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Emerging Trends in Romanian Music Education:
A Literature Review

Alexandra Belibou

Faculty of Music, Transilvania University of Braşov

alexandra.belibou@unitbv.ro

Abstract

Romanian music education is changing significantly as a result of international trends and technology breakthroughs. In order to identify important new trends, this paper examines the literature on music education in Romania from the last five years. The study's main topics are interdisciplinarity, digitalization, creative teaching strategies, and future challenges. The article focuses on the growing integration of music into interdisciplinary learning, the use of digital tools, and alternative pedagogical approaches like Orff, Dalcroze, and Kodály methods. Even though there are many advantages to new teaching methods and technology, problems like unequal access to digital resources and teacher training still exist. The study is based on articles published in the last five years, retrieved from the Scopus and Web of Science databases.

Keywords: music education, interdisciplinarity, digitalization, ICT.

1. Introduction

Romanian music education has been evolving significantly in recent years, influenced by international trends and advancements in technology. This paper aims to identify emerging trends in Romanian music education by reviewing literature published in the last five years. To gather relevant sources, two academic databases were consulted: Scopus and Web of Science. In Scopus, the search term "music education Romania" generated a total of 9 articles from the last five years, of which only 2 were relevant to the focus of this study. In Web of Science, using the same search term, 117 articles were found, of which 22 met the criteria for relevance, also covering the years 2020-2025.

The search included general education until higher education level and not integrated/supplementary education with a focus on arts – music (music schools with vocational education). The main areas of focus in this review include interdisciplinarity, digitalization, creative teaching strategies, and the challenges faced by music educators in Romania, with particular emphasis on the integration of music into interdisciplinary learning, the use of digital tools, and alternative pedagogical approaches such as Orff, Dalcroze, and Kodály methods.

2. Music Education in Romania

In Romania, music education at the primary level (general education) is regulated by the national curriculum, which includes the subject Music and Movement starting from the preparatory class. According to the curriculum plan, students in the preparatory, first, second, third, and fourth grades study music for 2 hours per week in the first three grades and 1 hour per week in the third and fourth grades. The main goal is to develop competencies related to cultural awareness and expression, with music education playing a crucial role in helping children appreciate and actively participate in cultural activities. Music also fosters creativity, expressiveness, and appreciation for both national and universal cultural heritage. At this level, students are encouraged to recognize and explore simple musical elements, participate in cultural projects,

and express various emotions and ideas through music (Ministry of National Education, 2019). However, there is a challenge in the system: primary school teachers, who are often referred to as generalist teachers, typically do not have advanced musical training. This presents a problem because the education system asks these teachers to teach subjects that require specialized knowledge and skills, which are developed over time through initial and continuous training. As a result, many teachers lack confidence in their ability to teach music effectively at the primary level (Milencovici, 2023b).

In middle school (grades 5-8 – general education), music education continues to play an essential role in students' development, being part of the Arts curricular area with one hour per week allocated. In this case, music education is taught by a teacher who has graduated from a Music Faculty with a specialization in pedagogy. The curriculum for music education is competency-based, aiming to foster students' personal and academic growth. Unlike the earlier stages, the focus shifts to more structured learning, emphasizing the development of skills like music notation and an understanding of sound parameters, such as pitch and duration. This stage builds upon the foundational knowledge gained in primary school, gradually introducing students to more complex musical concepts.

Music education at this level encourages artistic expression, cultural awareness, and the development of aesthetic judgment, creativity, and musical memory. It also promotes general skills such as self-discipline, concentration, and positive social interaction. The goal is to create a well-rounded experience that enhances students' overall educational journey, guiding them toward a deeper appreciation of music and the arts through activities that stimulate both their musical and personal growth (***, 2017).

In Romania, in the case of Music Education at the high school level, the curriculum is designed for students in the 9th and 10th grades, across all tracks and profiles, with the exception of the artistic profile, specializing in music. The aim is to contribute to the development of an autonomous and creative personality by fostering competencies, values, and attitudes. In the 9th grade, students are allocated one hour of music education per week within the common

curriculum. The curriculum introduces a new approach to music learning, promoting direct engagement with music, enhancing the way music listening is approached, and continuing the study of accessible musical instruments. In the 10th grade, Music Education continues with one hour per week, maintaining a flexible structure that allows teachers and textbook authors to innovate in presenting content and teaching strategies. The curriculum is applicable in schools where instruction is provided in minority languages. By the 11th grade, the curriculum is adapted for specific profiles, such as philology, social sciences, sports, and pedagogical tracks, with different lesson durations and a more in-depth exploration of musical content for vocational tracks (***, n.d.).

3. Literature Review
Music Across Disciplines

When discussing research on music within a transdisciplinary and interdisciplinary framework, we consider the functions of music as a form of general education. Music is not solely an artistic or aesthetic experience; rather, it plays a significant role in shaping cognitive, emotional, social, and even ethical dimensions of human development. Within educational contexts, music transcends disciplinary boundaries by integrating elements from psychology, neuroscience, pedagogy, and cultural studies. This multifaceted nature allows music to contribute meaningfully to the development of critical thinking, emotional regulation, memory, and social interaction skills (Jäncke, 2008; MacDonald et al., 2012; Sacks, 2008).

A 2021 article argues that music serves as a medium for promoting children's cognitive development and emotional intelligence. The article explores various learning styles and emphasizes the importance of musical listening experiences that support their growth. It also addresses different types of intelligence and how music can enhance them, drawing on the theory of multiple intelligences. All these aspects are examined through early childhood music listening interventions, presented as a form of early music education (Vasiu, 2021).

Also, Simion's article supports the ideas outlined above, highlighting the complex role of music education in both traditional and specialized music schools. It emphasizes that beyond skill acquisition, music contributes to the formation of children's personalities and prepares them for future professional environments. The article advocates for nurturing, holistic educational models that integrate cognitive, emotional, and artistic development. It also underlines music's potential to foster creativity, collaboration, and critical thinking—skills that are transferable beyond the musical domain. Finally, the article contrasts the immediacy and subjectivity emphasized in music schools with the structured feedback of traditional systems, suggesting that aligning these approaches could enrich educational practices overall (Simion, 2024b).

Among the sources analyzed, only one article addresses the integration of music into the teaching of other subjects, which highlights a significant gap in recent research. This finding suggests that, in the past five years, no studies indexed in the two selected databases matched our keywords or demonstrated the use of musical activities as tools for teaching other disciplines. The article in question explores how music, as a widely accessible and popular cultural practice, can be employed to teach topics such as geopolitics by fostering critical thinking and deeper understanding. Building on this perspective, it is recommended that educators from various fields collaborate on interdisciplinary projects where music serves as a medium for teaching foreign languages, geography, history, native language, mathematics, and more (Gavriș, 2022).

Alternative Approaches to Music Education

Alternative approaches to music education find their roots in the pioneering work of several key 20th-century pedagogues, whose methods continue to influence contemporary practices. Rather than adhering to rigid, standardized instruction, these educators—Dalcroze, Orff, Kodály, and Suzuki—developed holistic, child-centered models that emphasized creativity, active participation, and deep musical understanding. Émile Jaques-Dalcroze's eurhythmics encouraged students to internalize rhythm through movement, fostering a physical connection to music (Daly, 2022). Carl Orff introduced a method based on elemental music-making, utilizing

percussion instruments and simple, engaging repertories designed for children (Sogin & Wang, 2008). Zoltán Kodály placed vocal training and music literacy at the core of his approach, promoting the use of folk songs and systematic solfège instruction (Wei, 2022).

These approaches remain largely absent from mass or state-run music education programs from Romania, which often prioritize technical proficiency and standardized outcomes over creative exploration and individual growth. Nevertheless, there are educators who incorporate principles and elements from these pedagogical models into their traditional music education classes.

An article identified in the research highlights how elements of the Kodály approach have been deeply integrated into Hungarian music education practices in Transylvania. The study explores the evolution of this pedagogical model across all levels of education, showing how local musicians, educators, and scholars have contributed to its adaptation and continuity. Through original compositions, theoretical contributions, and the development of curricular materials, these individuals have embedded Kodály's vision within the cultural and educational fabric of the region. Their work demonstrates how an alternative educational philosophy can be meaningfully localized and sustained within a specific cultural context (Peter, 2023).

One article offers a comparative perspective on music education in Romania and Italy, highlighting both shared classical traditions and distinct national approaches shaped by cultural and historical contexts. While Romania emphasizes auditory learning and instrumental mastery rooted in folk and classical influences, Italy balances technical rigor with interpretive freedom, with both systems reflecting a blend of tradition and innovation (Bălan & Demenescu, 2024).

Another relevant contribution to the rethinking of music education methods is the study focused on the role of musicograms and creative listening strategies in the classroom. The article emphasizes the importance of preparing musical audition activities in a structured and imaginative way, highlighting the difference between passive hearing and conscious, active listening. By combining music with literature and visual arts or ICT, and translating musical content into graphic forms, the approach enhances students' receptiveness and interpretative skills. The experimental component of the study confirmed that such interdisciplinary and visually supported activities—anchored in the teacher's

creativity—significantly improve the quality of musical understanding and engagement. This reinforces the idea that innovative, multimodal teaching tools can make music more accessible and meaningful in the general education context (Homone, 2020).

Unfortunately, there is a noticeable lack of research on innovative music education methods beyond the well-established 20th-century models discussed earlier. These alternative approaches could offer valuable points of comparison with the standardized music education system currently in place in Romania. Comparative studies, as well as the development of new teaching materials inspired by models already implemented in other European countries, represent promising directions for future research and pedagogical innovation.

Music Education and Digital Technologies

The area of ICT and music education has generated the highest number of research articles in the past five years. This trend can be attributed both to rapid technological advancements and to the impact of the COVID-19 pandemic, which compelled educators to adapt and rethink their teaching strategies through digital tools and platforms.

A growing body of literature reflects the increasing theoretical and practical interest in the integration of ICT and music technologies into educational contexts, particularly in response to recent global shifts. One interesting article explores students' expectations and highlights the challenges posed by self-directed learning through digital tools, emphasizing the need for educators to adjust their practices accordingly (Demenescu et al., 2020). There are two articles that underscore the urgency of aligning national music education strategies with technological developments, while also recognizing the transformative potential of music technologies in teaching, learning, and assessment processes, especially during crises. These studies point to the inconsistency between the rapid evolution of technology and the slow institutional response, revealing a need for coordinated policy and investment in teacher training (Moldovan, 2020, 2021) .

Two studies offer quantitative insights, confirming that digital tools are increasingly embedded in primary-level music instruction and suggesting the need for curricular adaptations to match this

shift. They also reveal that music technologies not only support musical skill development, but also foster motivation, creativity, and student autonomy. The findings support the idea that music education is evolving from a focus on traditional performance skills to include composition and creative digital expression, democratized by widespread access to software and hardware (Milencovici, 2023a; Muntean, 2023). Additionally, Sârb's article highlights how both current teachers and future educators perceive digital tools not only as necessary, but as natural extensions of modern pedagogy—tools that promote interdisciplinary learning, flexibility, and individualized educational paths (Sârb, 2021). Collectively, these studies portray ICT not as a supplementary option but as a structural component of contemporary music education, calling for systemic adaptation, curriculum redesign, and sustained theoretical inquiry to meet the realities of 21st-century teaching and learning.

The COVID-19 pandemic exposed significant gaps in Romanian music education, particularly regarding the availability of digital tools adapted to the national curriculum and language. In response, the article called *A New e-Learning Resource to Support Music Education in Romanian Schools* presents the development and testing of a locally relevant software platform designed to align with curricular outcomes and improve student engagement during online instruction. The study's findings demonstrate notable improvements in both motivation and learning outcomes among students who used the tool consistently, especially when learning was supported by teacher guidance (Moldovan & Nedelcut, 2022). Complementing this, the research named *Solfy: An AI Didactic Support for Updating School Music Education* introduces an AI-based application aimed at enhancing solfège literacy through voice synthesis, feedback, and user performance tracking. Developed during pandemic-related restrictions, Solfy bridges classical pedagogical principles (such as those of Dalcroze, Orff, and Kodály) with technological innovation, promoting both autonomous and guided learning in online and hybrid settings (Pop-Sarb et al., 2021). While the first two studies illustrate practical and technological responses to the urgent needs of music education during the pandemic, there is one article that

offers a necessary theoretical reflection. It examines whether the shift toward digital tools represents a genuine paradigm change or merely a temporary adaptation to an exceptional context. By analyzing the structural changes, pedagogical novelties, and emerging challenges brought on by pandemic-driven digitalization, the study situates these developments within a broader inquiry into the future of music education (Muntean, 2021). Together, these contributions highlight both the creative resilience and the critical need for long-term strategic thinking in redefining music pedagogy for the post-pandemic era.

A diverse range of studies highlights the growing reliance on educational software and digital platforms as tools for enhancing creativity, performance, and conceptual understanding in music education. For instance, Mihai Popean underscores the value of musical improvisation and proposes using visual programming to create classroom applications that support improvisation with live electronics, compensating for the traditional curriculum's lack of such content (Popean, 2021). Similarly, Belibou's study explores the use of Reaper software to foster creative expression, suggesting that digital tools can cultivate both aesthetic sensitivity and technical proficiency (Belibou, 2021).

A broader review of Google Play applications reveals their role as accessible, auxiliary resources for teaching music reading and notation, now embraced even by initially skeptical educators (Spân, 2024). The case study involving the Musicators platform shows its effectiveness in developing ear training and music theory skills among young learners, with measurable improvements in engagement and individual practice (Demian & Nedelcut, 2021).

Complementing these, a 2024 study investigates digital assessment tools that allow personalized feedback in areas such as performance, composition, and music theory—further emphasizing the pedagogical shift toward student-centered and reflective learning (Simion, 2024a). The research of Banuț and Albulescu introduces Sonic Pi, integrating programming with music education through inductive strategies that develop computational thinking and composition skills (Bănuț & Albulescu, 2024) . Meanwhile, another study focused on rhythm education provides evidence

from students and teachers that ICT tools significantly enhance rhythmic competence and pedagogical clarity (Mârza & Yurevna Samohvalova, 2020). Collectively, these contributions illustrate the vast potential of technology—from specialized software to general-use applications—as a structural support for modernizing music education, increasing learner autonomy, and promoting creativity across various educational levels.

4. Conclusion

It is encouraging to observe the increasing interest shown by educators in integrating various forms of technology into music education, a reflection of their efforts to adapt pedagogical practices to the demands of a rapidly evolving world. This growing openness to digital tools and platforms illustrates not only a responsiveness to technological change but also a willingness to explore new ways of engaging students in the learning process. However, alongside this positive trend, a recurring concern identified in the literature is the lack of structured training programs for music educators in Romania. Most teachers who incorporate technology into their teaching do so independently, without formal guidance, which highlights a significant gap in professional development. There is a clear need for specialized programs that support music educators in acquiring digital competencies, including the use of educational software, applications for composition and ear training, and platforms that facilitate creative expression and student assessment.

Beyond technological integration, this review also reveals notable absences in Romanian music education research over the past five years. In particular, there is a scarcity of complex, practice-based studies exploring alternative educational models inspired by renowned 20th-century pedagogues such as Dalcroze, Orff, Kodály, or Suzuki. Likewise, the role of collective music-making—such as choral singing and group instrumental activities—remains underexplored, despite its recognized social, emotional, and cognitive benefits. Interdisciplinary approaches are also limited, and future research examining the potential of music as a tool for

teaching other disciplines, such as languages, history, or mathematics, would be both innovative and impactful.

Finally, this literature review is not without its limitations. A significant challenge lies in the fact that many Romanian journals are not indexed in the international databases consulted, which may have led to the omission of relevant perspectives and research. Additionally, the specificity of the search terms (music education Romania) may have constrained the scope of the review and excluded studies that addressed the topic from adjacent or complementary angles. These limitations point to the importance of developing broader research strategies and expanding the visibility of Romanian scholarship in global academic networks.

In light of these findings, it becomes evident that a more structured, interdisciplinary, and internationally visible approach to music education research in Romania is essential for aligning educational practice with the evolving needs of contemporary learners.

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Mapping the Reverse Gender Gap in Higher Education in Romania within the European Context

Raluca-Mihaela Molea

University of Bucharest, Department of Sociology, National Scientific Research Institute for Labour and Social Protection (INCSMPS), Bucharest

raluca-mihaela.molea@unibuc.ro / raluca.molea@incsmps.ro, ORCID

Abstract

This paper aims to analyse, through a longitudinal quantitative approach using secondary analysis, the phenomenon of the reverse gender gap in education, specifically in higher education. It seeks to document and examine the occurrence and evolution of this phenomenon in Romania and in other European countries. Initially, the gender studies were primarily focused on the challenges faced by women and girls in social structures and institutions that hindered their opportunities in education, the labour market, family life and so on. However, in recent decades, while the participation of girls in higher education has increased significantly, a new trend has emerged: the participation of boys has been declining year after year in the majority of countries around the world. Therefore, this paper studies the quantitative and temporal dimensions of male students' participation in higher education. By mapping this gap, the study tries to uncover the underlying factors contributing to this trend, such as shifts in labour market demands, changes in educational policies, and evolving societal attitudes towards gender roles.

Keywords: higher education, reverse gender gap, male students, Romania

1. Introduction

The phenomenon of 'reverse gender gap' in higher education, observed and documented in various studies, indicates a concerning trend: an increasing number of males are choosing not to pursue higher education, while the participation rate of women continues to rise. Previous studies (Vincent-Lancrin, 2008; Van Bavel, 2012; Klesment & Van Bavel, 2015; Van Bavel, Schwartz & Esteve, 2018; Lauglo & Liu, 2019) have approached this phenomenon predominantly from a quantitative perspective, focusing on statistical data to identify general trends and dimensions of the problem. These analyses have highlighted the fact that boys are less and less present in higher education, but have left mainly unexplored the root causes of this decline.

The relevance of investigating this phenomenon derives from the fact that it is present in Romania, according to data available from official sources (Eurostat, NIS), but has not been investigated at its roots. Through an exhaustive understanding of the factors influencing students' educational and professional decisions, public institutions such as the Ministry of Education, the Ministry of Labour and Social Solidarity and educational institutions can intervene to reduce the gender imbalance in higher education and other forms of education, as well as to prevent or reduce youth unemployment.

Therefore, this study aims to analyse the occurrence and evolution of the reverse gender gap in higher education in Romania within the European context and to identify the precise moment when the reversal took place.

2. Literature Review

2.1 The quantitative and temporal dimension of the reverse gender gap in the European context

Before the 1970s, women were a minority in higher education in Europe, but with significant differences between countries (Mischau, 2001). In Eastern Europe, due to the communist regime,

the percentage of women in universities was higher than in Western Europe. After 1975, as the total number of students increased, the number of women enrolled in higher education also increased, outnumbering men in many European countries by 1996, including in Romania, Bulgaria, France, and Sweden (Michau, 2001).

UNESCO data show that by 1986, women became the majority in higher education in countries such as Bulgaria, France, Hungary, Norway, Poland, and Sweden. In the following years, this trend extended to other countries such as Spain, Italy and Finland. However, in countries such as Germany, the Netherlands, Austria and Greece, women remained below 50% of all students until the late 1990s (European Commission, 2000).

Until the 1990s, on average, more men than women were enrolled in university, a trend also observed in OECD countries, where women were disadvantaged by inequalities in access to education (Vincent-Lancrin, 2008). In Europe, around 1950, participation in higher education was still very low for both men and women, but enrolment rates were more than twice as high for men as for women.

Participation in higher education has increased rapidly since the 1960s. Since the 1970s, the gender gap began to narrow, and by the late 1990s, more women than men were enrolled in higher education (Van Bavel, 2012). According to Vincent-Lancrin (2008), women accounted for 46% of university students in 1985, and in 2005, the average share of women in higher education reached 55% in the OECD area.

From a comparative perspective, in the USA, equality between women and men in higher education was already achieved in 1980, while only three communist countries in Europe had reached this level – Bulgaria, Poland and Hungary (Vincent-Lancrin, 2008). Women have not only outperformed men in higher education participation, but also in graduation rates: women are more likely than men to successfully complete university education and obtain a degree (Van Bavel, 2012; DiPrete & Buchmann, 2013).

Although more women are participating in higher education, this does not result in a majority representation across all fields of study (Van Bavel, 2012). There is a tendency for girls and boys to choose different fields of study, leading to gender segregation, known as horizontal segregation, which is the greater or lesser concentration of women and men in different fields (sectoral segregation) and occupations (occupational segregation) (EIGE, 2021a). This horizontal segregation is also evident in education, where there is an over- or under-representation of one gender in certain subjects and fields of study (European Commission, 2021).

According to a report by the European Commission - She figures (2021), in 2018, for all EU-27 Member States and associated countries except Switzerland, there were more female than male bachelor graduates in every field of study. The ratio of female bachelor's graduates to those entering university varied from 0.6 (Luxembourg) to 1.4 (Hungary), whereas the ratio for males varied from 0.4 (Latvia) to 1 (Ireland). This indicates that, at the national level, girls were more likely than boys to obtain a bachelor's degree.

At the national level, the trend of a widening gap and decreasing participation rates of males in education can be observed (**Table 1**). There has been a decrease in male participation in undergraduate education – bachelor studies – and consequently a widening gender gap over the last 10 years.

While in 2013, the percentage of males enrolled in bachelor education was 47.1%, in 2022 the percentage reached 45.2%, a decrease of 1.9 percentage points. Post-secondary education also saw a decrease in the participation of males. Although the participation of males at this educational level slightly increased after 2013, from 33.3% to 34.1% in the following two years, it followed a downward trend until 2022, reaching 29%. The steepest decrease is observed in vocational education, with the percentage of males falling from 77.5% in 2013 to 65.6% in 2022, a decrease of 11.9 percentage points in 10 years.

Bachelor studies	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Male	47.1%	47.0%	46.7%	46.7%	46.4%	46.1%	45.8%	46.1%	45.2%	45.2%

Post-secondary education	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Male	33.3%	34.1%	34.1%	33.0%	32.1%	31.0%	29.7%	30.7%	28.8%	29.0%

Vocational education	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Male	77.5%	73.9%	71.2%	69.5%	68.7%	68.1%	65.9%	66.8%	65.7%	65.6%

Upper secondary education	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Male	50.4%	49.4%	49.0%	48.4%	48.2%	48.2%	48.1%	48.1%	48.2%	48.3%

Table 1. Distribution of male student population in Romania by level of education

Source: NIS (Tempo online)

Also, these declines in males' participation rates in post-secondary education can be explained by the declining participation rate of boys in upper secondary education. While in 2013, the percentage of boys slightly exceeded that of girls (50.4%), in the following years it started to shrink, reaching 48.3% in 2022, a difference of 2.1 percentage points compared to 2013.

2.2 Key factors driving the reversal of gender gaps in higher education

2.2.1 Demographic factors

Fertility control through the advent of contraceptives, women's choice to marry and have a child later in life are demographic factors that have enabled women to go to university, contributed to lower school drop-out rates and facilitated entry and participation in the labour market (Goldin & Katz, 2002; Bailey, 2006; Vincent-Lancrin, 2008). Goldin & Katz (2002) studied the effects of the introduction of contraceptive pills and found that their widespread use by women resulted in beneficial effects for women who wished to acquire a higher level of education, thus allowing them to have a higher level of autonomy over the timing of marriage and childbearing. Bailey (2006) investigated the effects of the contraceptive pill Envoid, launched in the US in the 1960s, and found that between 1970-1990 access to it contributed to a 14% increase in labour market participation among women aged 16-30.

Another demographic factor that has contributed to the increase in female participation in higher education is the decrease in family size. Averett & Burton (1996) found that the likelihood of pursuing higher education is significantly and negatively affected by the number of siblings of the individual, particularly if female, and not significantly for males.

Therefore, a decrease in the number of siblings in families contributed to an increase in female participation in higher education.

2.2.2 Socio-economic factors

Other causes that may explain this phenomenon based on sociological factors. These would be lesser discrimination in the workplace, changes in social norms regarding women's behaviour in a society that has become increasingly egalitarian, changes in parents' choices in terms of investing in education for their children in a social environment where parents are better educated, with mentalities that promote greater gender equality (Vincent-Lancrin, 2008).

Economic arguments may also explain the reversal of gender gaps in higher education. According to human capital theory, people choose to invest in themselves through education, training or other types of activities that increase their chances of acquiring a better job and higher

future earnings (Becker, 2009). The decision whether or not to attend school, work or enrol in college is considered by proponents of this theory to be a rational decision in terms of costs and benefits. Lauglo & Liu (2019) consider that people who choose to continue their education after completing compulsory education do so until they identify an attractive "exit opportunity". Lauglo & Liu (2019) offer a conflictualist perspective, based on which they believe that girls, unlike boys, perceive fewer "exit opportunities" and for this reason women tend to acquire higher educational attainment in order to cope with gender discrimination in the labour market and to ensure autonomy in their family life, which is also likely to be affected by patriarchal values.

3. Methodology

The research methodology relies on secondary analysis that utilises quantitative data obtained from official statistical sources. This study involves a comprehensive examination of datasets from the Eurostat database and the National Institute of Statistics from Romania (NIS). Thus, the present study provides insights into key trends and patterns by leveraging existing data, thereby enhancing the reliability and validity of the findings.

To process and standardise the data, the absolute values were transformed into percentage values, facilitating a comparative analysis and interpretation of the results. The main indicator used in the analysis is the proportion of males in the total population studied, calculated as a percentage ratio. The proportion of females is determined by the difference of up to 100% of the value of the percentage of males.

