges but also unveiled opportunities. While it posed difficulties due to the abrupt need for planning, quality control, and increased administrative tasks, it simultaneously opened new avenues for rethinking traditional educational models, using technology in innovative ways, and ensuring continuity of learning in unprecedented circumstances.

This study effectively addresses all the research questions, revealing the difficulties and processes in implementing ERT during the COVID-19 pandemic, weighing its advantages and disadvantages, and offering suggestions for improvements based on school directors' perspectives. Also, it contributes important information that can guide the development of future educational programs and strategies. It provides a guide for developing inclusive, flexible, and robust educational policy, particularly during times of crisis. The dataset is a crucial resource for decision-makers, uncovers vital understandings, and underscores the difficulties and potentialities that have arisen. Equity and accessibility issues also emerged as significant challenges during this urgent transition.

The emergency transition to online lessons was a major contributor to the overall negative impact perceived in the digital learning experience. However, it is possible to understand the problems that arose and focus on them to build stronger, more adaptable, and comprehensive educational environments providing equal learning opportunities for all students and increasing the learning outcomes.

7. Future Work

A comprehensive investigation that reveals all the aspects of students, teachers, and parents involved in ERT is necessary to triangulate (cross-checking) its results and maximize the validity and reliability. Also, an in-depth analysis using machine learning algorithms can reveal invaluable insights into communication patterns and features within ERT environments. Creating features, such as pedagogical and technical support systems, optimized schedules, interactive learning strategies, and advanced assessment models can also be a promising line of research.

Through this multifaceted approach, can be crafted an evidence-based, comprehensive strategy for effective and efficient inclusive distance education.

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Conflict of Interest

Authors declare that they do not have any conflict of interest.

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