The temporal dimension of the analysis was also determined by the criterion of data availability from the sources used (Eurostat, NIS). Therefore, the period analysed includes all years for which there are records in the databases.

In this research there have been followed 2 main dimensions, which have been divided into indicators:

1. Quantitative dimension of participation in higher education:

- percentage of men enrolled in higher education;

- differences between study cycles (bachelor, master, doctorate);

- graduation rate of males.

2. Temporal dimension of participation in higher education:

- historical inflexion point when the reversal occurred;

- pace of change (gradual vs. accelerated);

- persistence/ instability of this reversal.

The data were analysed beginning with a higher level of aggregation (national) and then examined at disaggregated levels (NUTS 1 and NUTS 2). This approach allowed for both an overall view and a deeper focus on the reverse gender gap in the context of higher education in Romania.

4. Results and Discussions

Table 2 presents the distribution of male students enrolled in university education at the bachelor's degree level in European countries. Throughout the period covered by the analysis, Romania has had a higher rate of male student participation in bachelor's degree programmes than the European Union average.

At the European level, out of the 15 countries analysed, 6 of these (Germany, Spain, France, Austria, Romania, Sweden) have registered a downward trend in terms of the rate of participation of men in bachelor's degree programmes, another 6 countries (Bulgaria, Greece, Italy, Poland, Slovakia, Norway) have registered an upward trend, while 3 countries (Hungary, Portugal and Finland) have generally maintained the same trend, with small fluctuations.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EU-27	46.73%	46.92%	46.99%	47.04%		46.87%	46.93%	46.57%	46.35%	45.85%
Bulgaria	46.97%	47.40%	47.36%	47.91%	48.02%	48.11%	48.01%	48.18%	47.90%	47.17%
Germany	55.83%	55.22%	54.76%	54.07%	53.62%	53.26%	53.98%	53.30%	52.81%	51.49%
Greece	51.93%	52.13%	51.96%	52.18%	52.65%	52.59%	51.82%	51.65%	51.97%	52.09%
Spain	45.86%	45.70%	45.97%	45.94%	45.83%	45.56%	45.48%	45.10%	44.65%	44.41%
France	41.55%	41.56%	41.63%	41.81%	41.45%	41.05%	40.83%	40.34%	39.79%	40.06%
Italy	44.86%	45.21%	45.64%	45.94%	46.21%	46.27%	46.20%	45.62%	45.72%	45.43%
Hungary	46.58%	46.14%	46.69%	47.16%	47.39%	47.61%	47.47%	47.13%	46.90%	46.28%
Austria	46.91%	47.19%	47.34%	47.28%	47.41%	47.15%	46.27%	45.95%	45.32%	44.98%
Poland	42.85%	43.43%	43.81%	43.73%	43.66%	43.53%	43.26%	44.08%	44.59%	44.26%
Portugal	46.65%	46.35%	46.16%	46.12%	45.62%	45.39%	45.05%	45.28%	45.61%	46.80%
Romania	48.61%	48.51%	48.71%	48.48%	48.44%	48.16%	47.98%	48.00%	47.72%	47.10%
Slovakia	41.12%	40.97%	41.15%	41.38%	41.67%	41.98%	42.51%	42.76%	42.75%	42.26%
Finland	47.80%	47.83%	47.93%	48.07%	48.23%	48.57%	48.43%	47.90%	47.72%	47.15%
Sweden	36.85%	36.99%	37.01%	36.80%	36.54%	35.97%	36.09%	36.05%	35.65%	35.55%
Norway	38.17%	39.40%	39.19%	39.14%	39.31%	39.68%	39.82%	39.71%	39.69%	39.69%

Table 2. Distribution of male students enrolled in bachelor's degree programmes (% of total) in European countries

Source: Eurostat [educ_uoe_enrt06] (own calculations)

Among all the countries analysed, Germany stands out for having more than half of all students enrolled in bachelor's degree programmes being male. During the first period analysed, the data showed values between 55-54%, but these values stagnated for four years, remaining around 53%. In the last two years, there has been a slight decline, with values recorded at 52.81% in 2021 and 51.49% in 2022.

At the national level, the participation rate of male students in the bachelor's program has gradually decreased, reaching from 48.6% in 2013 to 47% in 2022.

At a higher educational level, master's degree programmes, (**Table 3**) the data have lower values compared to the bachelor's cycle, which means that men do not necessarily want to have a higher educational level, but rather view college from an instrumental point of view, with the main goal of obtaining a university degree, in this case a bachelor's degree, which would give them an advantage on the labour market. Compared to people who did not attend higher education, with the aim of specialising

in a certain field, men who graduated from university (bachelor's degree) would have more opportunities for employment and professional advancement compared to those who only have a high school education.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EU-27	42.71%	42.85%	42.98%	43.17%		43.18%	43.02%	42.82%	42.54%	41.89%
Bulgaria	41.68%	41.76%	41.00%	41.87%	42.37%	42.47%	41.75%	41.39%	40.45%	39.22%
Germany	46.19%	46.30%	46.47%	46.80%	46.86%	46.61%	46.14%	45.77%	45.41%	45.12%
Greece	42.03%	41.78%	42.37%	42.19%	40.35%	40.09%	40.10%	40.05%	38.51%	37.74%
Spain	44.82%	44.86%	44.35%	43.27%	42.42%	41.52%	41.46%	40.63%	40.76%	40.91%
France	46.53%	46.41%	46.40%	46.33%	46.53%	46.73%	46.81%	46.53%	47.03%	46.33%
Italy	39.63%	39.73%	40.15%	40.48%	40.80%	41.01%	40.95%	40.82%	40.40%	39.88%
Hungary	42.74%	42.48%	42.80%	42.59%	42.90%	43.30%	43.15%	43.41%	43.71%	43.23%
Austria	45.09%	45.18%	45.15%	45.49%	45.92%	46.07%	46.01%	45.57%	45.10%	44.69%
Poland	34.31%	34.34%	34.57%	34.72%	34.80%	34.42%	34.06%	34.32%	33.16%	32.04%
Portugal	47.64%	47.48%	47.66%	47.34%	47.14%	46.52%	45.85%	45.47%	45.38%	42.31%
Romania	40.07%	41.02%	40.70%	40.56%	40.45%	40.43%	39.95%	39.66%	39.08%	38.59%
Slovakia	37.61%	37.87%	38.00%	38.67%	38.22%	38.52%	38.01%	38.41%	38.61%	38.21%
Finland	40.11%	40.51%	40.82%	41.90%	42.43%	41.87%	41.84%	41.00%	40.52%	40.25%
Sweden	43.08%	43.58%	44.12%	43.66%	43.46%	42.88%	42.82%	42.64%	42.10%	41.58%
Norway	43.46%	43.87%	43.78%	43.40%	43.13%	42.65%	41.87%	41.23%	40.48%	39.77%

Table 3. Distribution of male students enrolled in master's degree programmes (% of total) in European countries

Source: Eurostat [educ_uoe_enrt06] (own calculations)

According to **Table 3**, Romania has lower values throughout the analysed period, unlike the EU-27 average. The most pronounced decreases in the participation rate in the master's program in the 10 years analysed are observed in Portugal - 47.64% in 2013 vs. 42.31% in 2022, a decrease of 5.33 percentage points, Greece – 42.03% in 2013 vs. 37.73% in 2022, a decrease of 4.29 percentage points, Spain – 44.82% in 2013 vs. 40.91% in 2022, a decrease of 3.91 percentage points and Norway – 43.46% in 2013 vs. 39.77% in 2022, a decrease of 3.69 percentage points.

At the national level, although an increase of 0.95 percentage points was observed in 2014 compared to 2013, in the following years, the data tend to gradually decrease, but they remain

slightly higher than in 2013. Since 2019, the percentage of male students enrolled in the master's degree program has begun to have a more pronounced downward trend, reaching 38.59% in 2022.

In the doctoral programs (as shown in **Table 4**), participation among men is higher compared to women in most countries during the initial period analysed. However, this trend tends to decrease over time, with men's participation falling below that of women in more recent years. Throughout the entire period analysed, the proportion of men enrolled in doctoral programs remains over 50% in countries such as Germany, Greece, France, Hungary, Austria, and Slovakia. Additionally, the EU-27 average for the percentage of men enrolled in doctoral programs has consistently been above 50% during the years studied.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EU-27						51.96%	51.94%	51.47%	51.17%	51.00%
Bulgaria	48.91%	49.35%	48.65%	48.74%	48.06%	47.70%	46.87%	47.45%	47.41%	48.04%
Germany						55.59%	55.65%	53.57%	53.03%	52.50%
Greece	52.49%	52.93%	54.69%	54.57%	52.53%	51.16%	51.56%	52.08%	52.18%	51.64%
Spain	51.90%	50.54%	50.36%	50.34%	50.33%	50.11%	50.04%	49.99%	49.91%	49.84%
France	52.84%	52.74%	53.10%	53.00%	53.24%	52.96%	52.60%	52.79%	52.57%	52.72%
Italy	48.43%	48.59%	49.10%	49.41%	49.61%	49.97%	50.74%	51.32%	52.04%	52.14%
Hungary	51.20%	49.91%	49.60%	49.67%	50.92%	52.59%	51.55%	51.57%	51.93%	50.87%
Austria	52.86%	53.13%	53.53%	53.74%	54.02%	54.48%	54.54%	54.70%	54.17%	54.31%
Poland	46.91%	46.17%	45.74%	45.31%	44.95%	45.09%	45.20%	45.35%	45.97%	46.74%
Portugal	46.51%	46.10%	46.79%	47.35%	47.54%	47.76%	47.97%	47.77%	47.96%	47.47%
Romania	50.66%	50.12%	51.91%	50.70%	51.50%	51.01%	49.49%	48.99%	48.62%	48.46%
Slovakia	52.41%	52.55%	52.18%	52.13%	52.53%	52.45%	52.13%	52.03%	52.37%	52.13%
Finland	47.88%	48.12%	47.31%	47.29%	46.94%	47.24%	46.93%	46.75%	46.83%	46.76%
Sweden	51.26%	51.64%	52.03%	52.48%	52.39%	51.80%	51.69%	50.76%	49.99%	49.08%
Norway	48.87%	48.18%	48.57%	48.84%	47.70%	47.33%	47.03%	46.28%	46.04%	45.96%

Table 4. Distribution of male students enrolled in Doctorate programmes (% of total) in EU countries

Source: Eurostat [educ_uoe_enrt06] (own calculations)

The countries that indicate a reversal of the gender gap in participation in doctoral programs are Spain, Romania and Sweden. A downward trend was recorded in the 10 years analysed in

Bulgaria, Hungary, Poland, Finland, Norway. Italy is the only country that had an upward trend and went from under half of male doctoral students to over half (48.43% in 2013 to 52.14% in 2022).

In Romania, the gender gap at the doctoral level began to reverse after 2019, with males representing 49.49% of doctoral students in 2019, being at parity with women. By 2022, this figure slightly decreased to 48.46%.

When comparing different study programs, a notable discrepancy is observed between master's and doctoral programs regarding the participation of men and women. At the master's level, women have significantly higher participation rates, while at the doctoral level, men outnumber women, both nationally and across Europe. The year 2019 marks a pivotal moment as it signifies the reversal of the gender gap in doctoral university programs at the national level.

Figure 1 depicts the distribution of male upper secondary education pupils and male undergraduate students in Romania over a 28-year period between 1955 and 2023. As can be observed, the reversal of the gender gap in undergraduate studies occurred in 1998 when the percentage of male undergraduate students decreased to 48.97% from 50% in 1997. Since 1998, male participation in undergraduate programs in Romania had a downward accelerated trend until 2004, recording values of 46.49% in 2000, 45.52% in 2002 and 44.14% in 2004.
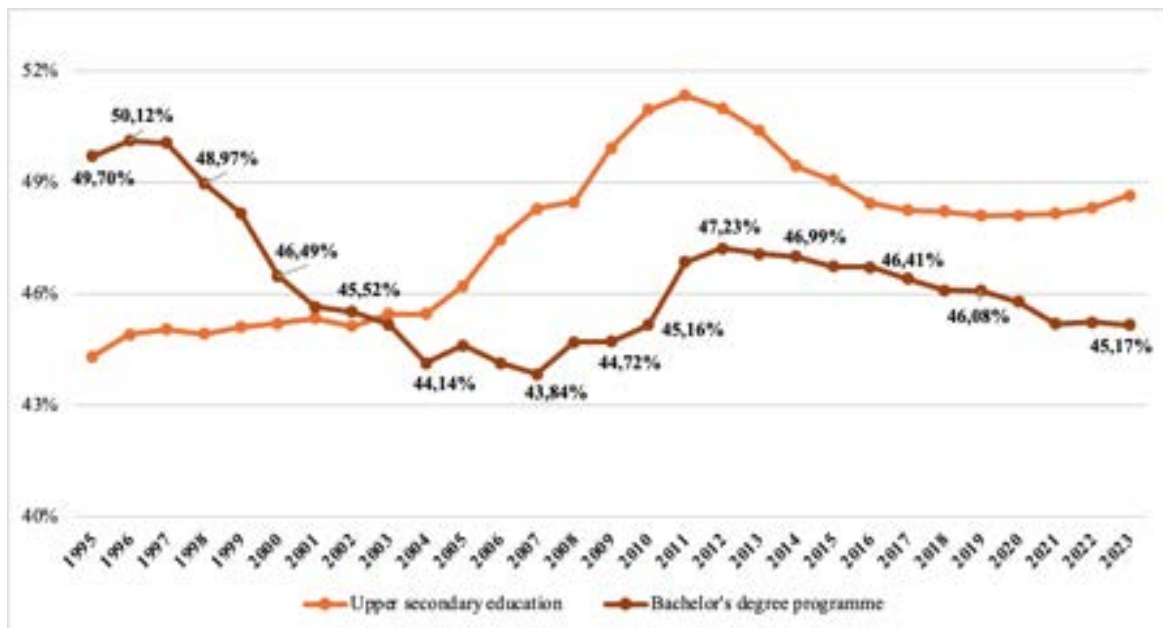
Romanian International Conference for Education and Research 15th edition, 05th June 2025 at "Alexandru Ioan Cuza" University of Iași

Figure 1. Distribution of male pupils and students in Romania (% of total) – Upper secondary education and bachelor's degree programme – 1995-2023

Source: NIS - Tempo Online (own calculations)

In 2005, the values were slightly higher (44.62%), but then dropped again, reaching 43.84% in 2007, the lowest percentage recorded in the period analysed. From 2009, the data started to gradually increase again until 2012 (45.16% in 2010, 46.86% in 2011 and 47.23% in 2012). From 2013, the participation of males in undergraduate higher education gradually decreased, as can be seen in the graph, reaching 45.17% in 2023. Therefore, from 1996, when the participation of males in undergraduate programs was at parity with that of girls (50.12%), it reached a gap of 4.95 pp in 2023.

In terms of upper secondary education at the national level, there is an upward trend in the participation of boys, with the highest percentage in 2011 (51.33%). For 4 years, boys have had a higher participation in upper secondary education than girls (50.94% - 2010; 51.33% - 2011; 51% - 2012 and 50.39% - 2013). Looking from the point of view of the variability of the data

over time, it can be observed a slow increase in the period 1995-2004 from 44.31% (1995) to 45.46% (2004).

At the same time, the analysis shows a rapid evolution of the data from 2005, which was maintained for 6 years. From 2012, the data had a downward curve until 2019 (48.10%), starting again to increase slightly, reaching 48.64% in 2023. Despite the fluctuating trend in the data over the period analysed, overall there has been an increase in the participation of boys in upper secondary education from 1995 (44.31%) to 2023 (48.64%).
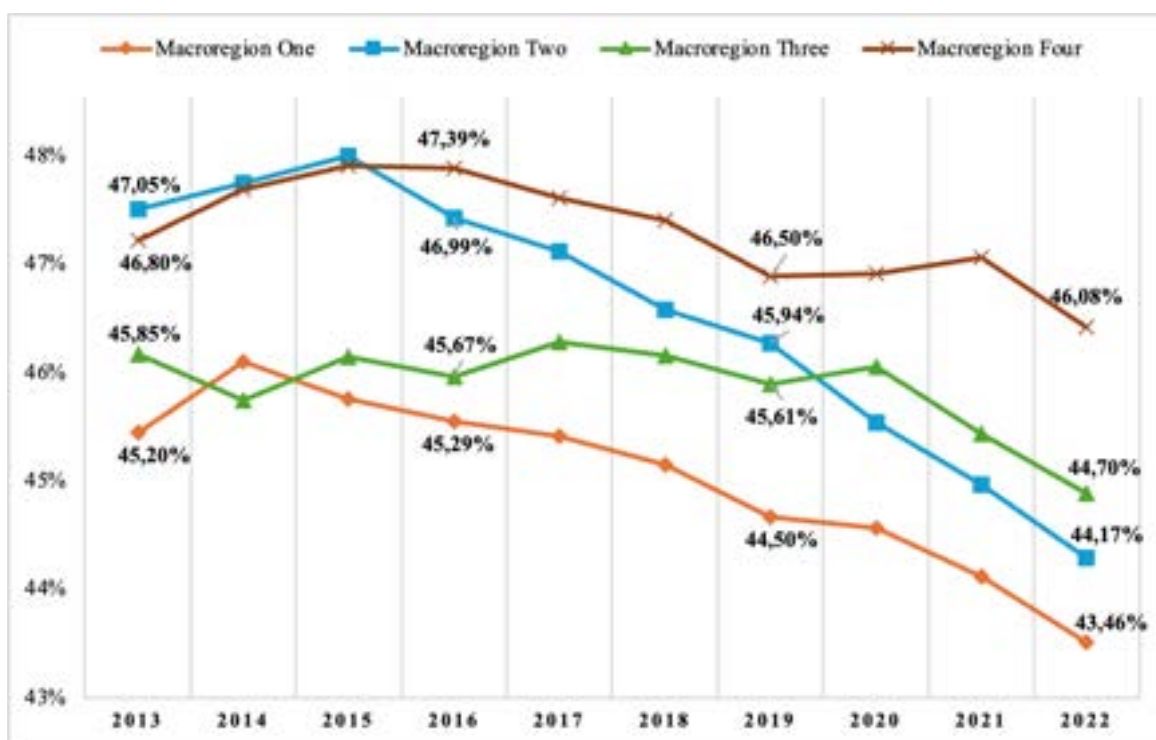
Figure 2. Distribution of male students enrolled in higher education in Romania by macro-region - NUTS 1 - (% of total)

Source: Eurostat [educ_uoe_enrt06] (own calculations)

Figure 2 above shows the distribution of male students enrolled in higher education in Romania by macro-region (NUTS 1 disaggregation level). Overall, there is a decrease in male

participation in higher education in all 4 macro-regions over the analysed period. Macro-region Four (includes Sud-Vest Oltenia and West region) is the only one that remains at the same values of 46.80-46% between 2013-2022, unlike the rest of the macro-regions which show more pronounced downward trends. Macro-region Two (includes North-East and South-East) had the steepest downward trend over the analysed period, falling from 47.05% (2013) to 44.17% (2022) in 9 years. Macro-region Three (includes South-Muntenia and Bucharest-Ilfov) had a fluctuating path over the analysed period, registering increases and decreases every year. The last recorded increase was in 2020 (45.47%), after which it gradually declined to 44.70% in 2022.

Regarding Macro-region One (includes North-West and Centre), only two moments are observed when the values increased, namely 2014 (45.79%) and 2020 (44.41%). For the rest period, the data present a downward trend that culminated with the value of 43.46% in 2022.
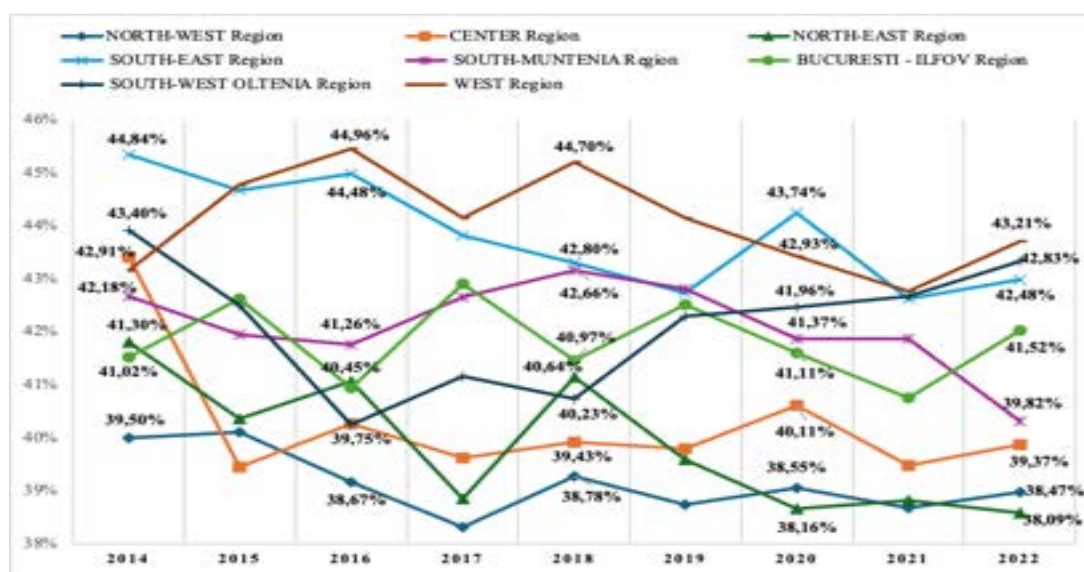

Figure 3. Distribution of male higher education graduates in Romania by development regions– (NUTS 2)
(% of total)
Source: NIS – Tempo Online (own calculations)

Figure 3 shows the distribution of male higher education graduates by development region. The North-West and Center regions, which belong to Macro-region One, are at a significant distance in 2014

in terms of the percentage of male higher education graduates (42.91% - Center vs. 39.50% - North-West), but immediately the following year the Center region shows a sharp decrease, reaching 38.94% and approaching the profile of the North-West region. In the following years, the Center region slightly starts to have slightly higher values, while the North-West region starts to show decreases. In the last year captured in the analysis (2022) the Center region has a value of 39.37% and the North-West region has 38.37%, both with lower values than at the beginning of the analysis.

The North-East and South-East Regions, belonging to Macro-region Two, have very different paths in the 9 years analysed, the South-East Region having in general much higher values than the North-East Region, but being characterized by a downward trend, starting from 44.48% in 2014 and reaching 42.48% in 2022. On the other hand, the North-East Region has in 2014 the value of 41.30%, registers in the following year a decrease of 1.16 percentage points, and then every year has an increase followed by a decrease until 2018, when it reaches the value of 40.64%, being the highest value for this region in the period analysed, having after an annual downward trend, reaching 38.09% in 2022, the lowest percentage in that year compared to the other regions.

The regions of Sud-Muntenia and Bucharest-Ilfov, which belong to Macroregion Three, show different trends, although their values are generally similar. A more stable trend is recorded by the Sud-Muntenia region, while the Bucharest-Ilfov region has an unstable path, characterized by annual increases and decreases. The moments in which the two regions have similar values are the years in which the Bucharest-Ilfov Region registers increases in the male higher education graduation rate. Two moments stand out in the values recorded by the two regions, namely the year 2018, when the South-Muntenia region has an increase in the graduation rate, with a value of 42.66%, and the Bucharest-Ilfov region has a decrease compared to the previous year, with a value of 40.97%, and the year 2022, when the South-Muntenia region records a decrease, reaching 39.82%, and the Bucharest-Ilfov region has an increase, reaching 41.52%. From a longitudinal perspective, despite the fluctuations recorded by the Bucharest-Ilfov region, it does not have a large difference between the values at the beginning and at the end of the period analysed; and even has a slight increase of 0.5 percentage points in 2022, compared to 2014. In the case of the Sud-Muntenia region, the longitudinal analysis shows that, despite 4 years of higher values compared to the beginning of the analysis, it has a decrease of 2.36 percentage points in 2022 compared to 2014.

The South-West Oltenia and West regions belong to Macro-region Four. Compared to the other regions, the West region has among the highest values of higher education completion rates for males in the analysed period. Although in 2014, the higher education completion rate for males had an average value in the West region (42.65%), at the end of the analysed period, it had the highest value since 2022 (43.21%). Also, the South-West Oltenia region had a value of 43.40% in 2014, but it experienced an accelerated decrease in the following two years, reaching 39.75% in 2016. Nevertheless, it managed to recover and gradually record annual increases, except for 2018 when it had a small decrease, and reach the value of 42.83%, very close to that of the West region in the same year (43.21%).

5. Conclusions

The analysis of these data indicates that they are consistent with the findings of previous studies that have investigated this phenomenon. The study identified that the historical inflexion point when the reversal of the gender gap occurred in Romania (1997-1998 period) corresponds to the moment when this phenomenon was also identified in other European countries, according to studies conducted previously (Vincent-Lancrin, 2008; Van Bavel, 2012; DiPrete & Buchmann, 2013; Klesment & Van Bavel, 2015; Van Bavel, Schwartz & Esteve, 2018; Lauglo & Liu, 2019).

Within the European context, Romania had a higher participation rate of male students in undergraduate programs (bachelor's degree) than the EU average for the same period. For university master's education, the data from all the countries analysed have lower values than for bachelor's education, which means that men do not necessarily aim to have a higher educational level, but rather look at university from an instrumental point of view, with the main goal of obtaining a university degree, in this case a bachelor's degree, which gives them an advantage in the labour market. In contrast to people who have not attended a university with the aim of specializing in a particular field, men with a university degree (bachelor's degree) would have significantly more opportunities for employment and career advancement than those with only a high school education. The steepest declines in the participation rate in master's programs over the 10 years are observed in Portugal, Greece, Spain and Norway. Romania has lower values over the whole period analysed (2013-2022) in contrast to the EU-27 average in terms of the percentage of male students enrolled in master's programs.

In Romania, the gender gap reversal at the doctoral program level started in 2019 (49.49%), reaching 48.46% in 2022. As a comparison between the study programs, a larger discrepancy is observed between the master's and doctoral programs in terms of the percentage of men enrolled in the two programs. While at the master's level, women tend to have a much higher participation, at the doctoral level, the opposite is observed, with men outnumbering women at both the European and national levels.

At the regional level, Macro-region Four had the highest participation rates in higher education for males compared to the rest of the region over the period analysed. At the opposite pole was Macro-region One, which recorded the lowest values regarding male participation rates in higher education.

The limitations of this study include its reliance entirely on secondary data, whereas some complementary data collected might provide deeper insights into the causes of the reverse gender gap. Also, the data sources are limited to Eurostat and NIS, which might not capture all relevant variables. For example, the study focuses primarily on enrolment and graduation rates without exploring performance metrics or dropout rates. While this study maps the quantitative trends, it offers a limited explanation of the causal factors driving the reverse gender gap in higher education in Romania specifically. Even though this study provides a context for the European comparison, it doesn't fully explain why some countries show different patterns than others.

It should be noted that this analysis is still in the early stages of investigation, and future directions should identify detailed and varied explanations for the evolution of the data in relation to the political, economic and social context in Romania over the last 30 years. Further investigation should be conducted into the phenomenon of gender gap reversal in higher education, using additional data to highlight the causes of this phenomenon. Other research directions would be to analyse the promotion rate in the Baccalaureate exam by gender in recent years, the results of PISA tests in recent years by gender, the participation of students by gender in Romanian universities and faculties according to macro-regions, development regions, to identify which universities have the lowest participation rates of male students in the four macro-regions and development regions, analysing data from gender barometers and other databases such as WVS, EVS, to see how social values on the importance of education have evolved according to gender dimension.

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Sustainable Agriculture and Education for Long-Term Development

Simona Gavrilaş[1], Ioan Calinovici[2]

1. Faculty of Food Engineering, Tourism and Environmental Protection, Aurel Vlaicu University of Arad, simona.gavrilas@uav.ro, ORCID

2. Faculty of Food Engineering, Tourism and Environmental Protection, Aurel Vlaicu University of Arad, ioan.calinovici@uav.ro

Abstract

Sustainable agriculture is becoming an essential pillar for sustainable development in the context of global challenges related to climate change, natural resource degradation, and population growth. This article explores the link between education and sustainable agriculture, with a special focus on the role of vocational training in adopting precision agriculture. Precision agriculture, based on modern technologies such as GPS, sensors, drones, and artificial intelligence, promises increased efficiency and reduced negative environmental impact. However, the success of its implementation depends significantly on the level of training of farmers and the capacity of educational institutions to respond to the demands of the modern agricultural market. The article analyzes the advantages and limitations of training in this field, proposes directions for improving educational curricula such as the local specific context, and provides recommendations for integrated public policies that support the transition to a

sustainable and digitalized agriculture. The conclusions emphasize the need for a synergistic approach between education, technology, and policies to ensure long-term sustainability.

Keywords: agroecological practices; agricultural policies; comparative analysis; green transition; vocational training

1. Introduction

In a global context marked by accelerated climate change, ecosystem degradation, and increasing pressure on natural resources, sustainable agriculture is becoming an essential condition for achieving sustainable development goals. However, this sector transformation cannot occur without a fundamental pillar: education (Durán Gabela et al., 2022). Access to quality vocational training, the development of green skills, and the promotion of lifelong learning are key elements in supporting a resilient agriculture, capable of responding to the economic, social, and ecological challenges of the 21st century.

The synergism between the two aspects could be of increased interest, especially when the system is active in rural areas. Education main role is to prepare well-trained specialists in the fields required mainly by the local economic sector. Another situation that may sustain the necessity of implementing new farming actions and training in the field relates to the family background. The possible heritage pass in the field to the youth may determine their career orientation and the intention to improve productivity through new strategies (Maini et al., 2021).

In particular, the transition to modern practices, such as precision agriculture, requires a profound reform in agricultural education systems and the public policies that support them. The concept implementation requires investments in technology and human capital prepared to integrate digital knowledge, analyze complex data, and make informed decisions to protect the environment and increase efficiency. As a member of the European Union, Romania has the

opportunity and responsibility to build a durable agricultural system by combining new technologies with future-oriented education.

Implementing "smart" agriculture instruments could contribute to improving natural resource management. A significant element in this area regards water managing. Use of the humidity detection level sensor and its maintenance according to crop needs is targeted. Another aspect that sustains the discussed technology's implementation is improving the control of dispensed fertilizers and pesticides. Integrating automated elements could provide good operation practices of the three dimensions and determine a lower environmental impact of farming (Getahun et al., 2024).

The new perspective for the domain development also sustains an increased desire among the youth to be involved in the field. The context limits are determined by their interest in using computer-based instruments in their professional activities and the possibility of engaging in a green and attractive financial sector. Sanyaolu and Sadowski highlighted significant positive correlations between the tendency to use precision farming instruments and the environmental and economic aspects (Sanyaolu & Sadowski, 2024). The actions that sustain the results are linked to the possible reduction of production costs. This objective could be reached through two mechanisms. One refers to improving the efficiency of the stimulators used for crop grow by decreasing their quantity without affecting plant productivity and characteristics. The other one marks the possibility of accessing public grants.

Following up on intentional education in this field may decrease or eliminate some possible limitations. Basic knowledge in accessing financial support, field data evaluation, and ensuring their security (Mgendi, 2024), but also the ethical (Gamage et al., 2024), legislation and technical blankness (Jerhamre et al., 2022) aspects that may drift from this field are some considerations that might raise difficulties in adopting the future-specific instruments that are currently being developed, but which will forestall the domain in the future. All intentions are directed to

productivity and quality traceability to ensure the needs al the entire world population in expansion, but with controlled use of natural resources (Kumar et al., 2024).

This paper aims to analyze the interdependencies between education and sustainable agriculture, assess the role of vocational training in adopting "smart" agriculture, and highlight strategic directions for the long-term development of this vital sector. The future of the agriculture sector integrates the precision agriculture instruments, and the way to use them in the field to optimize the domain outcomes.

2. Literature Review

The studies in the field underline that the interdependence between education and agricultural sustainability is increasingly highlighted. Vocational training could be considered a strategic factor in achieving durable development goals. Numerous studies have highlighted that farmers' education level is directly correlated with the degree of adoption of modern technologies, ecological practices, and efficient agricultural management methods. Kang et al. highlighted several possible benefits of implementing a smart farming learning manufactory in an educational institution. The advantages could be encountered at the students' practical and theoretical abilities acquisition level and for the economic actors. By benefiting from similar equipment to production units, students have acquired skills complementary to those acquired through on-the-job training courses. In this way, employers' costs for their practical training can be reduced (Wee et al., 2024).

European Council of Young Farmers (CEJA) makes a clear remark regarding three essential factors that contribute to the development of the future farmer. These relate to training for knowledge, education, and skills acquisition. Another important factor is the possibility of benefiting from innovative techniques, technology, and strategies. Neither of the two previous aspects could be performed without financial resources. Chen mentioned in his study the necessity of well-trained farmers for the future development of the rural areas. One important

element in their training is the skill to work with informational technologies (Chen, 2025). To accomplish such an objective, it is necessary to have an up-to-date curriculum, use active teaching methods, integrate the industry, and increase social awareness concerning vocational education for the field's development.

Being at the start of the implementation and a continuous development process, it is advisable to be flexible. For that, there is a need to adapt the teaching strategies to the specific realities of the field (Charles et al., 2020). Being involved in a seasonal activity, very much influenced by the weather conditions, the people interested in the field tend to prefer intensive, focused learning activities such as workshops and seminars (Oli et al., 2025). Forms of information, such as meetings, tutorials, or forums, could be adapted to online channels to ensure enlarged access to those interested. Chuang et al. underlined the necessity for lifelong learning in the field and the importance of disseminating the information related to the smart farming concept among farmers (Chuang et al., 2020). Some studies also mention a possible limiting factor for automated strategies besides the educational level and the enterprise size (Caffaro & Cavallo, 2019). Since the novel technologies initially have increased costs, small farmers are less likely to access them. Another important linked aspect concerns the possible expenses of training to get the needed knowledge to operate the technologies. There could be a reason why the entrepreneurs in the field have an increased yield of having more knowledge.

Although ten years ago, there were studies that underlined lower correlations between the farming practice adopted and the training level of the persons involved in the field (Meiguran & Basweti, 2016), there were recommendations for developing and raising awareness of literacy needs. Even if many of the employees in the farming sector had a low educational level, the current developments in the field tend to push the situation in a new direction: the need for specialized training. Some studies negatively correlate the willingness to implement new technologies in the field with the respondents' studies (Ewulo et al., 2025). The situation might be an alarm signal suggesting a possible gap between the current curriculum, the field's

socio-economic needs, and the necessity to form current skills and attitudes (Gemtou et al., 2024) and up-to-date visions in the education field (Yameogo et al., 2024). The intention to implement new development in the farming area could also be determined by the experience in the field or the specific local context (Erekalo et al., 2025). Considering these premises, educational policy implementation should be based on evaluating the concrete individual situations (Suebsombut et al., 2020).

3. Materials and Methods

The present investigation comprises an empirical evaluation of different EUROSTAT data regarding the evolution of the areas under green farming in Romania between 2006-2022. Comparative trends in vocational education and economic background for agriculture development in our country are also included.

4. Results and Discussions

4.1. Eco-friendly perspectives in farming areas

The interest in these data is justified by assessing the current status and trends in the field. The results are presented in **Figures 1** and **2**. The need to implement specific educational policies must also be sustained by the signals transmitted from the real socio-economic areas. **Figure 1** suggests increased interest in adopting environmentally friendly practices, especially after 2016. In the next six years, the percentage of the green regions' growth was over three times. That year was also the one declared as the International Year of Pulses by the Food and Agriculture Organization of the United Nations. Such initiatives tend to stimulate the various crop production sectors to ensure healthy natural nourishment sources and sustain the produce from a certain yield area.
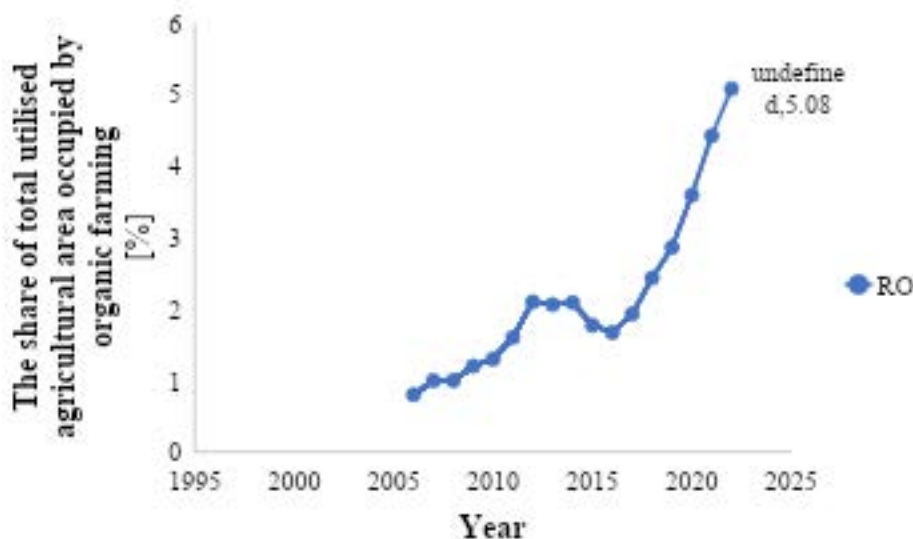
Figure 1. Organic farming share in Romania

Source: EUROSTAT

Another aspect targeted referred to the possibilities offered by the farming domains to the youth. There, the study concentrated on determining the percentages of used areas to assess if there are possibilities to begin an entrepreneurial activity.
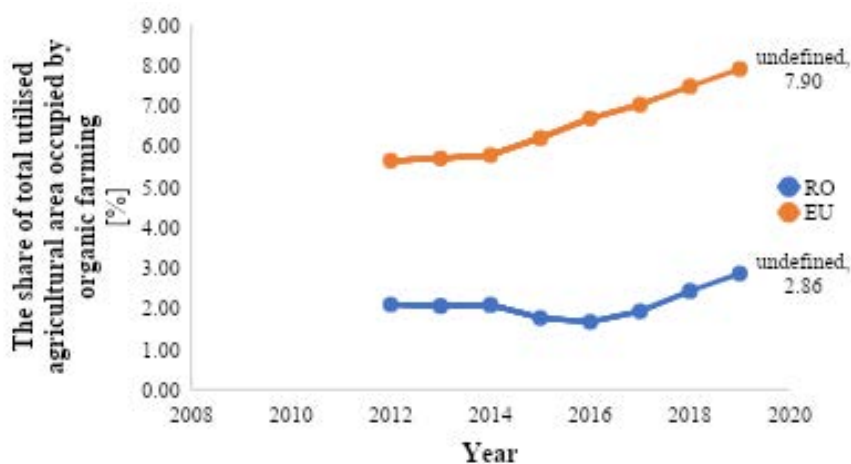

Figure 2. Organic farming share comparative evolution in Romania and the European Union

Source: EUROSTAT

Figure 2 shows the transition to organic farming in Romania and the European Union. It reveals the trend of the indicator that measures the share of total utilised agricultural area (UAA) occupied by organic farming. This class includes the existing organically-farmed regions and areas in the conversion process. As observed, the percentage of land used in Romania's based on this concept is almost three times lower than that reported at the EU level. This situation may be considered an opportunity for study in the field with a sustainable perspective on professional further activating.

4.2. Education in the vocational field and a specific economic setting

Since the enrolment in farming education could be determined by personal initial affinities, family background, and skills were also analyzed the data regarding the children who follow vocational programs. **Figure 3** shows the situation reported in 2022.
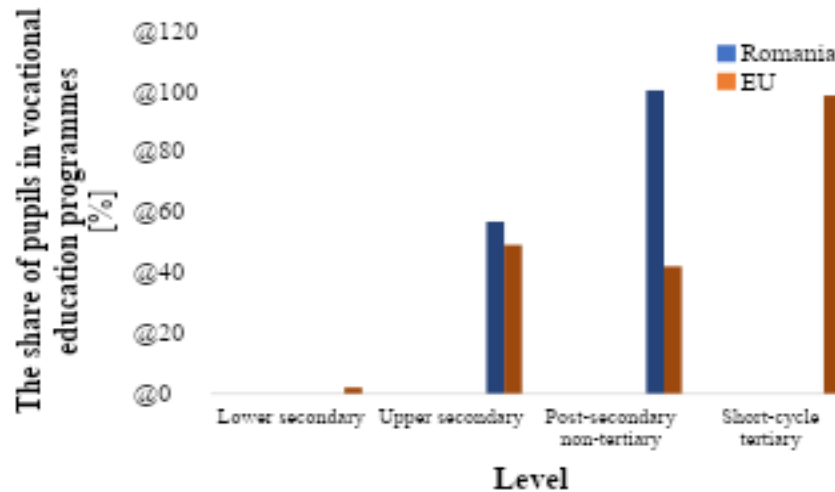
Figure 3. Percentage of students pursuing vocational education by level of training
Source: EUROSTAT

Compared to the situation on the European level in Romania, there is a higher interest in the post-secondary non-tertiary level of vocational education. There is no data regarding the lower secondary or short-cycle stages.

There is a need to increase the awareness of the necessity to improve specific skills in automated, machine learning concepts for future farmers. Process optimization will determine a less environmental impact of the activity and also economic efficiency. A forthcoming responsible agriculture has to be based on training models for farming education that require responsibility and knowledge for improved results (Farid et al., 2020). The learning process refers to the current persons involved in the domain and the youth, who could consider such a domain attractive. Active learning is also necessary, determined by the unpredictability of nature, characterized by multiple variables. These could be difficult to manage without integrating the current element of technological progress (Ritz et al., 2019).

To increase the youth's aspiration to be involved in the agriculture domain and be willing to study it, a key element could be represented by the performance registered in the sector. Using

the net entrepreneurial income of agriculture (Indicator C), **Figure 4** was obtained. A comparative chart of the data reported for Romania and the European level for ten years was made.
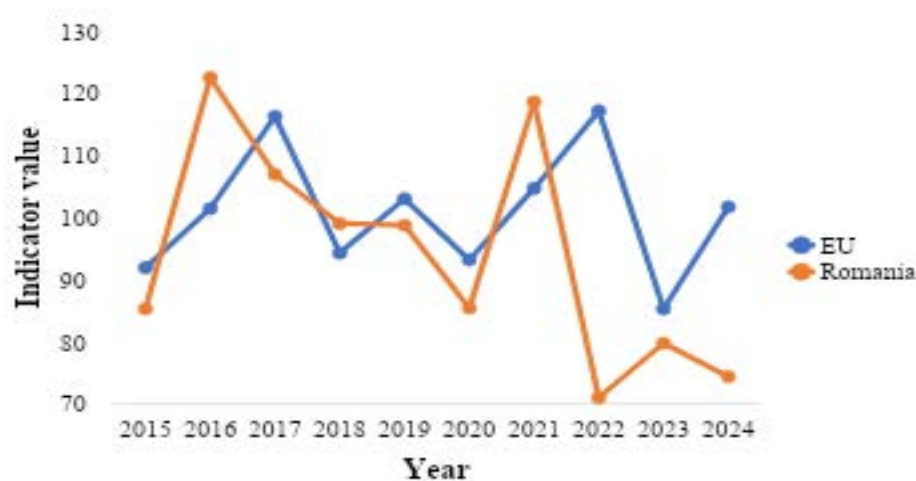

Figure 4. The annual *Indicator C* variation
Source: EUROSTAT

From **Figure 4** can be observed that the tendencies in Romania mostly follow the ones encountered at the European Union level. The trend differences appear between 2023 and 2024, where the directions are opposed, to the disservice of our county. The sector revigoration could happen since it closely depends on climate conditions and the region's market evolution.

Low educational participation could be correlated with low adoption of precision agriculture and organic practices. The transition to sustainable agriculture remains limited without a coherent national strategy for continuously training farmers.

5. Conclusions, Recommendations, and Future Developments

The results of the theoretical and empirical analysis highlight a clear relationship between the level of education and the ability of farmers to adopt sustainable practices, especially in the context of precision agriculture and the ecological transition. In the case of Romania, the underdevelopment of the vocational training infrastructure and the low participation in continuing education constitute major obstacles to the modernization of agriculture. To improve the situation, different initiatives may contribute. Some may refer to program reviewing, educators' coaching platforms, cooperation between schools, other educational institutions, farmers, national and local administrative institutions, and equipment developers (Nugroho et al., 2024).

It is essential to update the curricula in agricultural high schools and universities to integrate topics related to sustainability, digitalization, precision agriculture, and green skills. The programs should include theoretical and applied practice, collaborating with model farms and innovation centers.

Through the Ministry of Agriculture and local structures, the government should support continuous training through free or subsidized courses in collaboration with agricultural chambers, NGOs, and universities. A functional reactivation of the farming advisory system is necessary. Making access to certain forms of subsidies (e.g., investments in precision or organic agriculture) conditional on participation in training courses can be an effective method for accelerating the development of relevant skills. Creating a national digital platform for agricultural education, with free and interactive resources, can facilitate access to training for farmers in isolated or disadvantaged areas.

The transition to sustainable agriculture in Romania is impossible without a coherent and long-term investment in education. Both initial and continuous training are essential in equipping farmers with the necessary skills to adopt modern, efficient, and environmentally responsible practices. Precision agriculture, a symbol of innovation in the agricultural sector, cannot be

implemented effectively without well-trained human capital. The data support the idea that there is a correlation between the level of education and farming performance regarding productivity and sustainability to overcome the differences between the expectations and the reality (Simões & Brito do Rio, 2020).

Thus, to achieve the sustainable development goals, Romania must create an educational ecosystem adapted to the needs of future agriculture, in which training, innovation, and knowledge transfer become central pillars of national agricultural policies.

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Education in the Imperative of Sustainability. A Step towards the Impact of Science and Technology

Elena-Gabriela Dobre

University of Economic Studies, Bucharest

dobregabriela10@stud.ase.ro

Abstract

Sustainable Development (SD) heterogeneity outlines the diverse challenges of achieving economic growth. The strategy for the SD is framed within the broader framework of biodiversity ecosystems. This roadmap enhances resource management and education, both fundamental for achieving social progress and ensuring performance. Education in the SD strategy represents a significant challenge to the status quo in the domain of complementary education studies, with implications for employment in science and technology. According to Eurostat, the Human Resources in Science and Technology (HRST) index reported that in 2023, 71.8 million people were employed in science and technology within the European Union (EU). Researchers in this domain signal limitations on the education sector's ability to plan for the future, particularly regarding the constraints imposed by resource scarcity and economic growth. Highlighting the challenges of inquiry, this paper explores more specifically the key factors that shape HRST potential, considering the common context of all economies, the natural environment, which substantiates the performance equation that entails household economic growth and investments. Therefore, to grasp the trends of HRST, an analysis of Eurostat

indicators was performed. The paper's result was regressed in the landscape of statistical information ranging between 2014 and 2023.

To properly manage the performance context that biases science and technology, attention was focused on the primary keys of ecosystems, such as environmental protection actions, forestry, construction, and agricultural land. Moreover, the construction investment parameters imprint a significant behavior on science and technology, even if environmental protection activities dont have yet a corresponding impact in statistics, as Türkiye case, unlike Western Europe, which creates an influence between environmental protection activities and science and technology.

This framework aims to delineate the scientific and technological potential in achieving sustainable development goals, considering that innovation, science and technology are an imperative for society that connects the educational environment to economic performance.

Keywords: Science and technology, Resources, Education, Sustainable Development.

1. Introduction

The general lesson that sustainable development affirms in the context of the world economy imperative establishes the management of natural ecosystems' complexity in a sensitive social norm to the possibility of changing behaviors by emphasizing statistical reality. But listing corroborating facts does not necessarily mean proof. Moreover, can we construct a general rule according to observation confirmations, or do we approach the truth through negative examples? The linearity of confirmation observations (which mainly occurs after the action is completed) in SD is argued by the rationality of credible information that establishes a plurality of value judgments. An education conducted for democratic purposes establishes a critical evaluation of controversial evidence and develops the ability to judge controversial issues with solidly constructed arguments; practice for controversial discussions develops a deeply analytical thinking, increasing the ability to identify false statements and arguments (Kahne and Bowyer, 2017).

Human capital was considered an important and liberating step for the scientific community and subsequently for the economic environment, and the concept of approaching education as an investment and not as an experience is a fundamental idea in SD (Becker, 1993). Moreover, in SD, the individual rate of return and the social rate of return are reinforced by the return on environmental protection actions (the Edison company conducted a behavioral experiment on energy consumption among employees, signaling consumption outside of profitability) (Becker, 1993, and Thaler et al., 2016).

The starting point of the research is that the SD effect in education is not universal, and individual motivational processes create behavioral patterns that seek supporting evidence (confirmation bias) and behavioral patterns that seek counterarguments or exercise skepticism and negative inferences for behavioral patterns (disconfirmation bias) (Kahne & Bowyer, 2017). One explanation for SD is that its inferences have stood the test of time, and its advocacy of referential correctness and concern for fairness is economically and socially significant (employers who violate fairness rules have diminished profitability, and retailers with unfair policies may lose sales shares) (Kahneman, 2015). Keeping in mind the principle of education as an investment, SD goals balance the effect of education in the principle of multilateralism and appearance, so that almost certain outcomes receive less weight than their probability justifies. The imperative for sustainable development brings a qualitative change instituted at the expense of the certainty effect (expectation and confirmation bias) and recalibrates the utility of the educational institution to be more in line with economic needs (Tomlinson, 2017). The decisional weight in circumspect inference, which education capitalizes in SD goals, highlights the individual utility exercised in educational constructivism represented by the diversity of cultural, social, and human capital factors (Tomlinson, 2017).

An imperative for the value function is manifested even if utility theory is a logic of rational choice, choices are not always perfectly rational, and an educational pattern that includes attitudes, emotions, and perceptions represents a sustainable strategy for assessment and

capitalizing the diversity effect in SD (Banihashem et al, 2023). Even if we would be tempted to say that emotions and intensity, influence the availability and evaluations of educational performances, in the logic of rational choice the probability of an event is deprived of overestimation and overweighting, considering the educational commitment of students in effort, attention, persistence, and their emotional reactions (Korpershoek et al., 2020).

To this literary contribution, this study participates with a predicative analysis between the pillars of SD and human resources in science and technology. Considering that performance in SD is very probable, in the study we focus on the factors that influence it. A wide literature analyzes the rate of return in education with research probabilities that instrument qualitative or quantitative variables, as the educational act is a decision for its yield, this study proposes to increase the effects horizon within the limits that biodiversity establishes.

For this purpose, analysis includes statistical indicators capitalized by NUTS and Eurostat, such as forestry, environmental protection, construction investment, and agricultural land, analyzed in the HRST effect. Considering HRST as a predictor for education, the statistical analysis performed observes how various ecosystems influence the HRST effect. In the paper, it was analyzed whether HRST is influenced by anthropogenic ecosystems more than by natural ecosystems, and to what extent investments in SD (anthropogenic and natural) contribute to the variation of HRST. The results are capitalized by statistical executions, and the probabilities are calculated with hetregress fits linear regressions.

Considering SD as a result maximizer, the study reveals that parameters such as forestry, environmental protection, and construction exert benefits on HRST, although it establishes both social and economic responsibilities capitalized over time, in the SD goals. Time, the unit of measurement, is a parameter used in the profitability capitalization in the SD strategy. Central and Western European countries invest in environmental protection actions and forestry in maximizing the HRST effects, while Eastern European countries and Türkiye invest in construction. Of course, in utility theory, compatibility under all circumstances increases the

instance for "in provement" as a model of national choice. But the external perspective (diversity exogenity) that SD establishes is a remedy for biased value judgment, and from this point of view, the study is a contribution.

The study is divided into the following sections: in section 2 literature review is presented. Section 3 presents the theoretical framework and data. Section 4 depicts results and discussion. In 5 are presented the conclusions, recommendations, and the scope for future research.

2. Literature Review

The imperative for education right, professional training, and learning is reconsidered in the event horizon of the principle of education, equal opportunities, and inclusion broadly regulated in UN resolutions regarding Sustainable Development (SD) and the fact that the education system erosion substantiated in inequality, time and resources establish a framework for cooperation and development meant to facilitate SD goals and the future of next generations (ONU, 2024).

Education missions in the SD goals reveal an intrinsic relationship between time and action, coordinates that develop a strategic framework for actions: European Commission's endeavor for the European Education Area until 2025, Digital Education Action Plan 2027, European Cooperation in the Education field until 2023, European Research Area develops epistemological limitations, and grants propensity to a robust and synergic thought that interoperates traditional disciplines with empirical and scientific learning establish the principle for a universal education empowered by european states and at the same time preventing parallel instruments and practices (UE Council, 2021). Following the agreements of the member states of the UN Framework Convention for an efficient and progressive response to climate change treaties, recognizing that education is a strategic priority (Paris Agreement, 2015), operationalizing SD goals in education involves prioritizing information, allocating resources and measures the effects so that the burden

of proof intervenes in a system of non-liniarites and error amplification (concerning change clime treats) (Filho et al., 2019).

Sustainable education principles develop securitized institutional practices performed in the European Center for Digital Education with qualified resources and digital infrastructure, which enhance access, connectivity, and exchange of good practices. Forward education in the SD amplifies value chain effects and the corresponding expertise in the creative approach of green education, becoming an imperative for the green transition in the digital and green economy (UE Council, 2021).

Developing sustainability, these implementations create a contingent of social, economic, and environmental challenges, which increase the pursuit of silent evidence with interconnected educational resources for learning, communication, and reflection. This develops a world vision and a sensitivity to values. In SD, becoming intellectually conscious implies no longer ignoring statistics. Invisivibil statistical risk and historical retrospective risk are studied through integrity judgments based on scientific results, and not on biased judgments. Categorical necessities in SD imply decreased general asymmetries generated by social, economic, and environmental pillars, so that education must prepare students for the global context; moreover, ideal scenario learning addresses education global objectives not only correlated with a single discipline, but enhancing SD goals in which disciplines with particular objective regarding: water and sanitation, healthy lives, well being, healt sciences, this type of programs performs in Nottingham UK, Victoria University of Wellinghton, New Zeeland (Filho et al., 2019).

Although education in SD implies a heterogeneously multilateralism, at the same time develops value judgments that can be discussed but cannot be calculated. In a dynamic system, we can have rigorous thinking at the limit of authoritarianism, which conceives learning as an authoritarian form of control. Biesta (2015) defines this system's *Learnification* that defines new opportunities for learning, new experiences in learning, and environmental learning. In contrast with the principle according to which the student has to learn abstracts and general information,

educational assumption precision depicts that students learn something with a reason from somebody; this strategy accords education a sense of scope. Biesta brings in his research in the educational field, the positive effects of socialisation, which establishes a necessity for the accuracy of the intercorrelated effects of environment, culture, politics, religion, history, and traditions. A niche of researchers considers climate justice as a framework for formal education, creating a teaching methodology that addresses the issue of climate change in a way that confronts both economic and social issues (Trott et al., 2023).

The ability to see education futures can generate a complicated reflex, caused by the inequality of the educational system. Mishra's (2019) study makes a net and qualitative distinction on the factors regarding social networks, social capital, and social support that play a role in the academic process and the mechanism through which these factors bias academic performance. Its result confirms the fact that family plays a role in academic performance, and social support compensates for fundamental disadvantages alike: black female students in STEM disciplines, and underrepresented engineering students. Community influence in compensating lack of information, the positive impact of cultural resources and material, and the importance of networking resources in academic performance. Teachers' beliefs in constructivist theory are enhanced by technological advances, but teachers who position only institutional values in the educational process use technologies following the curriculum, which suggests that technologies in education will be used when teachers consider them an irreplaceable tool (Tondeur et al., 2017).

In a different research branch, the educational gender quality paradox identifies a major context that appears in countries with high levels of gender equality, which theorizes the biggest educational differences in secondary and tertiary education. Theory of value expectancy is an instrument used in decision-making by students, which optimizes academic decisions according to their performance. Social factors that manifest themselves in performance and economic sustainability bias value judgements in STEM careers regarding costs and benefits. The

jurisdictions with higher economic risks and lower opportunities can make higher-paid STEM occupations, a scenario that sacrifices economic security in the long term and education investments (Stoet & Geory, 2018). Moreover, business and education enhance the scope to change inherited inequalities, and Nordic countries support an egalitarian education and a mission for research (Marginson, 2016).

Continuous education makes us conscious of the environment. According to Kopnina (2020), SD education develops the individual intellectual condition of human beings and is not intended to serve economic purposes. SD goals optimization restricts libertarian actions, which enhance rational behavior for the future in the sustainable hypothesis of economic growth, coupling resource consumption with ecosystem boundaries. *Critical pedagogy* has an ideological utility that is settled beyond the biased interest of the state and industry, capitalised on cultural democracy, sovereignty, and human rights. Western European educational models develop analytical thinking and the capacity to make decisions without a general theory, involving quality of life indicators and ecosystem integrity. If SD phase a resource consumption counterfactually (Kopnina, 2020), human nature anticipates a *fine adjustment in the green transition* under the Student for Carbon Dividends (fiscal redistribution for the population of companies winnings still depend on carbon technologies) (Ionescu et al., 2022). Although SD brings incentives in technology, Loughurst (2020) identifies anxieties among students who learn online with uncertainty for their educational future and the resources that engage students in the institutional process. Environment predictive utility in the establishment of educational foundations is researched by Mouroe and his team (2017); their approach for a pedagogical constructivism generates context about climate change, which students analysed with activity surveys. Deliberate discussion and interactions with the scientific environment eliminate misconceptions and missing information, and students develop their pieces of knowledge by being involved in the climate project projections and implementations.

3. Theoretical Framework and Data

This study examines the empirical dynamics of SD pillars as a determinant of HRST performance, incorporating the effects of other control variables.

Knowing that a wide literature analyses science and technologies effects on the economy and on the environment as one of the leading factors that contributes to reducing the economic gap, increasing investment, and improving the employment rate. This study aims to code HRST in the associated probability of SD pillars, assuming that HRST exerts a dual correlation both in SD goals and in the economy. Aim performed with the following research question: *SD incorporating the expectancy of economic and environmental assessment has a dynamic outcome on HRST.*

To test the SD pillars' impacts in research and development, according to the following execution syntax, it is understood the level of forestry, as HRST proxy, together with other input factors, as agricultural land, environmental protection, and construction.

To determine the relationship between sustainability and the HRST was model the below multiple econometric regression, (Zahar et al, 2022).

$$HRST_{it} =$$
$$\beta_0 + \beta_1 forestry_{it} + \beta_2 environmentprotection_{it} + \beta_3 construction_{it} + \beta_4 agriculturalland_{it} + \varepsilon_{it}$$

Where the dependent variable is HRST, β_0 is the constant, and $\beta_{1-4\,is}$ the slope of the independent variables, *i* is the country, and *t* represents period, and ε_{it} count standard error.

3.1 Data

The list includes dates reported by 33 countries as follows: Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, Norway, Switzerland, Bosnia and Herzegovina, North

Macedonia, Serbia and Türkiye. Panel observations were retrieved from the Eurostat database, regarding Eurostat, it is the statistical official website of the European Union. Panel data contains non-financial observations, and the research sample includes the countries for which the required variables are available for 2014 - 2023. Dates are capitalised in the Eurostat framework by country reports, provisionals, and values imputed by Eurostat or other receiving agencies. Given the heterogeneity of the dates, reported in different measurement units: HRST, person with tertiary education employed in science and technology in thousand person, forestry with an annual frequency, reported in million euro, environment protection reported in million euro for the undertaken activities, construction reported in production volume index and agricultural land reported by arable land in euro per hectare, the final panel dates for statistical and regression execution contains median of the period 2014 - 2023, performed for which variables. To ease the interpretation of results, moreover, the advantages of using median are that the results would be in point elasticities, tending towards convergence.

3.2 Methodology

The major challenge for the distribution performed was the fact that HRST dynamics are not exogenously related to various macroeconomic variables. Given the difficulty of finding reliable variables beyond the lagged value of HRST, a large literature uses GMM to deal with possible endogeneity, considering internal instruments, since such a setup is not appropriate for our analysis, requiring a large number of dates in cross cross-sectional time dimension (Combes et al., 2024).

Keeping in mind the orientation from reality to possible explanatory models, and taking into account that there is a similarity between the different processes of nature and the behavior of social groups, and taking into account that the information in the theory of dynamic systems can be fragmented or even insufficient or unavailable. Considering that in OLS the significance level was not reached due to the number of observations, we considered the variance fractal (asymptotic approximations with low influence, Ghosh et al, 2016; unknown signal steering, Liu

et al., 2013), managing to calibrate it with hetregress fits linear regressions (heteroskedastic model in cross-section time, Blazsek et al., 2024; multinomial distribution in heteroskedastic robustness, Landa et al., 2021). We applied this method under the assumption that the average is correctly determined, according to the best knowledge we have, which determined a correct variance model for the exponential function. In this inference, variance might increase with the HSRT likelihood.

4. Results and Discussions

Taking into account the properties of the dynamic systems in which HRST manifests, even if HRST manifests a critical exponent of the nature of well-being in the effects horizon of the variables, this is independent of the details of the dynamic systems in which it manifests itself by the fact that HRST generates a response reaction and not a confirmation of reality. Moreover, the logarithmic method used may indicate an advancing process of HRST conferred by ecosystem dynamics. Forestry and Environmental protection are performed in HRST as a descriptive forecast. The transition from descriptive to reality is rendered even more precisely by the predictability of the constructions in HRST, although the inference must be approached from the perspective of incompleteness and scalable results; nevertheless, the obtained model invokes the transition towards an open and analytical thinking.

4.1 Statistical results

The distribution model was statistically analyzed regarding the properties of the distribution. Symmetry of the distribution was examined with the Skewness test, and to test the characteristics of the distribution tails was applied to the Kustosis test. For each variable, the minimum, mean, and maximum orientation were determined. Summary statistics are represented in **Table 1**. *Descriptive statistical results*.

Descryption	Min	Mean	Max	Skweness	Kurtosis	SD

HRST	0	264	3718	2,653175	7,259930	31,96914
Forestry	0	663	8668	1,907507	2,784315	31,96914
Environment protection	0	161	6917	4,211249	20,00759	31,96914
Construction	82	98	118	0,319374	1,034726	31,96914
Agricultural land	0	8271	11706	-1,10168	-0,533449	31,96914

Table 1. Descriptive statistical results

Source: Author research

Notes: Statistical technique determined for the dependent variable HRST and for the independent variables Forestry, Environment protection, Construction, and Agricultural land, the dynamics of min, mean, and max. The distribution's distinctiveness was analysed symmetric and tailored.

Skewness test indicates a positive distribution except for the agricultural land parameter, achieving a negative effect. Symmetry of the distribution indicates two different types of tails. While Construction, Forestry, and Agricultural land assemble a light tail, with results near to zero, HRST and Environment protection perform a heavy tail, giving robustness to the distribution. This indicates an asymmetrical but balanced distribution. Even though the result of the Kurtosis test can be considered a regression, with a higher error weight (HRST and Environment protection >3, leptokurtic tail), in fact, the characteristics of the dates generate a scaling amplitude.
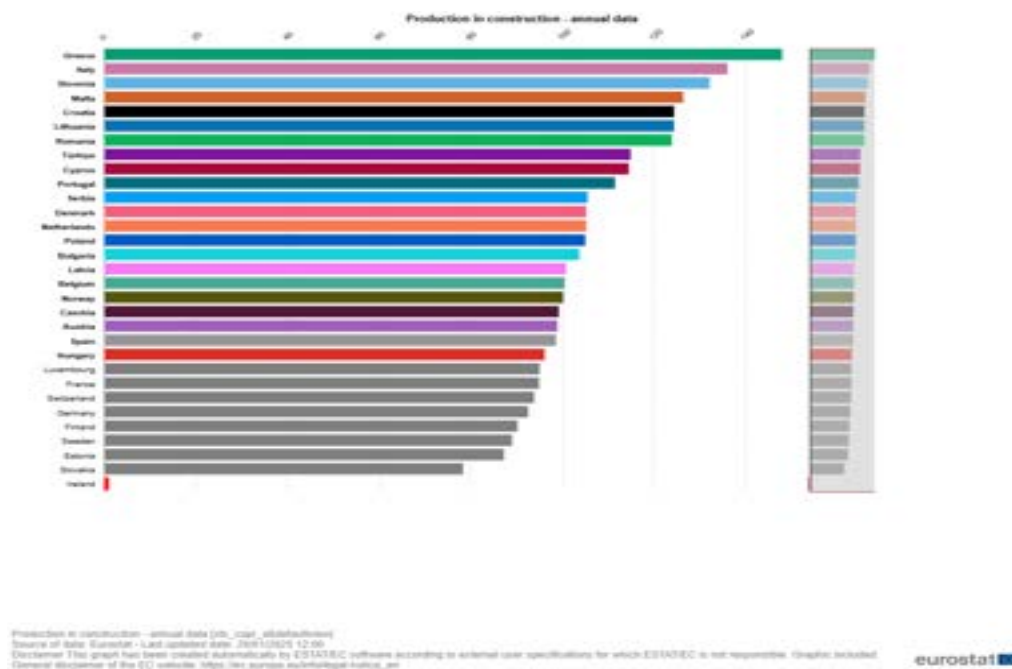
Figure 1. Production in construction

Studying statistical results from the perspective of time (panel contains dates between 2014-2023) suggests that the SD pillars take effect in the last part of the analysed period. Taking into consideration that all variables have a minimum of 0, the large distance between mean and max indicates that the action in SD was capitalized in effects (actions and dates) in recent times. The exception to this inference is construction with a constant presence during the cross-section time. This can be seen in the average presence of states in Eastern Europe, Southern Europe, but also in countries like Türkiye. **Figure 1** represents countries in construction production. If the construction contingent is mainly represented by countries from southern and eastern Europe, investments in science and technology are represented by central European countries and Türkiye, results shown in **Figure 2.** *HRST in Europe and Türkiye.*
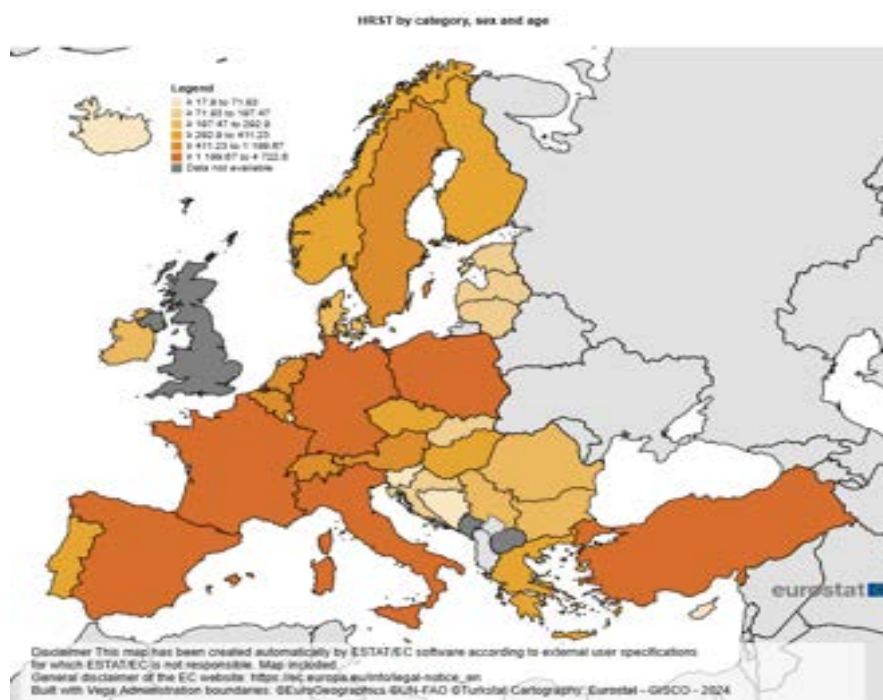
Figure 2. HRST in Europe and Türkiye

Source: Eurostat database

4.2 Regression results

The combination of events established for the research assumption analyzed under the impact of the probability effect of the SD pillars on HRST reveals the complexity of the statistical correlation of the social dimension (represented by HRST) with the statistical dimension represented by the SD pillars. In the study, the popularization that science and technology achieves in the complex systems of biodiversity explains the existence of analogies between the different processes of nature and social behavior, moreover, the analysis reveals a hypothesis for equilibrium signaled by the presence of natural ecosystems that outpace critical phenomena in social science. However, the analysis highlights that there is more statistical support for natural ecosystems (forestry, agricultural land) that outpace anthropic parameters (construction, environmental land) in the variation of human resources in science and technology. I said in the

statistical analysis that the dynamics of the system is independent of its critical points, a scaling that the countries of Central and Western Europe manage to achieve, in the regression analysis, the hypothesis is tested by the forestry significant effect on HRST. Is construction a predictive model for HRST, or is it the best proxy for some states? Analyzing the inference for Central Europe does not represent a valid model, but for Eastern and Southern Europe and Türkiye, it represents the optimal land for HRST.

Statistically argued the benchmark model depicts a result that calibrates a nonlinear process in favor of the research hypothesis. Under the uncertainty revealed by SD (the essence of sustainable development is based on a functional rationalism), science and technology can be compatible with this. The performance that the study achieves (with a very small dataset) maximizes the probability of the variant under the effect of informational entropy (Log likelihood = -144,43). **Table 2** represents regression results.

	β coefficient	Std. err.	Z-Test	p > |z|
HRST				
Forestry	.365775	.0344238	10.63**	0.000
Environment protection	.4680971	.0816201	5.74**	0.000
Construction	-5.197598	.1347402	-38.57*	0.000
Agricultural land	.0035001	.0003624	9.66**	0.000
Log likelihood	-144.4313			
Wald chi2	323566.56			
prob>chi2	0.0000			

Note: ** z test >1,96, and * z test < 1,96

Table 2. Regression results

The regression model performed with the Wald test demonstrates the weak contribution of the independent variables to the variation of the dependent variable HRST (low influence Ghosh et al., 2016) with a probability prob>chi2 = 0.0000, which generates constraints on the statistical parameters, including estimated precision, incidence of which is also contributed results of p-value = 0.000, we can conclude for the low materiality of the panel observations.

The theorized distribution with the Z test places the significance level in the critical region $(- \infty; 1,96] \cup [1,96; + \infty)$, a predictive result considering the abstraction obtained for the p-value. However, the model is a suggestive example for SD research, while many studies analyze SD performance using statistical tools with standard errors and linearities, for SD scenarios with a random degree of risk, traditional statistical tools may be out of date or meaningless. A representation of the econometric results is made in **Figure 3**, representing the impact of environmental protection in Europe, and the impact of construction investments is represented in **Figure 4**.
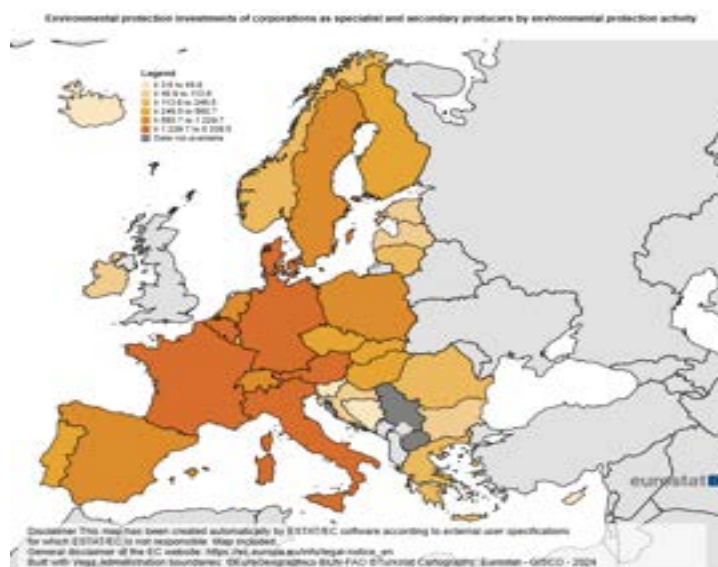

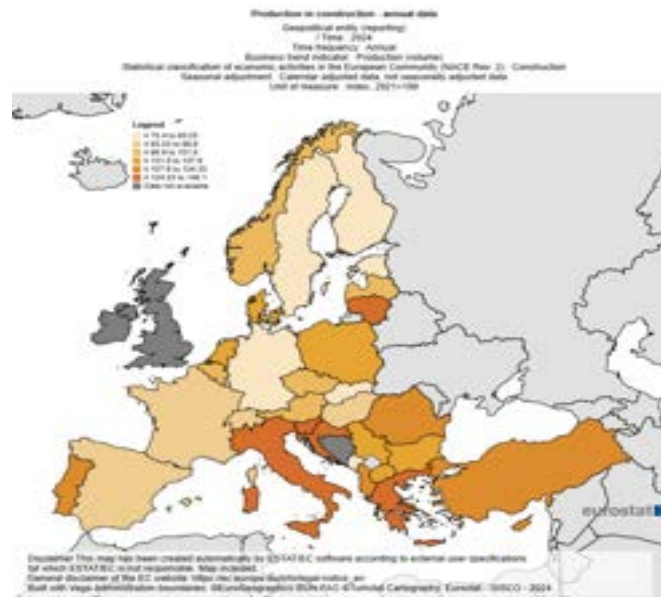**Figure 3.** Environmental protection

Source: Eurostat

Figure 4. Construction

Source: Eurostat

5. Conclusions

The study highlights the relevance of environmental characteristics for the educational process. For the research objective, the prerogatives of education were exponentiated in the field of science and technology (HRST), resources anticipatory SD.

When higher education in society generates a qualified resource and not from regulation or economic pressures, but from the social need for higher educational opportunities, the role of the school context is reflected. But in a capitalist society, the opportunities that higher education introduces are not universal. In the expectation principle, the common form of education as a good increases the return on its opportunities, but also perpetuates inequalities and demonstrates the autonomous power of institutions to shape social outcomes (Marginson, 2016). The demand

for human capital (skills and productivity) unlocks institutional boundaries, and further value in rates of return is a trigger for accessing and performing in the educational system.

HRST also contributed to the teacher-student relationship, which can increase or decrease externalities generated by the environment. In the sense of connection to a group or community, it is a generating factor for institutional performance. *Engagement*, according to Korpershoek teams (2020), is a meta-construct for the relationship between the student and the environment, although many other studies define it as *behavior,* however, the inference establishes self-concept and efficacy to perform both in school and in the environmental system. The behavior of teachers centered on students adopts an educational process that is identified in constructivism theory or social constructivism, the information is capitalized under the relevant context oriented towards technology and applied sciences, a relevant context for SD where new information and experience call for relevance and meaning (Tondeur et al., 2017).

Time pressure, from the SD perspective, suggests both the obstacles that explicitly become rules for the educational system, but also the benefits that SD creates for the educational system, biased by the same institutional rules.

The present study, based on statistical research according to an observational panel collected for Europe and Türkiye (we considered it important to keep Türkiye in the study due to its contributory role in science and technology), highlighted stringent results, the smaller the number of observations.

The hypothesis research represents a direction of statutory correlation that the states of Western and Central Europe realize. According to it, the elements of diversity represented by environmental action protections and forestry have a significant impact on HRST. The presence of the natural element forestry is a parameter that acts positively on the HRST yield, which means that people include in their opportunity endorsements (in terms of education and profession) the weight of the diversity of natural elements. This parameter is amplified by the power effect of environmental protection actions. The investments made in this regard by the

above-mentioned states compete in the opportunity analysis for a choice made in HRST. That improves the HRST trend across the SD outcome.

But the same positive effect on HRST is also manifested in the Eastern countries and in Türkiye under the action of construction investments. The presence of construction investments is a median (and not only from the perspective of the statistical results obtained), it has a constant presence throughout the last 10 years analyzed and as a result of the dual function it performs, of investment and sustainable development, which can be considered a binder in SD and more precisely in HRST.

Limitations and future research

Given the world wide dimension of SD and HRST, the selection of interest centers may bring limitations. Europe is an operational center for SD, but equally are: Africa, Australia, America, Western Asia, so that studies increase in effectiveness the more the native criterion is present in a diversified manner. Future research may bring more into discussion the SD epistemology.

Acknowledgment

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A Comparative Analysis of Autonomous versus Guided Task-Based Approaches for Enhancing Speaking Proficiency among EFL University Learners

Daniela Duralia

Nicolae Balcescu Land Forces Academy, Sibiu, Romania

d_duralia@yahoo.com, ORCID

Abstract

This article explores the relative effectiveness of two teaching methods applied in a unit on Artificial Intelligence for two English as a Foreign Language (EFL) groups of students at the same language proficiency level. The instructor applied different strategies to the two 15 student groups: Autonomous Active Learning (AAL) and Guided Task-Based Learning (TBL). Both methods are acknowledged for their potential to improve speaking proficiency among university-level EFL learners. Although both approaches are based on communicative language teaching and task-based instruction, they should be used according to students' needs, depending on learner autonomy and teacher involvement. Through a review of related literature, an analysis of empirical studies, and a theoretical discussion, this research seeks to clarify the advantages and disadvantages of each method. The results suggest that students flourish in active learning settings where they are highly engaged and interact directly with English speakers. While guided TBL provides chances for memorization and practice, it may restrict vocabulary growth and learning new terms due to insufficient exposure to authentic texts and real-life conversations. By

the end of the study, students in the AAL group showed increased confidence in presenting their projects, whereas those in the TBL group displayed more hesitance.

Keywords: university level, EFL (English as a Foreign Language), Autonomous Active Learning (AAL), Guided Task-Based Learning (TBL), speaking.

1. Introduction

Despite 12 years of English language instruction before their first year of university, Romanian EFL students often exhibit notably low proficiency in speaking skills. Educational institutions' use of teaching strategies both provides language knowledge and promotes its practical application, which should also continue outside the class. Teachers ensure that the foundation is created on which students will reinforce and consolidate through individual work. The methods applied in class represent the frameworks that students will follow in organizing their work. Among the various techniques utilized, Autonomous Active Learning (AAL) and Guided Task-Based Learning (TBL) prove to be particularly effective approaches, both being grounded in communicative language teaching (CLT). The two methods differ significantly in their application, especially regarding the roles of the actors involved, namely the teacher and the students. Teachers' main challenge has been to engage learners in meaningful ways of using the language. This study conducts a comparative examination of AAL and TBL in the context of two university EFL classrooms. By analyzing pertinent literature and evaluating empirical data from classroom practices, this article aims to reveal the advantages and disadvantages of each method in developing speaking abilities.

Within the Communicative Language Teaching (CLT) framework, Autonomous Active Learning and Guided Task-Based Learning present different interpretations and applications of these approaches. Autonomous Active Learning is a constructivist educational theory, following Piaget and Vygotsky's ideology, based on the belief that learners create knowledge through experiences and social interactions. In AAL, students are responsible for their learning, researching topics

discussed in the class, and expressing their ideas using relevant language. Conversely, Guided Task-Based Learning assigns a more prominent role to the teacher, developing and facilitating tasks with specific goals, clear structure, and feedback strategies. Although interactive and communicative, TBL often focuses on repetition, precision, and the incremental development of language proficiency through structured tasks.

2. Literature Review

An increasing amount of research indicates the effectiveness of both AAL and TBL in EFL contexts. Investigations into AAL demonstrate its advantages in promoting learner independence, critical thinking, and practical communication abilities (Little, 2007; Benson, 2011). Learners frequently express elevated motivation and involvement in AAL settings, mainly when students drive projects and align their interests. On the other hand, studies focused on Guided TBL emphasize its organized approach as a positive aspect, particularly for learners who may be uncertain or have limited prior experience with language acquisition (Ellis, 2003; Willis & Willis, 2007; Yusnimar, 2019). Furthermore, Yan Yu et al. (2024) have proven the effectiveness of TBL in fostering language development over traditional methods. According to Safitri et al.'s study (2020), their students experienced "problems in speaking due to inadequate knowledge of the language, which in turn made the students feel unconfident to speak." In their research on "task-based learning," the authors found that this approach significantly improved students' speaking skills, particularly in areas such as accuracy, vocabulary, and comprehension. They noted that students could practice various activities, including simple dialogues, turn-taking, information gap exercises, interviews, discussions, short role-plays, and simulations.

Practice and teacher-guided activities can offer a clear path for learning and instantaneous feedback, which are vital for language progress in structured settings. Nevertheless, critics suggest that Guided TBL might restrict spontaneous language application and genuine interaction, which are crucial for developing communicative competence. Moreover, excessive

dependence on memorization and scripted conversations can hinder creativity and restrict vocabulary learning beyond what is explicitly presented.

3. Methodology

This research involved two university-level EFL groups, each comprising 15 students with comparable proficiency levels. One class utilized the Autonomous Active Learning method, while the other employed Guided Task-Based Learning. Throughout the unit, both groups concentrated on enhancing their speaking abilities through project-oriented activities. Data collection techniques included classroom observations, student presentations, vocabulary evaluations, and self-assessments. Additionally, the instructor noted her views on student development and engagement.

4. Results and Discussions

Student engagement and autonomy were significantly higher in the AAL group compared to the TBL group, leading to greater language fluency, confidence, and expressive ability. Student Engagement and Autonomy Learners in the AAL group exhibited significant levels of engagement and responsibility for their educational experience. They took the initiative to choose project subjects, perform independent research, and prepare their presentations. Such results have also been confirmed by other studies, such as the study by Ismail et al. (2023), which states that "using authentic assessment techniques can help students develop their character and skills since they expose them to real-world situations." This level of autonomy boosted their intrinsic motivation and readiness to take risks while using English. Conversely, students in the TBL group completed assignments the instructor gave and engaged in activities within a more structured environment. Although this method ensured uniformity and permitted focused language practice, it did not generate the same enthusiasm or independence observed in the AAL group. With the AAL, students displayed remarkable progress in expressing their ideas, addressing questions, and expanding on their thoughts. Classroom presentations highlighted enhanced fluency, consistent vocabulary, and more natural speech patterns. These students also

indicated that they felt more assured in communicating in English in real-world situations. In contrast, while precise in their language use, TBL students often depended on memorized scripts and showed hesitation during unscripted interactions. Their presentations were typically well-organized and grammatically correct but lacked spontaneity and richness in vocabulary.

The exposure to debates in the AAL group significantly enhanced vocabulary acquisition through contextual learning, unlike the more structured but limited approach in the TBL group. The AAL group's exposure to genuine materials and conversations was crucial to their vocabulary growth. Students learned new words in context, enabling them to deduce meanings and apply them appropriately. This incidental learning process led to more vibrant and expressive language use. In contrast, the TBL group primarily came across vocabulary through teacher-chosen texts and task materials. While this approach effectively reinforced familiar words and introduced specific language concepts, it provided limited chances for discovering and experimenting with new vocabulary.

The AAL and TBL approaches represent different performances for teachers, each method having distinct implications for student autonomy and learning outcomes. The AAL approach implied a transformation in the teacher's role, shifting from a provider of knowledge to a facilitator and mentor. Teachers offered guidance, resources, and feedback, and the students were responsible for their learning process. Although this shift was initially challenging, it ultimately paid off, as it encouraged a more collaborative and responsive learning atmosphere. TBL educators maintained more authority over the learning process, delivering explicit instruction, corrections, and task management. This method was especially advantageous for students requiring direction or who struggled with independent learning. However, it may have unintentionally stifled initiative and self-expression.

This comparative analysis highlights the significance of synchronizing instructional methods with educational goals and learner characteristics. Autonomous Active Learning is especially effective in improving speaking skills, encouraging learner autonomy, and enhancing

engagement. It focuses on real-world communication, preparing students for genuine language use beyond the classroom. Even if AAL offers comfort and flexibility, it requires considerable learner accountability and self-management, which may not be suitable for every student. It also requires educators to concede some control and adapt to more flexible, student-centered roles. Although more conventional in its structure, guided TBL provides essential support for language acquisition, particularly in the initial stages. Its emphasis on accuracy and repetition aids in solidifying grammatical foundations and building confidence. Despite its advantages, TBL may be inadequate in fostering the spontaneous and adaptable use of language essential for effective communication.

5. Conclusion

Educators ought to adopt a blended approach that utilizes the strengths of both methodologies. For example, during the early phases of a unit, Instructors can use Task-Based Learning (TBL) to introduce essential language components and establish foundational skills. Instructors can introduce Autonomous Active Learning (AAL) as students develop confidence to promote independence, creativity, and genuine language practice. Teacher training should focus on the competencies required to support AAL, including scaffolding methods, project management skills, and formative assessment techniques. Schools and curriculum developers must provide the necessary resources and adaptability to facilitate these dynamic learning environments. Effective topic selection is essential, as it often acts as the initial hook to draw students into group discussions. Language education aims to empower students to use English confidently and competently across various settings. Educators can more effectively support the intricate language acquisition process by creating learning environments that combine structure with freedom and guidance with exploration. Consequently, the accurate measure of effectiveness is demonstrated in real conversations on diverse topics with English-speaking individuals.

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Enhance on Clinical Education for Nursing Students with Videos:
A Review of the Literature

Hong Nga Thi Nguyen

Dotoral School of Economics and Business Administration, Alexandru Ioan Cuza University of Iași, Romania

hong.nguyen@student.uaic.ro

Abstract

Clinical education is the cornerstone of nursing education, essential to equipping students with the skills, knowledge, and attitudes required for professional practice. However, challenges such as limited clinical placement opportunities, varying levels of instructor support, and increasing student enrollment have necessitated the consideration of alternative or complementary teaching methods. One such method that is gaining prominence is video-based learning.

The review synthesizes findings from peer-reviewed studies published for ten years (2015-2025), highlighting the diverse ways in which videos have been employed-including procedural demonstrations, scenario-based simulations, and reflective learning modules. Evidence suggests that video-based instruction enhances *learning outcomes development, emotional-interpersonal development, and technological integration-accessibility*. Moreover, video tools offer flexible, repeatable, standardized learning opportunities that accommodate various learning styles.

Despite the numerous advantages, the literature also identifies challenges such as the need for high-quality, evidence-based video content, technological barriers, and the importance of integrating video resources with active learning strategies and instructor guidance. This review

concludes that while video-based learning should not replace hands-on clinical training, it serves as a valuable adjunct that can enrich the educational experience and better prepare nursing students for competent, safe, and compassionate patient care.

Keywords: nursing education, clinical training, video-based learning, educational technology, skills development, student engagement.

1. Introduction

Clinical education is a cornerstone of nursing training, essential for equipping students with the skills, knowledge, and attitudes necessary for professional practice. However, challenges such as limited clinical placement opportunities, varying levels of preceptor support, and increased student enrollment have necessitated the exploration of alternative or supplementary teaching methods. One method gaining increasing prominence in clinical education is video-based learning. With the growing availability of digital education tools and multimedia content, this approach offers flexible, consistent, and engaging instructional experiences that can enhance the quality and accessibility of clinical training.

This review aims to explore and synthesize the existing literature on video-based learning in clinical nursing education for ten years (2015-2025).The review explores the impact of video resources on developing key clinical competencies, examining their influence on three core areas of student learning outcomes: skill acquisition, emotional and interpersonal growth, and the integration of technology and accessibility. It also addresses the limitations associated with this educational approach.

Research Objective

The primary objectives of this study are:

1. To evaluate the effectiveness of video-based learning in clinical nursing education.

2. To provide recommendations on the use of clinical teaching videos in nursing.

2. Methodology

Fink, A. (2005) emphasizes that a literature review should adopt a systematic approach, involving a comprehensive search of existing literature and structured content analysis. Similarly, Zainuddin et al. (2019) advocate for a systematic literature review methodology, recommending the use of databases such as ScienceDirect, ERIC, and ResearchGate. In alignment with these guidelines, a systematic search of electronic databases including PubMed, ScienceDirect, ERIC, and Scopus was conducted for the present review. The included studies focused on undergraduate nursing students and investigated the application of video-based tools in clinical education. Articles that discussed non-clinical subjects, were not in English, and did not provide empirical evidence were excluded.

The initial search was based on the keyword "clinical training". After obtaining 564.559 results, the searches were limited to "video-based learning", which yielded 175.271 articles. To achieve fewer results, we added new keywords, such as "nursing education, and to ensure relevance, we limited the search to identify peer-reviewed literature published between 2015 and 2025. In addition, the search had no geographical limitations. **Figure 1** below suggests the steps for identifying and selecting sources.

After reviewing the results, 10 out of the 19 selected articles were excluded for not aligning with the research focus. Consequently, content analysis was performed on the remaining 9 articles relevant to the topic.
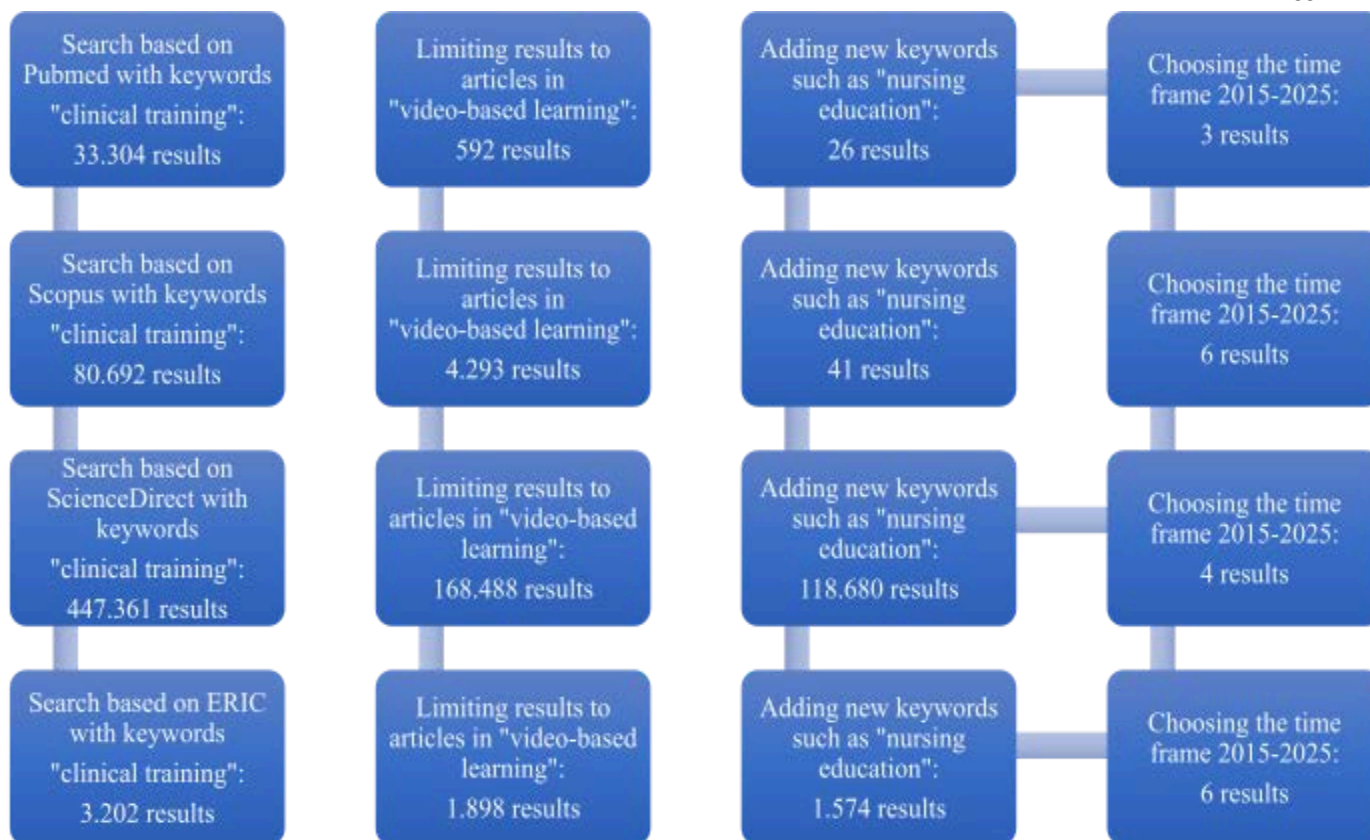
Figure 1. The steps to follow for identifying and selecting sources

3. Results and Discussions
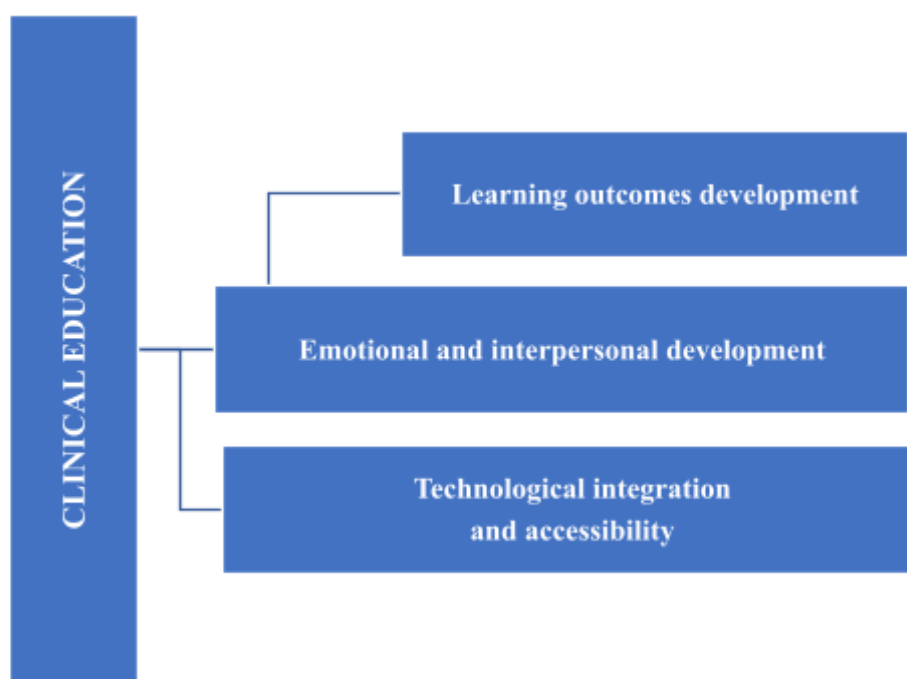
Figure 2. Major research focuses on video use in clinical education in nursing

This review examines current research on the use of video in teaching clinical nursing, identifying three major areas of focus: learning outcomes and skill development, emotional and interpersonal development, and technological integration and accessibility. The findings highlight video-based instruction as a promising and widely adopted method for enhancing nursing education. Based on **Figure 2** above, we analyze studies that emphasize three primary effects of using video in clinical nursing education.

1. Learning Outcomes Development

This theme explores how educational interventions influence knowledge acquisition, clinical skills, self-confidence, and overall performance.

Leidl et al. (2024) investigated the effectiveness of Branching Spherical Video Learning (BSVL) in mental health nursing education. The pilot study, employing a mixed-methods design (quasi-experimental and qualitative interviews), aimed to reduce student anxiety and improve knowledge of the Mental Status Examination (MSE). Students were assigned to either a control or intervention group. Findings revealed that BSVL significantly reduced anxiety, enhanced student confidence, and improved MSE knowledge in the intervention group.

Similarly, Chieh Wu et al. (2022) reported that video-assisted self-assessment is a powerful educational tool, demonstrating positive outcomes across several learning domains. This approach significantly enhanced students' knowledge, skill performance, and satisfaction while fostering reflective learning. It was particularly effective for developing psychomotor skills, such as nasogastric catheter (NGS) insertion. The method not only improved clinical readiness and reduced procedural errors but also boosted students' confidence and competence in real-world clinical settings.

Yavuz et al. (2025) examined the impact of two interprofessional education (IPE) methods simulation-based IPE (SIPE) and video-enhanced interactive discussion (VIPE) on knowledge acquisition, practical skills, and self-confidence among medical and nursing students. Both approaches significantly improved learning outcomes across multiple domains; however, SIPE demonstrated superior effectiveness in enhancing task performance and team behavior. However, SIPE incurred about twice the staffing costs and 1.3 times higher space usage costs than VIPE. Both SIPE and VIPE are effective for developing emergency response skills and team behaviors. SIPE offers better learning outcomes but at significantly higher costs. Educators should balance educational effectiveness with budget constraints when choosing IPE strategies.

HyeSun Jeong (2017) conducted a quasi-experimental study to evaluate the impact of smartphone video recordings on nursing competency, self-efficacy, and learning satisfaction. Sophomore nursing students were divided into an experimental group (using video recordings) and a control group (traditional practice). The study assessed self-evaluation, nursing skill

competency, self-efficacy, and learning satisfaction. Findings revealed significant improvements in competency and learning satisfaction for the experimental group, highlighting the effectiveness of smartphone videos in self-directed learning.

Forbes et al. (2016) reviewed the effectiveness of video use in teaching clinical skills; The integration of information and communication technology (ICT) in education is growing, especially in nursing, where clinical skill training is vital. Videos offer a flexible, visually rich tool for linking theoretical knowledge to practice, providing simulated clinical experiences. This review explores current research on employing videos in teaching clinical nursing skills, identifying four main research areas: effectiveness, efficiency, usage, and quality.

In conclusion, innovative tools like videos and interactive technologies enhance nursing students' cognitive and practical competencies, leading to better learning outcomes.

2. Emotional and interpersonal development

This theme includes empathy, teamwork, communication, leadership, and student satisfaction-skills critical for clinical settings.

Wong et al. (2024) assessed teamwork, communication, and leadership through simulation or tech-enhanced methods; The Collaborative Learning in a Student-led Global Classroom (CLSGC) program effectively improved students' non-technical skills and global nursing perspectives. The study supports integrating video-based simulations and student-led debriefings into curricula to build culturally competent, team-ready future nurses. Early and continuous exposure to non-technical skill training is recommended to bridge gaps between theory and real-world clinical practice.

Mei-yi Siu (2025) investigated the development of empathy using digital storytelling (YouTube); Digital storytelling using YouTube is an effective, flexible, and engaging pedagogy for teaching empathy in nursing education. It supports deep learning and enhances emotional engagement, making it a valuable tool in curricula.

HyeSun Jeong (2017) linked self-evaluation and satisfaction to skill development; The study underscores the importance of fundamental nursing practice in preparing students for clinical work. However, challenges like limited practice time and resources make it hard to achieve competency. Self-directed learning using smart learning methods like smartphone videos is proposed as a potential solution to enhance engagement, skill acquisition, and student satisfaction.

Patchra Eamcharoen (2024) found that interactive videos fostered active learning and student engagement, contributing to emotional and social development. The study highlighted how creatively designed YouTube videos incorporating interactive pathways can effectively teach entrepreneurial concepts in higher education. Students gained deeper insights into entrepreneurship, appreciated decision-based learning, and reported high satisfaction. However, the study suggested that increasing choice options, diversifying storylines, and incorporating peer discussions could further enhance the learning experience.

Instructional approaches that incorporate storytelling, simulation, and interactivity cultivate emotional intelligence and interpersonal skills, which are crucial for delivering comprehensive nursing care.

3. Technological integration and accessibility

This section focuses on how various digital methods such as videos, mobile technologies, IVT, and YouTube impact access, flexibility, student engagement, and the quality of instruction.

Leidl et al. (2024) investigated the feasibility of technology-enhanced interventions and identified Branching Spherical Video Learning (BSVL) as a promising instructional tool in nursing education, particularly within mental health settings. BSVL was shown to reduce student anxiety, enhance confidence, and improve learning outcomes. However, the authors highlighted the need for further large-scale studies and recommended enhancing scenario design-especially by increasing interactivity to maximize its effectiveness.

Joel et al. (2021) highlighted flexibility and valuable access through IVT (Interactive Video Tech); The study concluded that IVT offers valuable access and flexibility, particularly in resource-constrained environments. However, technical and infrastructural challenges hinder its effectiveness. Nursing students appreciate IVT but call for improvements to enhance the learning experience. The researchers recommend infrastructure upgrades, more trained personnel, and blended approaches to improve teaching outcomes.

Patchra Eamcharoen (2024) emphasized the role of interactivity and engagement through YouTube videos. This study explored the innovative design of YouTube videos for teaching entrepreneurship and assessed their effectiveness in enhancing student learning. Conducted with 20 graduate students, the research found that the videos were highly engaging, interactive, and promoted active learning, leading to high learning outcomes and student satisfaction. The innovative use of YouTube's end-screen features enabled students to make choices within scenarios, fostering critical thinking and reflection. The author recommends expanding the video series to create more complex and nuanced learning pathways, incorporating scenarios of failure to enhance realism, allowing time for reflection and peer interaction to deepen learning, and conducting future research with a larger, more diverse sample to validate findings.

Forbes et al. (2016) addressed broader tech considerations like efficiency, usage, and content quality; Videos are a valuable, increasingly popular tool in nursing education for teaching clinical skills. While effective in many ways, their design, delivery, and quality control require further attention. Research should focus on optimizing video-based learning strategies and expanding studies into mobile accessibility, user-generated content, and quality assurance.

Decision, tech-enhanced learning (video, mobile, YouTube) is accessible, flexible, and highly engaging but requires attention to content quality and infrastructure for maximum impact. Findings indicated that video-based learning enhances cognitive, motor, and affective learning domains. Videos improve knowledge retention, support the development of clinical skills,

promote critical thinking, and accommodate diverse learning styles. However, challenges include ensuring high-quality video content, avoiding passive learning, and maintaining equity in access.

4. Conclusions

Video-based learning has emerged as a highly effective and adaptable tool in clinical nursing education, offering significant benefits that complement traditional teaching methods. This literature review demonstrates that video-based instruction not only enhances the acquisition of theoretical knowledge but also plays a crucial role in developing essential clinical competencies, such as procedural skills, decision-making, and self-confidence. Through consistent, repeatable, and visually rich content, videos help bridge the gap between classroom learning and real-world practice, providing students with a safe environment to observe, practice, and reflect.

Moreover, video-based learning enhances emotional and interpersonal development by fostering empathy, effective communication, and teamwork-core competencies essential for delivering patient-centered care. The integration of storytelling, simulations, and interactive video elements has been shown to engage students more deeply and promote critical thinking.Research also indicates that video-based learning can reduce learner anxiety, increase satisfaction, and promote self-directed learning-particularly when complemented by timely feedback and active instructor facilitation.

Technological integration through platforms like YouTube, mobile apps, and virtual reality adds flexibility and accessibility to clinical education. This is especially valuable in resource-limited settings or during disruptions to in-person training. However, the effectiveness of these tools depends on the quality of video content, infrastructure readiness, and proper instructional design. While video-based learning should not replace hands-on clinical experience, it functions as a powerful adjunct that can enrich nursing education, improve learner outcomes, and better prepare students for the dynamic demands of healthcare environments. Thoughtful implementation,

alongside traditional methods and reflective practices, will ensure that video-based learning continues to evolve as a transformative element in clinical education.

On the one hand, video-based learning is a powerful supplement to traditional clinical education. When thoughtfully integrated, it enriches the educational experience and better prepares nursing students for safe and effective clinical practice. It should function alongside hands-on training and instructor-led activities to create a balanced instructional approach. This review aims to explore and synthesize the existing literature on video-based learning in clinical nursing education.

The review focuses on the effectiveness of video resources in supporting the development of specific clinical competencies that promote knowledge acquisition, practical skills, confidence, empathy, teamwork, communication, leadership, flexibility, and accessibility.

Simultaneously, video-based learning offers a valuable and versatile supplement to traditional clinical education in nursing. By enhancing learning outcomes development, emotional-interpersonal development, and technological integration-accessibility, videos can help bridge the gap between classroom instruction and clinical practice. While challenges exist, thoughtful integration of video resources can enrich nursing education and better prepare students for the complexities of real-world healthcare environments.

Limitations of the study

While this study provides insights into the effectiveness of video-based learning in clinical nursing education, several limitations should be acknowledged:

Limited sample size and scope of reviewed studies: the review is based on only 9 articles selected from an initial pool of thousands. This small number restricts the generalizability of the findings and may not fully represent the global landscape of video-based clinical education.

Narrow time frame and inclusion criteria: although the review spans a decade (2015–2025), the inclusion criteria (English language, peer-reviewed, empirical evidence) may have excluded valuable qualitative studies, grey literature, or innovations published in other languages.

Lack of Primary Data or Meta-analysis: the study relies exclusively on secondary data and content analysis. It does not perform a meta-analysis or primary investigation, which could provide more robust statistical conclusions about effectiveness.

Variability in video design and implementation: the reviewed studies employed diverse video formats (e.g., simulations, YouTube, smartphone videos), making it difficult to compare outcomes consistently. Differences in content quality, interactivity, and instructional design limit the ability to generalize findings.

Technological and contextual disparities: many of the reviewed studies highlight technological limitations such as inadequate infrastructure, poor video quality, and limited internet access which were not uniformly addressed or evaluated across contexts.

Lack of focus on long-term learning outcomes: few studies included in the review examined long-term knowledge retention, post-graduation clinical performance, or the real-world application of video-supported learning.

Recommendations

Despite the significant benefits of using videos in clinical teaching for nursing students, several limitations persist, including challenges related to resources, facilities, content quality, and limited patient interaction. Based on these findings, we propose several key recommendations on the use of clinical teaching videos in nursing. Overall, four main themes have been identified:

- Broaden Research Scope and Diversity: expand the literature base to include studies from a wider range of countries and educational systems. Incorporate qualitative and mixed-methods research to gain deeper insights into learners' experiences and contextual factors influencing video-based learning.

- Develop and Standardize High-Quality Video Content: establish criteria for video quality, realism, and instructional design. Encourage collaboration between educators and media professionals to ensure videos meet pedagogical goals.

- Enhance Interactivity and Engagement: incorporate interactive elements such as branching scenarios, quizzes, and decision-making tasks within videos to actively engage learners. Utilize storytelling techniques and reflective prompts to deepen emotional connection and support the development of interpersonal skills.

- Promote Infrastructure and Technical Support: improve institutional investment in technology infrastructure to support video-based education. Provide training for faculty and students on how to create, evaluate, and use video materials effectively.

- Integrate with Blended Learning Approaches: combine video-based learning with simulation labs, peer discussion, and instructor-led feedback for a holistic educational model. Support self-directed learning with structured guidance and assessment criteria.

- Assess Long-Term Educational and Clinical Impact: conduct longitudinal studies to evaluate the sustainability of skills and knowledge gained through video learning. Investigate correlations between video-based training and clinical competence or patient care quality in practice.

- Address Equity and Accessibility: design content and delivery methods that are accessible for learners with disabilities or limited resources. Ensure video content is mobile-friendly and downloadable to support learning in low-bandwidth environments.

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Medical Education in the Digital Age - Benefits and Risks

Curis Cecilia[1], Curis Sebastian-Marius[2]

1. University „Dunărea de Jos", Galați, Romania, cecilia_curis@yahoo.com
2. University „Dunărea de Jos", Galați, Romania, curissebastian20@gmail.com

Abstract

The prophylactic and curative programs aim to use digital literacy as a tool to promote health education and to increase the accessibility and quality of health services. What is called "e-health" has become an important component of connecting health systems around the world. Variables such as cost, time, availability can be improved through the mechanism of digitization. Despite the benefits, there are a number of barriers, among which we mention the lack of digital literacy, reduced access to devices, user reluctance, and the danger of accessing scientifically unvalidated databases. Also an important risk factor is the vulnerability per se of these types of systems, which contain sensitive data about large categories of individuals. Apart from the risks and imperfections of actual digital health networks, the overall benefits of digital health networks cannot be minimized. Therefore, it is necessary to increase the literacy level of the population, in line with the current policies to be implemented by 2030. The aim of the study is to raise awareness among policy-makers and patients about the need for digital literacy. Through the current research we conducted an analysis of a total of 182 studies that we have identified in the PubMed database for the period 2005-2024. Data processing was performed using Microsoft Excel.The findings of the study point to the need for digital literacy of the population with the

amendment to correct issues such as misinterpretation of data, misuse of databases or misuse of devices.

Keywords: Internet, self-care, medical information, diagnosis

1. Introduction

Education is a concept that at the current moment of human evolution can no longer be limited only to the knowledge acquired during the period spent in educational institutions. Progress in science and the development of technology in all fields constitute the premise and at the same time a necessity for the continuous education of the population of all ages in various directions, because all discoveries have been made for and in the benefit of man. The present paper aims to address the subject of e-learning in relation to the health education of the population and medical information through digital platforms (Delungahawatta et al., 2022). The educational and medical systems, pillars of progress and social welfare, use the notion of continuous education. This phrase can also be taken up and used in the case of health counseling for the general population and patients (people already diagnosed with various conditions), in addition to the e-literacy process. In order to increase the efficiency of the medical act as well as the level of understanding, awareness and correct perception of the concepts of health and disease, measures are needed to instruct the patient in surfing the internet. Current medicine promotes prevention as a means of reducing morbidity and mortality (Perera & Agboola, 2019). Given that a responsible attitude towards one's own health should be a component of individual education, it is important to "provide" information on this topic. Digital education offers an effective way to offer health information. In general, digital information is accessed mainly by young people and adults with limited time resources, who prefer contact with the medical system, at least for general information, in an online manner. This population category, which has already gone through the digital literacy process, has the necessary skills to access medical platforms and health services online (Stukus, 2019). However, it is important to analyze the type and scientific validity of the

medical information accessed. It is equally important to prioritize understanding how medical information is perceived as useful for both the prophylactic and curative components. Therefore, in addition to digital education itself, it is necessary to implement ways to learn the process of selecting scientifically validated information. There are often situations in which false information represents "traps" of "self-care" via the Internet (Battineni et al., 2020). Although e-literacy is a continuous process and progress in facilitating access to the digital health network is undeniable, certain barriers can still be identified at present (Jia et al., 2021; Mee et al., 2024). One of these is represented by the distrust of certain categories of the population in the possibilities offered by online health networks, an aspect also determined by limited access to the Internet, the lack of digital knowledge or the devices necessary to access it and, last but not least, the perception of health and illness. This population sample may include the elderly, residents of isolated areas or those with limited financial resources. With social evolution, especially post-pandemic, the population's perception of health and access to medical services has changed considerably, in the sense of accepting online medical consultations and information to a growing extent (Haleem et al., 2021). In addition, the current lifestyle has led to limited time resources. This situation is also encountered in the medical system, where the greater the complexity of the medical act, the more time-consuming it is. The need to increase the degree of digital literacy of medical personnel and the general population has increased in parallel with the need for access to information. Consequently, these social goals can only be achieved by implementing programs that will contribute to increasing the percentage of individuals with a high level of awareness of the benefits of health education and digital education in a complementary way (Ruiz et al., 2006; Oluwadele et al., 2023b; Abbas et al., 2024b). Associated conditions of the process are represented by the access to this type of education and the establishment of the limits of safety and medical ethics conferred by the use of the online environment for medical purposes (Chaet et al., 2017b; Nason, 2023b). The reasoning would be that the search strategies and the quality of the websites visited are determining factors of the

patient's perception of a certain diagnosis or medical problems, in general. Individual education regarding medical information should start from the premise that there are no "minor" diseases and that any medical condition not diagnosed in time, neglected or incorrectly treated represents, firstly, an unnecessary suffering for the patient and, secondly, a burden for the health systems, in the short, medium and long term. From a medical point of view, the statement "there are no diseases, there are sick people" offers the possibility of a correct approach in the sense of personalized medicine. Studies show that the majority of internet users use the symptom exploration strategy, which is used as the origin for establishing a self-estimated symptom severity score (Kwakernaak et al., 2019b). Another aspect of the problem is the awareness of the risks related to data protection that patients are exposed to when using online platforms. E-digitalization can also contribute to solving the problems of digital vulnerability (Gao et al., 2022b) of patients by improving knowledge of legislation, correct use of devices or storage of medical data, to eliminate the risk of loss or dissemination of confidential medical data in the online environment where they can be accessed and used in the context of cybercrime (Ewoh & Vartiainen, 2024; Alodaynan & Alanazi, 2021b).

2. Literature Review

A review of the literature on the subject of online access to health information demonstrates slightly different conceptualizations in the pre-pandemic period compared to the pandemic and post-pandemic periods. Thus, while in the pre-pandemic stage the focus was on the credibility of information in relation to the quality of websites, (Daraz et al., 2019) in the pandemic period this aspect was pushed to the background as a practical necessity, the health crisis making it impossible for patients to access health systems (Suh et al., 2022; Chen, 2023) For this reason, the interest has focused on the aspect of monitoring patients who have gradually stepped into the digital world, regardless of age, adopting a digital behavior adapted to the period of health crisis. (Thapa et al., 2020) Of course access for seniors has been less easy due to lack of digital skills as

well as devices. This barrier has been gradually removed in urban and high economic potential environments and even though the pandemic has passed, the behaviors related to medical digitization have remained (Galavi et al., 2022b). There still remains a barrier in disadvantaged environments, in those where the Internet is unavailable or where the level of e-literacy is low not only due to age or level of education but also due to the limitations imposed by conditions that interfere with the ability to learn or to anchor in an objective reality (neurological or psychiatric conditions - dementia, cognitive impairment). (Kozelka et al., 2023b). In the pandemic period, the complexity of the issue has focused on aspects that are also related to medical ethics and the quality of medical care per se, namely, the influence that medical information obtained online can have on medical decision-making. (Heaton-Shrestha et al., 2023b). The post - pandemic period has preserved and improved the digital behavior of individuals who have discovered the benefits and advantages of online access to both medical information and the medical act *per se* in a particular form, different from the classical approach to the medical act (Starcevic, 2024c). Most studies emphasize the benefits of accessing health information online by linking it to increasing the health literacy of the population (Di Novi et al., 2024). The limitations, barriers and disadvantages of this practice are also mentioned, but the most important aspect is the need for further research to understand how access to online medical information affects medical decisions and therapeutic relationships (Coughlin et al., 2020; Bachofner et al., 2024b).

3. Purpose of the Study

The main purpose of the study is to provide a current dimension of the concept of digital literacy in relation to population health education, indirectly, by quantifying the interest in this topic in specialized literature, starting from the question: is digitalization and health education currently at the level required by the objective needs of social and health systems? Another purpose of the study is to increase awareness among decision-makers and the population regarding the need for

digital literacy, in an era when there is increasing talk about both the benefits and the risks of accessing the internet, in its various variants.

4. Research Design

The research question can be formulated as follows: are digitalizing and e-education currently at the level required by the objective needs of health systems?

The present study falls into the category of non-interventional systematic reviews. It is a mixed study, with a quantitative component - the identification of a number of 182 studies and a qualitative component - with reference to the phenomenology of the e-education process in relation to population health education. We searched the PubMed database for articles in English using the association of three terms as search keys: internet - self-care - medical information - diagnosis. The result was the identification of a total of 182 articles for the established period, namely, 2005-2024. The data obtained from the search process in the mentioned database were statistically analyzed using the Microsoft Excel application using the Data Analysis function. The data search was performed independently by the two authors. Between the first database search at the beginning of June 2024 and the date of finalization of the article, a total of 15 studies were indexed in the PubMed database. We included the work in the systematic review category, arguing that it met the criteria established for this type of analysis: academic synthesis of evidence (182 studies on the topic of digital education in correlation with health education) using critical methods of identification, definition and evaluation. In other words, the affected systematic review extracted and interpreted data from published studies on a mentioned topic, subsequently performing an analysis, description, critical appraisal and summary of the data in an evidence-based approach. Mention: in the meaning of the analysis carried out, the terms study and article are interchangeable because the identified articles represent the form in which scientific information resulting from research activity (studies) is disseminated.

Inclusion criteria
Articles published on the mentioned topic
Articles identified between 2005-2024
Articles published in the PubMed database
Articles in English
Exclusion criteria
Articles on related topics
Articles on the chosen topic but published in different periods
Articles published in other databases
Articles published in other languages

Table 1. Inclusion criteria

Study Limitations

The limitations of the research process were due to limited access to information (in this case by accessing a single freely accessible database), differences between studies, time constraints, methodological limitations, high heterogeneity due to multiple variables, linguistic fluency, methodological diversity of the studies analyzed, differences between outcome assessments, limitations of the review process, limitation to studies in English, objective difficulties in the selection process.

5. Results and Discussions

We performed statistical processing of the data from the point of view of the representativeness and validity of the analyzed sample. We calculated the mean, median, standard deviation and confidence interval (for $\alpha=0.05$ (confidence interval 95%)). The values for these statistical indicators are listed in the table below.

Statistical variables
Mean 10.05555556
Median 10
SDEV 6.72
Confidence level 3.344500484 (α=0.05; 95%)

Table 2. Statistical variables

The Pearson correlation coefficient, whose value is 0.83, signifies a positive correlation but a weak strength between the two variables (number of published articles and the years of the chosen period). This finding confirms the inhomogeneous distribution of the data, more precisely the fact that there are years with a large number of published studies on the mentioned topic and years in which there are no published studies or there is a small number of published studies.
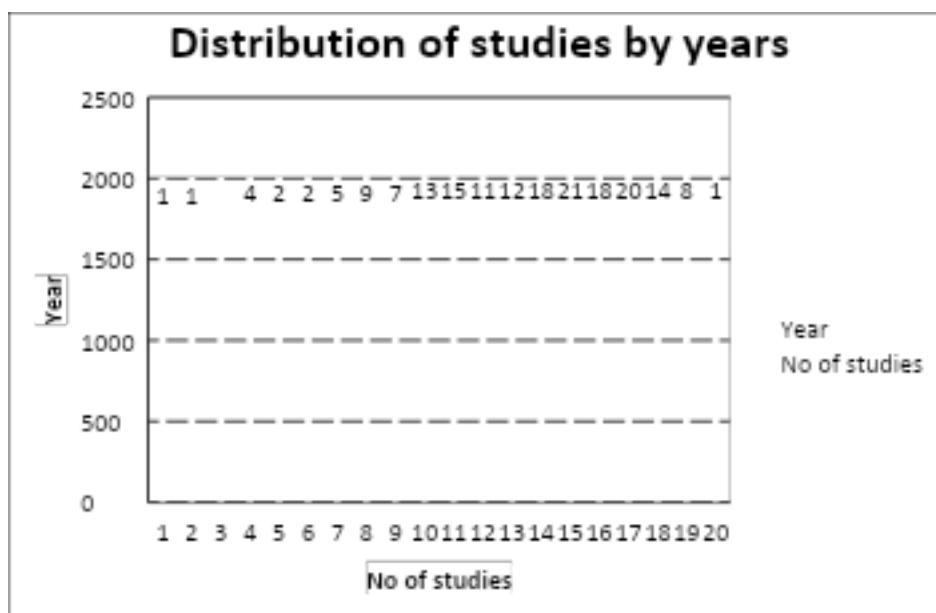

Figure 1. Distribution of studies by years

Regarding the importance of these statistical data in the educational process, analyzing the data in **Table 2** and **Figure 1**, we can state that with regard to the interest in medical education through digital platforms and implicitly, the interest in digital education, indirectly quantified by the number of studies carried out and their related articles identified in the PubMed database, there was an upward trend during the period 2005-2024. For a better comparison of the data, we divided the 20-year period into 4 periods, namely: 2005-2009, 2010-2014, 2015-2019, respectively, 2020-2024. (Shaver, 2022b; Alibudbud, 2025b)
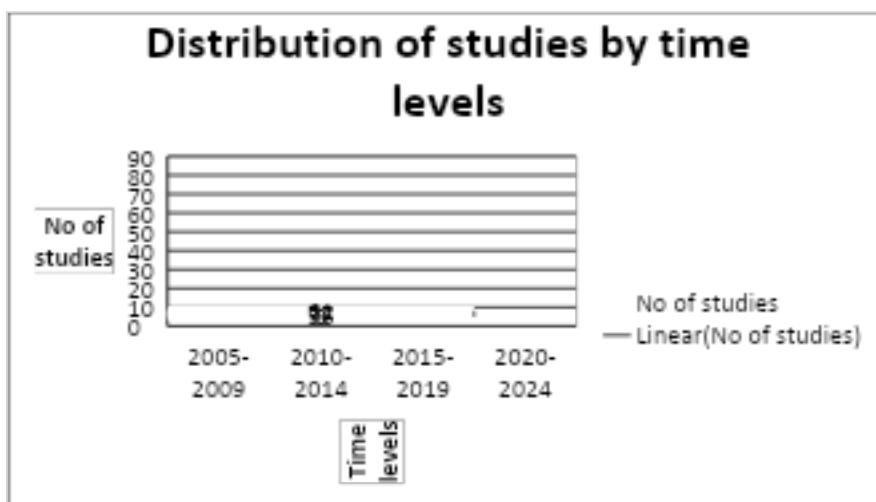
Figure 2. Distribution of studies by time levels

The analysis of the data distribution across the 4 time periods demonstrates a 4.5-fold (22.22%) increase in the number of studies in the period 2010-2014, compared to the period 2005-2010. The largest increase in the number of studies is observed in the period 2015-2019, 9.62 times compared to the period 2005-2010, respectively 2.13 times compared to the period 2010-2014. A slight decrease is observed in the period 2020-2024, with 1.26 times fewer articles being published than in the period 2015-2019. The analysis carried out through this study highlighted the fact that during the period 2015-2019, both digitalization itself and digital education were

carried out at an accelerated pace. Although the pandemic period represented an important leap in individuals' awareness of the importance and necessity of digitalization, especially of digital education, in terms of interest in general medical information it constituted a regression. The health crisis determined the focus of attention on the Covid 19 disease with its major implications both at the individual level and at the level of the entire health system. Using previously acquired knowledge, the population integrated it into its way of life, compensating for restrictions on social interaction (Khosrowjerdi et al., 2023b). This reduced the possibilities for research in the field of digital education per se. In the post-pandemic period, a hypothesis for the decrease in the number of studies on the subject can be represented by the natural integration of the use of digital systems and education of the population's needs into everyday existence (Htay et al., 2022b).
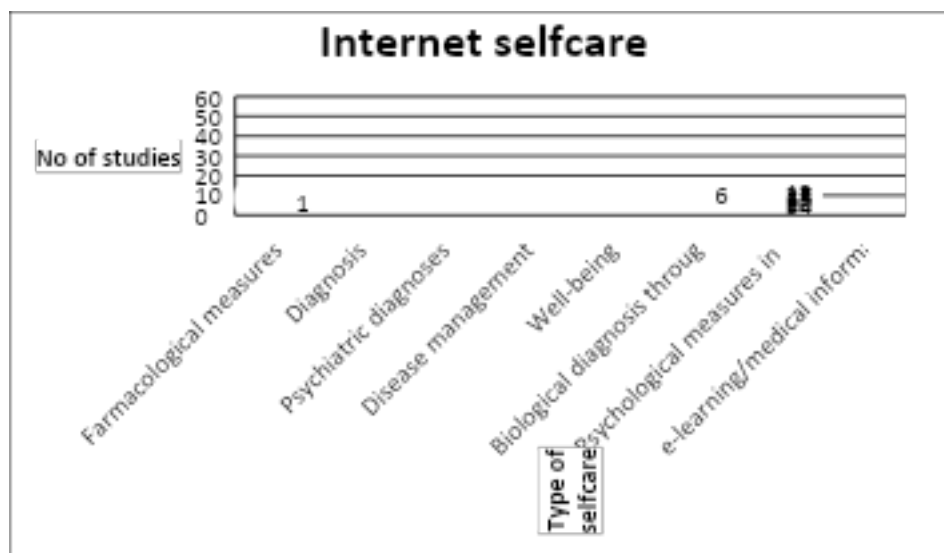

Figure 3. Internet and self-care

The research we conducted revealed that a total of 20 studies (10.98%) out of 182 studies revealed the use of the internet for diagnostic purposes. This is a relatively low percentage but by comparison with the n=12 studies, i.e. 6.59% studies showing the use of the Internet for

e-learning purposes in relation to medical problems, we can conclude that patients prefer to self-estimate risk by self-diagnosis, assuming that there are harmless diseases that can be ignored or self-treated without requiring a specialist consultation. The analysis we conducted revealed that n=57 (31.31%) of the 182 articles studied accessing medical web sites in search of information about the management of various conditions after diagnosis, and a total of n=34 (18.68%) studies highlighted the search for information about appropriate treatment. From a medical point of view it is encouraging that patients want to have more information about how to treat and manage their own disease, but at the same time it is worrying the other aspect, medical education that they consider unimportant in the equation of medical care. From the point of view of medical professionals, the basis of prophylaxis for the onset of disease lies precisely in patients' knowledge of information on how to maintain their health and the possibility of screening methods and access to validated websites that can guide patients on the decisions to be taken in the presence of certain symptoms. Based on the idea that prophylactic interventions (lifestyle optimization with reference to diet, smoking cessation, exercise, weight loss) reduce mortality by about 40%, the goal of medical education through digital applications is to provide information related to primary prophylaxis (prevention of disease). Studies show that the prevalence of metabolic diseases has increased over the last two decades (Chew et al., 2023). The importance of this lies not only in the prevalence of mortality and disability-adjusted life years, but especially due to the consequences occurring in the third stage of life. These lie in the impact of the risk factors listed above on lifespan and age-related decline through increased morbidity and impaired functionality (Zhang et al., 2023). Another important aspect is that of patients' addressability to the health system after the moment of information on certain aspects of medical interest starting with symptomatology and ending with treatment methods or management of various conditions. Previously I referred to the need to integrate the medical information accessed by the patient through the platforms in a clinical context (Farnood et al., 2020b). This can only be done by people with a medical background who, based on their clinical

knowledge and experience, can fill in the missing pieces of the clinical picture, formulate a correct diagnosis and finally correctly determine the risk score and prognosis of the disease and choose the most appropriate methods of therapy. In our analysis we found only one study promoting this aspect (0.54%). We found that the most numerous studies were those referring to the management of various diseases n=57 studies (31.31%) followed by studies on the psychological component in chronic diseases n=27 studies (14.83%) followed by studies on the medical education component N=12 (6.59%). From the perspective of disease management by health professionals, this is not a positive direction. It is encouraging that patients are willing to self-manage their conditions and this can be translated into an assumption of all that is involved in the individual relationship with the disease. On the other hand, these figures can also be interpreted as a lack of interest in prevention and a lack of interest in the curative component. Beyond the fact that only 6.59% of the identified articles address the subject of medical information in relation to e-digitalization, we found that a number n=34 (18.68%) articles address the interest in pharmacological measures and a number n=20 (10.98%) refer to diagnosis. Considering the high percentage of patients who resort to self-medication referred to in the specialized literature, often related to adverse reactions and information from scientifically unvalidated online sources, this is a worrying situation (Raja et al., 2024b; Agarwal et al., 2021b). On the other hand, and with regard to diagnosis, the literature frequently brings into discussion the fact that self-diagnosis, especially that associated with self-medication, (Bergmo et al., 2023b) leads to dangerous situations for patients, often reaching a life-threatening risk (Cotobal-Calvo et al., 2025b; Khoshbakht et al., 2023b; Efthymiou, 2025b).

After the lifting of restrictions, people realized that the existence of digital means during the pandemic constituted an opportunity that contributed greatly to the possibility of resolving the medical and social crisis we faced. People also realized that the use of digital means opened up new opportunities for distance communication and information that offer numerous advantages even after the lifting of restrictions and continued to adhere to this form of social behavior. As

for the education system in general and the medical education system in particular, they were reconfigured during the pandemic on the structure of digitalization, taking into account the risks of exposure to disease. The previous existence of digital education for children and young people represented an alternative that offered them the chance to access medical education and information even during the period of isolation. The analysis carried out through this study highlighted the fact that during the period 2015-2019, both digitalization itself and digital education were carried out at an accelerated pace. Although the pandemic period represented an important leap in individuals' awareness of the importance and necessity of digitalization, especially of digital education, in terms of interest in general medical information it constituted a regression. The health crisis determined the focus of attention on the Covid 19 disease with its major implications both at the individual level and at the level of the entire health system. Using previously acquired knowledge, the population integrated it into its way of life, compensating for restrictions on social interaction. This reduced the possibilities for research in the field of digital education per se. In the post-pandemic period, a hypothesis for the decrease in the number of studies on the subject can be represented by the natural integration of the use of digital systems and education of the population's needs into everyday existence. Regarding the connection between e-education and disease management through the perspective of medical information education of the general population, the problem that arises is represented by gaps in knowledge of internet navigation when there is no digital education, a situation in which the vulnerability of the internet user appears. This vulnerability refers both to the "public" exposure of confidential data and to accessing scientifically unvalidated data, the latter of which may constitute the premises of erroneous medical decisions on the part of the individual. This confirms the need for digital education that offers protection to those who surf the internet. There is also increasing talk in specialized literature about the vulnerability determined by excessive use of the internet network both from the perspective of the fact that frequent access represents an exposure to the dangers of cybercrimes, and from the perspective of the fact that excessive use of digital means

can itself cause medical and psychological problems. The correct management of diseases, which also involves informed consent in order to accept the diagnosis or to choose the type of therapy, are components of the medical act closely related to health education and, in the current context, to digital education. Consequently, a person who does not have the skills to access scientifically valid information will not be able to realize the lack of seriousness or, on the contrary, the seriousness of the disease, will not be able to make the best decisions for himself and will not collaborate with medical teams. Moreover, he will believe in the "myths" available on the internet, becoming a victim of his own distorted beliefs both in terms of prevention and the curative aspect of diseases, as a component of population health education. This also represents a form of manifestation of the digital vulnerability of individuals.

6. Conclusions

In conclusion, we can consider the Internet a valuable source of information conducive to educational activity. However, the present analysis demonstrates the existence of an insufficient level of interest in digital education and a discrepancy between it and accessing prophylactic or curative medical information. There are still a number of barriers to accessing information online, such as: lack of digital skills or digital devices, as well as the lack of access of internet network. Another problematic aspect would be related to the vulnerability of Internet users closely linked to the lack of digital skills, with reference to the protection of personal data or accessing scientifically unvalidated sources of information. All these variables can create an erroneous perception of the disease, representing risk factors for making rational decisions (non-acceptance of the diagnosis, abandonment of treatment or poor adherence to prescribed medication), belief in myths and unrealistic therapeutic possibilities or adherence to an inadequate lifestyle (e.g. restrictive, inadequate or pseudo-scientific diets). Negative affectivity determined by uncertainty and distrust in medical personnel in the event of accessing scientifically invalid information is another risk factor. For the patient himself, overwhelmed by

the burden of a bleak diagnosis and under the influence of contextual emotional imbalance, the information available online that does not respect the principles of evidence-based medicine can represent a trap with negative implications for the management of the disease. Self-management of the disease without the knowledge and expertise of a health professional can also pose a danger in the evolution and prognosis of the disease. At the end of the presentation, the answer to the initially formulated question is that digitalization and e-education are not currently at the level required by the objective needs of health systems. From this perspective, e-literacy, access to online medical platforms and raising the awareness of the population regarding e-health at all age groups, can constitute effective means of solving certain medical problems in the future and at the same time can contribute to improving the means of prophylaxis, decreasing the burden exerted on health systems. Consequently, continuous digital education correlated with health education based on scientifically validated information represents a necessity and an important social objective with addressability to all age groups and social categories.

Funding

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Enhancing Learning Objectives in Legal Education: Comparing Smart and ABCD Strategies

Olga Dorul[1], Andrei Nastas[2]

1. "Dunarea de Jos" University of Galati, Romania, Moldova State University, Republic of Moldova, dorulolga@yahoo.com
2. "Dunarea de Jos" University of Galati, Romania, Moldova State University, Republic of Moldova, andrei.nastas@ugal.ro

Abstract

The process of training future specialists of legal professions in higher education institutions of any country, today is subject to teaching traditions that have been strongly imprinted by the culture of that geographical space. The culture of teaching legal subjects is dictated by the particularities of the great legal systems. Although national legal systems differ significantly—even within the "major legal families"—we find it appropriate, within the present investigation, to identify the "ideology" of an effective and efficient methodology for training law students. In essence, the "legal education architecture" will strictly respect learning objectives.

By analyzing teaching traditions, curriculum frameworks, perspectives of labor market representatives, and the views of legal education beneficiaries, this paper evaluates the effectiveness of the SMART methodology—defined by its focus on specificity, measurability, achievability, relevance, and time-boundedness—and the ABCD model, which emphasizes audience, behavior, condition, and degree, in defining the learning objectives within the field of legal sciences. The analysis aims to demonstrate how the pedagogical principles advanced by

Malcolm Knowles and Benjamin Bloom can be implemented in a harmonious way and integrative manner, enabling universities not only to impart knowledge and develop professional competencies, but also to foster and reinforce fundamental human values among future legal professionals. However, in this research, based on the role of the jurist in contemporary society, we intend to formulate strategies for defining learning objectives in the context of new challenges to legal education: artificial intelligence, pandemic, economic security, migration, armed conflicts, environmental protection giving rise, already at university level, to scenarios that future legal professionals must not only reflect upon, but also address and respond to promptly.

In the paper, in order to demonstrate the theses formulated at the outset, we have employed theoretical research methods: analysis and synthesis. We employed deductive reasoning whenever necessary, as it is central to legal argumentation and, by extension, to legal activity. This emphasis on deduction does not diminish the importance of its counterpart, induction, nor does it reduce the relevance of combining analysis with synthesis and applying other complementary methods. Certainly, in order to substantiate the research results, we resorted to empirical methods such as observation, verification, and testing. Empirical methods specifically allowed us to identify qualitative indicators of learning objectives formulation strategies. Learning from experience and through experience is the key to the success of training valuable professionals in the field of legal sciences. In this regard, contemporary methodologies abound in methods and techniques of experiential learning. Therefore, in the proposed study, we will identify to what extent experiential learning fits into the strategies for formulating SMART and ABCD learning objectives. In the ideal version, a curricular standard at the law faculties will be thoroughly thought out by calibrating the learning objectives with the teaching techniques and methods that allow the most successful achievement of the training goals.

Keywords: strategy for formulating learning objectives, SMART model, ABCD model, training of future lawyers, teaching traditions

1. Introduction

The present scientific endeavor is a response to the continuous concern for the refinement of methodological and didactic tools in order to achieve the goals of university education for students in law faculties.

The educational process within law faculties is a complex one, and in addition to transmitting knowledge in the field of legal sciences, it is important to be designed taking into account the following factors: "learning culture" (the motivation of the beneficiary, learning methods and techniques), "teaching culture" (selecting the subject matter, structuring it, presenting the content).

Certainly, higher education in the field of legal sciences—similar to other domains within the social and human sciences—is currently undergoing paradigm shifts, being significantly influenced by the digitalization process. This transformation has led to a reduction in the traditional time allocated to direct student-teacher interaction, in favor of enhancing students' ability to navigate and utilize new technologies. As a result, the emerging connections between educational platforms and students imply an entirely different *modus operandi*, one that does not always foster universal human values. Under these circumstances, the long-term repercussions on the quality of professional training for future legal practitioners remain unclear and require closer examination. Another contemporary challenge facing legal education is related to the pursuit of inclusion, in line with broader ideals of equality and non-discrimination. Such positive actions, promoted by authorities responsible for higher education policy, must also be supported through the development and dissemination of methodological guidelines aimed at facilitating the adaptation of educational service beneficiaries to these evolving frameworks.

The heterogeneity of the actors in contemporary life has direct implications for the formation of traditions in university teaching. Nevertheless, it is imperative that the fundamental values underlying the formation of future legal professionals be clearly reflected in the pedagogical

approach, regardless of the geographical context in which the teaching and learning processes take place within law faculties.

The subject addressed in the present study has not been specifically explored by researchers in the field of legal sciences. However, certain theses relevant to this investigation have been examined within the broader context of studies authored by Ponkin I., Lapteva A., and Kurt S. Undoubtedly, the hypotheses advanced by the authors of this study regarding the relevance of learning objective formulation strategies may serve as a foundation for future research in this area.

2. Methodology

In this paper, in order to support the initial theses regarding the relevance, as well as the risks and opportunities associated with the SMART and ABCD models in the training of future legal professionals, we employed theoretical research methods, specifically analysis and synthesis.

Where appropriate, deductive reasoning was also applied, which, as noted by Ponkin and Lapteva (2021), constitutes "the heart of legal argumentation" in legal practice, and by extension, of legal activity more broadly. This does not, however, diminish the importance of inductive reasoning, nor of the interplay between analysis and synthesis and other complementary research methods.

By conducting deductive research, we inferred that effective legal education entails the implementation of both strategies—SMART and ABCD—as they facilitate the achievement of both short-term and long-term educational objectives.

To further substantiate our findings, we also employed empirical research methods, including observation, verification, and testing. These methods were particularly useful in identifying qualitative indicators relevant to strategies for formulating learning objectives. In this context, we conducted comparative analyses of teaching materials, curricula, and study plans, as well as student performance indicators across face-to-face and online instructional formats in both

full-time and part-time modalities. The analysis focused on law programs at higher education institutions in the Republic of Moldova, including the Academy of Economic Studies of Moldova, Moldova State University, the "Ștefan cel Mare" Academy of the Ministry of Internal Affairs, and the "Dunărea de Jos" University of Galați.

3. Results and Discussions

To conduct this analysis, the university curricula for law programs from five accredited institutions in the Republic of Moldova and Romania were examined. The selection included publicly available program documents, accessed via institutional websites between 2020-2025. The qualitative analysis of curricular materials, in line with the objectives of the present scientific endeavor, was supported by interviews and feedback collected from colleagues—teaching staff from five higher education institutions—as well as from students involved in learning and assessment activities. This feedback was gathered when the authors of the present study implemented and experimented with both strategies for formulating learning objectives.

We begin our analysis of strategies for formulating learning objectives by referring to the learning model proposed by David Kolb. In his 1984 study, *Experiential Learning: Experience as the Source of Learning and Development*, Kolb argued that experience is the fundamental and unique source of knowledge—a thesis that forms the foundation of experiential learning theory.

Learning is the process whereby knowledge is created through the transformation of experience. This definition emphasizes several critical aspects of the learning process as viewed from the experiential perspective. First is the emphasis on the process of adaptation and learning as opposed to content or outcomes. Second is that knowledge is a transformation process, being continuously created and recreated, not an independent entity to be acquired or transmitted. Third, learning transforms experience in both its objective and subjective forms. Finally, to understand learning, we must understand the nature of knowledge, and vice versa (Kolb, 1984).

Regarding the specificity of the teaching process in the field of legal sciences, it is important to initiate the investigation by citing the famous postulate of Thomas Hobbes.

Thomas Hobbes asserted that reason is the soul of the law: *nihil, quod est contra rationem, est licitum*; that is to say, nothing is law that is against reason; and that reason is the life of the law, nay the common law itself is nothing else but reason; and *æquitas est perfecta quædam ratio, quæ jus scriptum interpretatur et emendat, nulla scriptura comprehensa, sed solum in vera ratione consistens*; i. e. Equity is a certain perfect reason, that interpreteth and amendeth the law written, itself being unwritten, and consisting in nothing else but the right reason (Hobbes, 1840). Therefore, in our opinion, drawing from *the soul of the law* and *the heart of legal argumentation*, we conclude that the strategies for formulating learning objectives should be grounded primarily in reason and deduction.

Additionally, these strategies will be based on the algorithm that best addresses the needs of contemporary education processes: Bloom's taxonomy.

In 1956, Benjamin Bloom with collaborators Max Englehart, Edward Furst, Walter Hill, and David Krathwohl published a framework for categorizing educational goals: Taxonomy of Educational Objectives. Familiarly known as Bloom's Taxonomy, this framework has been applied by generations of K-12 teachers and college instructors in their teaching. The framework elaborated by Bloom and his collaborators consisted of six major categories: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. The categories after Knowledge were presented as "skills and abilities," with the understanding that knowledge was the necessary precondition for putting these skills and abilities into practice. While each category contained subcategories, all lying along a continuum from simple to complex and concrete to abstract, the taxonomy is popularly remembered according to the six main categories (Armstrong, 2010).

In 2001 the taxonomy was revised by underscoring this dynamism, using verbs and gerunds to label their categories and subcategories (rather than the nouns of the original taxonomy). These

"action words" describe the cognitive processes by which thinkers encounter and work with knowledge:

Remember (Recognizing, Recalling), Understand (Interpreting, Exemplifying, Classifying, Summarizing, Inferring, Comparing, Explaining), Apply (Executing, Implementing), Analyze (Differentiating, Organizing, Attributing), Evaluate (Checking, Critiquing), Create (Generating, Planning, Producing) (Council of Europe, 2016).

To effectively achieve curricular objectives, it is essential that all actors involved in the teaching and learning process—particularly those from non-pedagogical fields—possess the knowledge and skills required to formulate clear and coherent learning objectives.

Based on the authors' experience in teaching university courses at higher education institutions with a legal profile in the Republic of Moldova and Romania, two essential approaches to formulating teaching objectives can be identified: the so-called ABCD and SMART models.

By using the ABCD formula, we will be able to create clear and effective objectives. It consists of four key elements: (A) Audience, (B) Behavior, (C) Condition, and (D) Degree:

A-Audience: Determine who will achieve the objective.

B-Behavior: Use action verbs (Bloom's taxonomy) to write observable and measurable behavior that shows mastery of the objective.

C-Condition: If any, state the condition under which behavior is to be performed. (Optional)

D-Degree: If possible, state the criterion for acceptable performance, speed, accuracy, quality, etc. (Optional). (Kurt, 2020)

Example of a learning objective formulated in accordance with the ABCD approach in the field of legal sciences: *After completing the seminar on international crimes (C), students (A) will be able to distinguish between war crimes and crimes against humanity (B) by accurately identifying at least 4 distinguishing criteria (D).*

In another approach, *learning objectives should be SMART*: i.e.,

S-Specific ˗ Any objectives must be concrete, clear and unambiguous. It should target something specific – for example, clear understanding of a topic.

M-Measurable ˗ The objective will include some indication of how learner progress may be measured.

A-Attainable ˗ The objective should be appropriate for those undertaking it.

R-Relevant ˗The objective should be relevant to those undertaking the course.

T-Time-specific. The objective should specify the time parameters in which the task should be completed. (Council of Europe, 2016)

Example of a learning objective formulated in compliance with the SMART approach in the field of legal sciences: *By the end of the module on the right to liberty and security (T), students (A) will develop professional skills in human rights law (R) by analyzing and discussing the reasons and limits of the state's positive obligations in this area (S), as defined by the European Court of Human Rights' practice, and demonstrate their understanding through a written assignment submitted on the HELP platform of the Council of Europe (M).*

An analysis of the university curriculum of law faculties reveals a trend toward the SMART approach in the formulating learning objectives, which, according to the teaching staff, are more aligned with the content and specifics of legal disciplines: they are clear, accessible and predictable. Furthermore, the SMART approach undoubtedly the development of both general and specific skills that contemporary legal professionals must possess.

Learning from experience and through experience is the key to the success of training valuable professionals in the field of legal sciences. In this regard, contemporary methodologies abound in methods and techniques of experiential learning.

As an extremely efficient method in the process of acquiring knowledge and developing the skills of future professionals in the field of law, debate is frequently utilized. Debates focus on events and phenomena that spark intense discussions in society, where consensus for assessing these situations is lacking. Another method that allows active involvement of students is the

Socratic method, based on a discussion conducted through multiple rounds of relevant questions on a researched phenomenon, culminating in the deduction of legal reasoning, concepts, or principles. Problem solving involves organizing the learning process by moderating teaching activities in which students are tasked with formulating the problem, devising a strategy for solving it, and proposing solutions.

4. Conclusions

The university training of specialists in the field of law from the perspective of the organization of the study process does not differ much from the training of other specialists in the field of socio-human sciences. The process is presented as a complex one with inputs and outputs set according to clear, accessible, and efficient algorithms whose efficiency has been demonstrated over time.

The design of the training process in higher education institutions should be based on practical experience in the field. A holistic, deductive approach to the educational process is essential for the formation of highly qualified specialists. The strategies for formulating objectives, whether ABCD or SMART, are both relevant and effective in legal education. Additionally, the teaching staff should consider that the ABCD model is more rigorous, enabling the achievement of specific objectives and short-term tasks, making it ideal for seminars in the field of law. In contrast, the SMART model provides a global perspective on the academic content, being more flexible and promoting the development of a broad perspective, essential for achieving long-term goals.

The strategy of formulating SMART learning objectives, in our view, is the most effective way to develop the skills of future specialists in the field of law. It not only fosters professional skills but also social and personal skills, which promises high adaptability in the behavior of future lawyers to contemporary challenges such as artificial intelligence, pandemics, migration, armed conflicts, environmental protection, and more.

In the ideal version, a curricular standard at the law faculties will be thoroughly thought out by calibrating the learning objectives with the teaching techniques and methods that allow the most successful achievement of the training goals.

This study is limited primarily by the scope of the didactic support documents analyzed, which were collected from several universities with law faculties in Romania and the Republic of Moldova. The analysis also included direct observation of teaching practices. The conclusions are based on a qualitative interpretation of curricular content and instructional strategies.

The authors do not intend to impose their own vision on the design of legal education programs. However, drawing from approximately 20 years of personal teaching experience in the field of legal sciences, the authors advocate for a more holistic approach to this domain, through the integration of both strategies examined in this study—given the clear opportunities and benefits they offer.

The models discussed in this research are applicable to full-time, part-time, and distance learning programs in legal education institutions, whether civilian or military in profile.

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Book Reviews in CAE Exams Papers: A Tool for Developing Vocabulary

Raluca-Andreea Nechifor

School of Doctoral Studies, "Vasile Alecsandri" University of Bacau

raluca.nechifor17@gmail.com

Abstract

Cambridge Assessment, generally known under the name Cambridge University Press & Assessment, is a part of the University of Cambridge plays a major role in educational assessment and qualifications worldwide. Its main roles include providing internationally recognised exams and results, organising and marking exams in order to be obtained different certificates, supporting institutions, candidates and teachers, as well as ensuring reliability and fairness in global education standards.

In conducting our study on the role of book reviews in CAE examinations and English language learning, we focused on identifying the use of both the descriptive and evaluative discourse of literary critics, used with the main purpose of persuading the audience, as well as on assessing its educational and instructional qualities, concerning Cambridge English exam candidates.

Keywords: book reviews, literary critique, Cambridge qualifications, vocabulary development.

1. Introduction

In the Cambridge C1 Advanced exam, a few parts include pieces of specialised language. More specifically, Parts 5 and 6 of the Reading and Use of English paper often include longer, more

detailed texts that require close reading, deep understanding and a skillful mastering of critical thinking. In this respect, one of the most common types of text occurring in these parts is under the form of book reviews. These pieces of text are particularly useful in this situation due to their capacity of combining informative content with personal opinion, their role including a wide range of functions, such as offering rich language, highlighting a varied tone and creating structured arguments. All these factors act as elements having the ability to test a candidate's reading skills, at an advanced level.

In Part 5 for instance, candidates typically have to read an entire text, usually of long lengths, often embodying a book review, followed by multiple-choice questions. These questions are designed to check the level and the skill of understanding different points of interest and topics within book reviews, including the writer's ideas concerning reality and fiction, the attitude towards the work itself, together with the implied meaning of different structures.

Consequently, in the following part (Part 6), each candidate is asked to match missing paragraphs to the correct gaps into a text, this task being considered the most difficult one in the entire exam, due to the complexity of the task and the wide knowledge a candidate has to master. Therefore, book reviews are highly suitable in this stage of the exam, as they often follow a logical, yet flexible structure, pushing the student to identify how each paragraph develops the topic, while using linking devices in order to solve the task and maintaining coherence, as well as meaning at a larger scale.

Among the reasons offered by candidates concerning the difficulty of the tasks involving their comprehension of book reviews, they mention the following: (1) the complex vocabulary, containing a large list of terms, idioms and phrases, often being characterised by a wide variety of specialised terms; (2) the extensive range of texts, especially the ones extracted from academic sources; (3) the difficult multiple-choice questions, formulated in order to trick the reader's eye; (4) challenges with respect to the understanding meaning and correctly selecting the key-words.

Concerning the first hurdle, the complex vocabulary used in the construction of the texts to read are usually reviews of different sorts, including literary critique, plastic art reviews and even culinary reviews. In the CAE Advanced examination, part 5 consists of one long text, usually about 700-750 words, extracted from a reliable source, the most common choices including a newspaper, magazine, novel etc. There are numerous situations in which the text consists of a book review. The task comprises 6 multiple-choice questions with four answer options (A, B, C, D), all meant to trick the eye of even the more experimented readers. In this respect, multiple challenges may arise, as the answers are not directly stated, but rather need to be identified within the text, along with the main idea of the paragraph and of the entire text. Therefore, the meaning needs to inferred, a process only available for the ones having a large knowledge of English in specialised terminology and grammatical patterns exploited in different categories of texts. In addition, the options often seem very similar, but only one is fully correct. Therefore, this part tests the candidates' understanding of tone, opinion, argument development and the general understanding and attention paid to details.

As in other challenges, the methodology offered by the Cambridge University provides tips in order to facilitate the understanding of such texts. The first step involves reading the text quickly to identify the general idea, sometimes even twice, so that the questions are easier to approach. Secondly, an inexperienced candidate may read only a few of the variants, which is not advised by the specialists. As an example, they may read until the second option, B, and they stop there, not checking the following two. Even though, in their eyes B must be the correct answer, there is also a possibility for C and D to contain a more complete and suitable answer for the question, in comparison to their first choice. Thus, they need to read the question before the options in order to predict the answer. They have to do this and only after, to use process of elimination, that is to cross out obviously - or not so obvious - unsuitable answers. Last step is to look for synonyms or maybe elements in the text, which may enforce their perception of the right answer, or some which may equally contradict their chosen option. It is worth mentioning that the correct answer

is often phrased differently from the given text.

In this part, the identified challenges were the need for a clear, swift reading of the text. This step may seem ordinary and very obvious, however, there are numerous cases in which candidates do not have the necessary patience to take their time when assessing the text, paired with their inability of recognising terms and patterns of literary critique.

Part 6 is more complicated, as it introduces multiple points of view. The candidates get four short texts, excerpted from different sources, usually books reviews on the same topic or constructed around the same theme. The task comprises four questions, each requiring the student to connect the sentences with one of the texts.

Handling this task requires a wide knowledge concerning the comparison between texts, with the aim of identifying differences and similarities. Moreover, some of the given texts may seem to contradict each other, therefore, candidates are faced with a situation which calls for the critical thinking much discussed in the beginning of this paper. This is achieved by studying the language of literary critique, in order to adapt to the ever-changing shift in style, pattern and choice of terms. Finally, the answers are based on implicit rather than explicit statements; thus, a good understanding of critical terms is vital for succeeding in this part. The advice offered by examiners includes reading the introduction first, as this important part provides the general framework in which students may dwell and perform their analyses, as well as having the necessary patience for assessing the role of each text to identify the main idea before answering questions. Candidates are advised to underline or highlight keywords in the questions and look for similar ideas across the texts and finally, to select the best option.

2. Research Methodology

We have focused upon the category of book reviews, including vocabulary research and identifying patterns. Analysing register involves the stage of examining how language is used in different contexts to convey specific meanings and achieve particular effects. Register analysis is

crucial in understanding how variations in language style, tone and formality affect communication and thus, the process of creating book reviews. It involves a systematic process to ensure that the review is insightful, balanced and engaging.

This research focused on identifying the use of both descriptive and evaluative discourse of literary critics, to the purpose of persuading the audience, as well as of assessing its educational and instructional qualities, concerning Cambridge English exam candidates. Hence, we could observe that critics have a particular manner of engaging in the construction, negotiation and dissemination of meanings constructed in books. Additionally, they gain distinct meanings and functions as they operate at different levels, mainly at the intersection of literary judgment, educational and instructional purposes, being an inclusive part in the process of critical thinking. The analyses performed upon the manner in which students assess the language of reviews have shown the existence of a strong connection between language (its function and its manner of engaging students into developing skills concerning vocabulary assessment) and the formation of appropriate abilities in recognising and understanding meanings within the specialised register of literary critique. Therefore, from a purely communicative point of view, the goal is to understand the extent to which the study of literary critique aids exam candidates perform better when faced with book reviews in the reading parts of CAE examination. We started from the assumption that these reviews have, though not directly, the effect of creating a safe space for the students to understand and analyse, as well as to understand the message, while enhancing their knowledge of vocabulary and grammar.

2.1. Research objectives

This section has the main purpose of studying the language of literary critics, based on a corpus of current contemporary texts and materials extracted from the samples offered by the Cambridge University for CAE exam preparation. This research analyses and equally highlights the linguistic techniques used by critics, specialised in the domain of literature.

The specific objectives are listed below:

O1: To identify specific terms of the register of literary critique, as well as their role in the process of persuasion.

O2: To underline the morphological, syntactic and pragmatic boundaries of the register used by art critics, used to create an impact upon targeted groups.

O3: To study, analyse and assess the role of literary critique in the process of enriching pupils' vocabulary during their preparation for C1 exam.

O4: To identify a specific pattern of action in similar cases to the one of Cambridge English candidate, as applicable in other domains or for other purposes.

2.2. Research questions

The process of analysing registers and various choices of personalised vocabulary patterns acts as a key operator in assessing the role and influence of literary critique in general, especially within the field of book reviews involved in language assessment. In this respect, this research focused upon understanding the sociological and psychological functions of specialised languages in different contexts, the main goal being the assessment of meaning in language acquisition and vocabulary development. To this purpose, we have established the following research questions:

Q1: What are the linguistic manifestations, roles and functions of literary critique and what impact do they hold upon general understanding of book reviews as a specialised register?

Q2: What is the connection between language, emotion and sociological development within the process of conveying opinions while describing the quality of books?

Q3: Are there any other practical functions and roles influencing targeted groups, in this case, the young generation?

Q4: Does the language of art critique have any pedagogical, instructional and associative implicature, with respect to literary critique?

Q5: Does the language of book reviews have a significant impact upon the process of language acquisition for the candidates preparing for the CAE Advanced English Exam?

2.3. Hypothesis

The language of literary critique encountered in the book reviews included in the fifth and sixth parts of the Reading and Use of English sections of the CAE Advanced English exam has a direct impact upon the students' ability of enriching their vocabulary.

2.4. Methodological Framework

2.4.1. Research methods

At its initial stage, this research involved the process of preplanning and drafting a mind map, aiming to guide our activity, in order to maintain the direction of our study and work. We have begun this journey from the enlarged and highly accessed domain of literary critique in which we needed to consider three essential variables: *who* (literary critics and the targeted group), *where* (the context in which we needed to place the two actors) and *how* (the proper exploration of these dynamics). This process developed to reach the so much desired *why* (the result of this research itself). We have selected the necessary tools for approaching the topic and identified the two layers of data which should be rigorously studied to reach the deeper layers of meaning within enclosed social and cultural spaces. We determined that literary critique offers the untrained eye an exterior layer, available to ordinary readers, as well as a kernel which needs to be reached through the dense body of information, by means of specific methods and techniques. The exterior layer may be brushed and inspected with the aid of quantitative research, in order to gather samples (corpus of texts and different sorts of materials, in this case being the samples of book reviews used as means of assessing reading skills of C1 candidates). These are elements which have the necessary power and finesse to create the opening within the mass of data, in order to collect and to analyse the necessary pieces of information. These are the tools which are considered a vital step when preparing the application of different methodological models upon the cases presented in this research.

We opted for a mixed approach, one which would integrate both quantitative and qualitative research techniques. This perspective enables us to employ different, mixed techniques to

address the research objectives comprehensively and in a balanced manner, as well as the documented responses for the proposed research questions. This methodological synthesis will enable a multifaceted exploration of the subject matter, ensuring both empirical robustness and contextual depth in the study's findings.

The present study revolves around the domain of literary critique, which may be defined as the scholarly examination, evaluation and interpretation of literary texts, involving a critical analysis of literary works. This inquiry was created with the goal of uncovering the deeper meanings within the language of book reviews, while assessing their artistic and functional values to be contextualised within the given historical and societal framework.

However, to achieve the underlying objective of this paper, concentrated in the need for examining the extent to which literary critique, specifically in the form of book reviews, influences vocabulary acquisition among learners preparing for the CAE (C1) language examination, both quantitative and qualitative methods of research proved useful. They involved conducting a targeted study on a group of students enrolled at a Cambridge educational centre. The research specifically followed how exposure to the linguistically rich discourse of book reviews enhances students' lexical development, particularly in relation to parts 5 and 6 of the Reading and Use of English section of the CAE examination.

For the qualitative component, the study used observational techniques at large, followed by discussion, evaluation and focus groups. This particular stage comprised structured discussions with a selected group of C1 students, which we moderated for 3 and 4 months. This method acted as a particularly valuable tool, fostering interactive dialogue that allowed participants to share insights regarding their weekly engagement with book review samples. The goal of these discussions was for students to reflect upon how their exposure to literary critique has expanded their vocabulary, prompting them to investigate unfamiliar terms and discern contextual meanings. The progressive nature of this linguistic development was systematically documented through evaluation charts, facilitating a structured analysis of participants' lexical enhancement

over time.

Additionally, our interest was placed upon the observational research, serving as a complementary qualitative method to corroborate the findings of the focus group. This approach offered details upon the systematic recording of students' behaviours, choices, interactions, preferences and engagement patterns in a very natural, unbiased educational setting. The study incorporated different means, the focus shifting from the mere observation of the participants (in which we have actively engaged with the group) and the *in-absentia* observation (a process in which we assumed a more passive role). This dual observational framework complemented a large and efficiently established framework, offering valuable insights into students' engagement with literary critique and their evolving linguistic competencies.

On the other hand, speaking from the quantitative perspective, the research made use of descriptive and inferential statistical analyses, the former being heavily used when summarizing and elucidating important milestones in understanding trends within the collected sets of data. Therefore, the goal was to gain insights into the frequency and distribution of specific linguistic improvements, whilst inferential statistical methods had the chance to be applied upon the collection of data, with the aim of creating strong, well-founded conclusions, capable of making predictions concerning the broader language acquisition patterns.

These statistical tools ensured that the data collected had been neatly organised and appropriately interpreted, allowing for a rigorous examination of the impact of literary critique on vocabulary enrichment.

By synthesizing qualitative and quantitative methodologies, this research provided a comprehensive and empirically substantiated understanding of how literary critique, in the form of book reviews, contributes to lexical expansion and cognitive engagement among advanced English learners.

Furthermore, we will present the components of the research, as mentioned in the beginning of this section.

2.4.2. Participants to the research

We have conducted this study on a number of two groups of C1 candidates enrolled from two different cities of Romania, Bacau and Focsani. The group from Bacau consists of 7 students, while the group from Focsani consists of 9 students, all aged between 14 and 18.

2.4.3. The timeframe of the research

This research was conducted between October 2024 and February 2025, and it included a number of 4, respectively 3 sessions, for the two groups. One session comprised five weeks of preparation, divided into two groups, the first four weeks being for theory, teaching and continuous assessment, whereas the last week involved a mock test, a simulation in which students needed to perform as they would during the real exam.

2.4.4. Research stages

In proceeding to the general monitoring of evolution, being concerned with the final progress per session, we have conceived tests inspired from the samples discussed during the breakdown of the mock tests and from the additional professional reviews used as a complementary task for students struggling in getting acquainted with the intricate language patterns of critique. Each test was handed at the end of each week. The usage of the focus group created even more space for discussion, as students were able to discuss the most difficult tasks and terms between themselves, allowing us to design new challenges and tasks in order to expand their area of study. These tasks included a wide variety of exercises, ranging from mere translation and equivalation of meanings, to more complex ones, such as the reformulation of sentences or certain paragraphs in their own words or using the words discussed as anchor to uphold their focus, as to guide them on this path.

Along this research, even from the first session, we had in view the following aspects: (1) understanding specialised terms and if the meaning was unknown, tracing their connection to other terms or to a certain context of discussion; (2) understanding connective words and their usage, extending their range of employment; (3) identifying typical patterns and intentions of

different sentences; (4) recognising these patterns and using them to the advantage of the students; (5) correctly assessing the messages within the text based on the already acquired knowledge. To this purpose, we planned the focus group meetings as two per session, that are two per a period of five weeks, placed within the first and the fourth week, in order to comprise the theoretical part of the session and not to interfere with the mock test. In this respect, we have planned the following structure for the focus group meetings, as we may observe from the following two tables.

Focus group	Date	Main topic and issues
1.	October 3rd, 2024	Discussing terms: the level of nouns and adjectives.
2.	October 24th, 2024	Discussing terms: the level of nouns and adverbs.
3.	November 7th, 2024	Discussing terms: the level of connective words and other particles.
4.	November 28th, 2024	Applying the acquired knowledge into a new text- assessing functions.
5.	December 5th, 2024	Identifying typical patterns in literary critique (1).
6.	January 9th, 2024	Identifying typical patterns in literary critique (2).
7.	February 6th, 2024	Paraphrasing, interpreting and rephrasing texts.
8.	February 27th, 2024	Discussing meanings and correctly assessing messages.

Table 1. The planification of focus group session, with their respective themes and issues of interest, 8 in total for the group of students from Bacau.

Focus group	Date	Main topic and issues
1.	October 3rd, 2024	Discussing terms: the level of nouns, adjectives, verbs and adverbs.
2.	October 24th, 2024	Discussing terms: the level of connective words and other particles.
3.	November 7th, 2024	Identifying typical patterns in literary critique (1).
4.	November 28th, 2024	Applying the acquired knowledge into a new text- assessing functions.
5.	December 5th, 2024	Paraphrasing, interpreting and rephrasing texts.
6.	January 9th, 2024	Discussing meanings and correctly assessing messages.

Table 2. The planification of focus group session, with their respective themes and issues of interest, 6 in total for the group of students from Focsani

During the first focus group meetings, we have assessed the level of terms, as individual units of meaning, as well as collective pieces from a bigger picture. We have discussed the manner in which the review from part 5 employs a mix of formal, semi-formal and conversational language, in order to create a familiar setting for the students to feel acquainted and comfortable when assessing the unknown terms and phrase. By processing as such, we have established the boundaries of common ground, avoiding a forceful approach, one which may take students by surprise and would have the opposite effect. The main goal was to make this stage accessible to a broad readership while maintaining intellectual depth. The terms identified in both groups are listed as follows: formal terms *transition, ubiquitous, decentralisation, advent, irrevocably, entrenched, superiority, foibles, sociological insights*; semi-formal words: *bearable, makeover, illuminated, dominance, accessible*; the colloquial expressions including: *littered with children's toys, go to your room, seems much of a threat, whatever happened to…?*. The list comprises terms which they had never used before, such being the case of *decentralisation,* a term belonging to a formal and academic register, rarely encountered, if ever, in spoken English. Formal language was out of reach from the start for some students, due to their constant contact with oral English and limited exposure to the academic levels of the language. This is due to their manner of learning English from extracurricular contexts, rather than the academic, formal one. Another step in explaining and expanding the meaning of certain words involved tracing its origin and related terms. In this respective case, students assessed that *decentralisation* is a term derived from *central/centrum*, to which were added two different particles, named affixes, namely the prefix *de-*, having the meaning indicating *removal* or *reversal*, as well as the suffix *-isation*, normally used to create a noun of *process*. The final result was that students were able to understand that the combination suggests a structural shift away from a central authority or

point of control. This fact would later help them when connecting multiple words within the review.

The following step was to extend the initial framework to a more complex dynamics for students, in order to stress upon the fact that by choosing *decentralisation* instead of *spreading out* or *distributing*, the reviewer tried to sustain a certain frame for their discourse, characterised by an analytical and intellectual tone which reinforces the sociological nature of the discussion. This *modus operandi* perpetuated throughout the discussion, as students managed to created their own analyses, while discussing and debating their findings with the ones of their peers. The transition from a linguistic analysis led to an interactional perspective, assessing meaning in context: "Key to that decentralisation of the home – and the implied shift of power within it – is the advent of central heating". Students managed to understand with the help of dictionaries and group discussion that the author made a clear reference to the redistribution of control within households, moving from a single dominant space to multiple accessible areas. The implicit meaning has facilitated, as the term suggested a shift in the domestic environment or a greater change in the domestic life, drawing a clear parallel meant to enhance wider social changes by taking into account numerous factors but focusing upon shifting family dynamics and the great impact of technological influence on it.

The desired effect was to differentiate students from the general readers, in order to increase their vocabulary knowledge. Consequently, for ordinary readers, *decentralisation* may evoke ideas of social progress and increased individual freedom, whereas for the more trained eye, the word invites a deeper analysis of power structures within domestic settings. Such was the case with the students, who, at the end of the first focus group, were able to understand the critic's choice of the word *decentralisation* as a method of strengthening the argument presented within the text by creating a direct connection to a larger social and historical shift rather than a simple, passive change in household arrangements.

Additional terms and phrases, including *irrevocably, entrenched, superiority, foibles* and

sociological insights were also discussed to indicate how they are interconnected through their role in creating a certain pattern in communicating narratives concerning the topic of change, on which the critique in the book review was based. They contributed to a broader discussion involving erudite topics such as historical transformation of households and mentalities, resistance to change of different social classes and the way modern perspectives evaluate the past alongside its key points in development. For instance, one of the main themes in the review expanded upon the topic of how domestic habits and language change *irrevocably*, meaning there is no returning to previous norms, the critic stating the following: "The message is that even the language of the home has changed *irrevocably*: airing cupboards are going the same way as drawing rooms". As a result, the term *irrevocably* was assessed as a unit underscoring the permanent character of temporary shifts both in language and culture. It was suggested the fact that terms from a similar group to which *parlour* and *airing cupboard* belong were closer to archaisms rather than be used in actual, current topics of conversation, a phenomenon which aligned with events detailing about broader societal transformations, in which technological and cultural developments redefine the manner in which domestic enclosures, as well as homestead-related phenomena are perceived.

Other terms have been deemed even more ambiguous, due to the manner in which they have been employed in the review. While some changes are inevitable, others face resistance to different cultural phenomena due to entrenched social norms, highlighted in the review the social belief concerning children necessitating fresh air for a well development: "It was a belief so *entrenched* that even a voice of dissent merely argued that in winter (…) healthy child only needs about three hours a day in the open air, as long as the day and night nursery windows are always open". The employment of the word *entrenched* was also brought into discussion, as it suggested a deeply rooted, unquestioned tradition, almost acting as an unwritten rule stipulated for the previous, actual and succeeding generation. This was perceived as custom which persisted throughout years, despite counter arguments and evidence against being revealed by specialists

in the domain, illustrating the manner in which societal norms, from the most harmless to the most excessive ones, have been difficult to change or to debunk for centuries.

Progressively, students' perception shifted, as they began to familiarise with the approach and thus, their general understanding of words, stating that literary critique must indeed exert a certain power over their capacity of understanding and correctly assessing meaning in these parts of the exam due to the enrichment of their personal, vocabulary knowledge supported by the contact with these reviews.

For instance, the usage of *foibles* instead of the terms *flaws* was found to convey a more humorous and light-hearted tone: "Rather more clear is the reason why a 1902 Teasmade failed to catch on: 'when the alarm clock triggered the switch, a match was struck, lighting a spirit stove under the kettle". This word choice softens critique and adds an element of nostalgia, while instead of simply ridiculing or praising historical trends, the reviewer chose to bring to the spotlight sociological insights, as seen in its praise for Highmore's approach: "For the most part, he's an engaging and quirky guide, dispensing sociological insights without jargon", emphasizes the importance of contextual analysis rather than the hasty judgment. The approach was clearly understood, and thus, the point of focus was more complex, replacing the mere action of pointing out that past customs seem odd today, the review takes its responsibility for encouraging readers to understand the reason behind the existence of such customs.

The discussion session of this focus group was followed by completion of a worksheet, acting as a progress report for the vocabulary knowledge accumulated by the students. Furthermore, other focus group sessions managed to enhance the power of literary critique over the vocabulary of candidates.

Another issue we focused upon was the use of specialised and technical vocabulary, which pose difficulties for students. In this respect, the review incorporates terms from various disciplines, including sociology, cultural studies, technological innovation, household improvement, historical development and literary references.

First of all, the category of sociology and culture include elements such as *domestic democracy, decentralisation, internationalism in taste, societal changes*. These terms are the tools with the help of which the author theorizes upon the manner in which homesteads reflect broader societal changes that expand its territory and innovation over the classical personal or aesthetic spaces as topic of general discussion. Concepts such as *domestic democracy, decentralisation* and internationalism in taste shifts the discussion in a slightly different direction, as domestic democracy reflets upon the creation of a more equitable distribution of resources, technology and power overall, within the household. Additionally, technological registers were studied at large, for the students to get acquainted with the more accessible specialised terms, emerging from the innovations within the household environments and the technological advancements. Terms such as *gas-powered fridges, dishmaster, spirit stove, airing cupboards* have made the topic of this part of discussion, as the review incorporates these terms in order to reflect historical advancements and shifts in home utility, convenience and safety standards. These units of meaning have been brought into analysis with the aim of highlighting the manner in which technological progress has shaped everyday life, as a vital tool aiding ordinary people perform simple actions related to their home, namely how to cook, clean and organise their living spaces within their houses.

By referencing these terms, the review not only creates a space of documentation, engaging the students and stirring up their curiosity, both necessary when studying vocabulary data, but also uphold the capacity of criticising the probability of some technologies to fail due to impracticality, inefficiency or evolving consumer needs, topic considered extremely resourceful when answering some of the questions offered in the given task. This perspective creates common ground for the two worlds by connecting domestic history with larger themes of technological progress, stressing upon key-topics such as marketing influence and the ever-changing nature of daily life.

Lastly, historical references, accompanied by literary mentioning of period and movements have

constructed another path of research for students, as they felt the need to study syntagms and terms including *Victorian knick-knacks, parlour, Housewife magazine and others*. Linguistic choices in this sense are meant to reveal how historical objects, and items of information reflect broader societal changes, as well as disruptions within certain contexts. Their natural manner of occurring in the review not only provides helpful insights into the styles practiced in the past, but also, it maintains a stable function of enriching the vocabulary knowledge of students by exposing them to terms with emotional charge, embedded in historical, cultural and sociological contexts.

For instance, the reference to *Victorian knick-knacks* suggests that these non-essential decorative items acted, in fact as associated units of meaning in close connection to aesthetic excess and nostalgia. Consequently, the contrast presented in the review, with regards to the opposition between Victorian-era decor and modern living rooms has the main function of insisting upon a shift in taste and customs, from formal, display-oriented homes to casual, functional spaces, whereas its assessment in the process of vocabulary enriching was easily determined. Its role, similar to numerous other terms, was to introduce students into the realms of historical home aesthetics, broadening their understanding of how material culture reflects social attitudes, stressing upon the clear need for an explanation upon how language evolves; more specifically, while *knick-knacks* is still used today, it carries different connotations depending on the era and context, an almost identical process to the other terms discussed. The term "parlour", alternatively, refers from a historical point of view to a formal sitting room used for receiving guests, a common feature in middle and upper-class homes during the 19th and early 20th centuries.

Similar to the terms discussed previously, *parlour* teaches students about semantic change. It may be characterised by the manner in which words can fade from everyday use as the concepts they represent become obsolete, eventually forgotten once and era ends or if an idea loses its popularity. These terms are meant to introduce a sort of sociological connection between

language and lifestyle, phenomenon helping students understand linguistic patterns and their evolution, while reflecting social transformations.

Lastly, socials issues and delicate perspective connecting to those were brought to the surface, as the term housewives appeared in the title of a highly regarded magazine back in the day. *Housewife magazine*, as mentioned, was a cultural expression of an entire era, from its position of a mid-20th-century publication. Originally designed to aim at women, it was the Bible of social mannerisms, offering advice on domestic life, family care and traditional homemaking role, issues the trad wife trend nowadays tries to stress upon, encouraging women to return to their initial position within the society and the family. The quote extracted from the magazine and introduced in the review "men make houses, women make homes" reflects rigid gender roles of the time, being able to critique past social norms and to question traditional family dynamics then and now.

Students were quick to recognise this concept, as it circulated around social media platforms, especially on TikTok and Instagram, being turned into a famous trend by models such as Nara Smith[1] or former ballet dancers, as Hana Neeleman, a.k.a the Ballerina farm[2]. It introduced students to historical perspectives on gender roles and media influence, ideas contradicting with the overall appearance of the trend today, given the economy, social right and struggles on gender equality. We notice that these data combined helped them recognize how social attitudes are reinforced through language, expanding their understanding of periodicals as cultural artifacts. Additionally, we remarked the risks of misunderstanding as the two realities, the one in the mid-50s and the current one circulating in society might clash. However, the proper comparison between the two made it simple for students to assess the real meaning behind the concept.

The review presented a balanced mix of formal and informal language, historical and modern vocabulary and technical and figurative expressions, creating an engaging yet accessible food for

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[1] https://www.instagram.com/naraaziza/?hl=en, accessed February 11th, 2025.
[2] https://www.instagram.com/ballerinafarm/?hl=en, accessed February 11th, 2025.

thought, making it an excellent resource for enriching vocabulary and enhancing linguistic dexterity.

The adjacent manner in which we have guided the students on the process of enhancing vocabulary knowledge stressed upon the general understanding of connotation and its involvement into the texts, as book reviews provide context for words, helping students grasp their meanings, nuances and appropriate usage. This stage led to an increase in the critical thinking, encouraging them to analyse the manner in which language is used, aiming to improve their own perspective and ability in understanding meaning and context. Additionally, by observing how reviewers construct arguments, students have identified patterns used in varied sentence structures, being able to incorporate similar techniques in their writing.

3. Book Reviews as Persuasive Tools

In order to use book reviews as persuasive tools, ones for creating a bridge between language and critical assessment for students, we have selected the text from part 5 within the first mock test, which was the same for both groups, despite the temporal gap. We asked the students to read twice by themselves and after that, to look for unknown terms. They selected a wide range of terms, including: *episodic, nonlinear, antagonist, foil, archetype, imagery, tone, diction, Existential themes, social commentary, allegorical representation, Marxist*. After identifying the specialised words, students were asked to infer the possible meaning from the text, while categorising the words into morphological groups, including nouns, adjectives, verbs, adverbs, etc. They observed that, due to the context which was easily described and identified, they find quite easy to assess the morphological value of each of these words, given also the speeling of some of them, while other categories were facilitated by the additional knowledge concerning endings and structures. As for the meanings, they were more difficult to guess, some were discovered without any help, but other posed serious issues. For instance, in the text, the level of adjectives is abundant, as the text is a book review, characterising the strengths and weaknesses

of the writing, process usually accomplished with a large variety of adjectives. As previously mentioned, the language employed vivid and nuanced adjectives such as *entertaining, informative, engaging*, *quirky* and *disturbing*, words perceived by students as liable to help readers to grasp subtle distinctions in tone and meaning and to improve their ability to use precise vocabulary. In this respect, *quirky* and *engaging* led students to create associations between familiar words and these two more formal options.

At the level of nouns, another issue was the usage of extensive references to different specialists or other names of writers, unknown to individuals with a relatively limited general knowledge concerning the domain of literature. Consequently, by referencing figures like Billy Williams, Norman Wisdom and Margaret Thatcher, along with historical events and trends, the review broadens their contextual vocabulary. Other references contribute to the formation of comparisons and analogies, acting as figurative representation of reality in different stages of development. The review creates parallels between past and present household dynamics, using terms like *domestic democracy, decentralization of the home* and *irrational fears,* acting as comparisons familiarising students with abstract concepts and sociological terminology. Being exposed to such concepts, students are capable of enriching not only the vocabulary, but the general understanding of the messages, while stimulating free will and the expression of personal opinions.

comparisons familiarising students with abstract concepts and sociological terminology. Being exposed to such concepts, students are capable of enriching not only the vocabulary, but the general understanding of the messages, while stimulating free will and the expression of personal opinions.

This exposure helps students understand how to articulate opinions with sophistication. In this respect, these ideas are closely related to more complex phenomena occurring in the process, such as the need for critical analysis and self-argumentation, both being founded upon the general knowledge concerning vocabulary enrichment.

Furthermore, persuasion, as a means of communicating intention and opinions, has a fluid existence in book reviews, being often supported by logical reasoning and critical arguments. In this respect, there are lexical and stylistic markers triggering different reposes, which need to be correctly identified and studied. Reviewers present both positive and negative aspects of a book, and in order to do so, the authors chose their words carefully. No word is placed randomly, as they use words expressing agreement or critique, some examples including *compelling*, *flawed*, *well-structured* or *redundant*. By reading such analyses, students learn how to structure their arguments and express complex thoughts effectively.

The book review submitted to analysis includes words ranging from *parlour, airing cupboard* and *drawing room*, to more modern literary items including *iPads, laptops* and *mobiles*. This illustrates language evolution and helps students recognise shifting lexical trends, as well as the existence of smaller groups of meaning within the same stylist area. Additionally, there are numerous tendencies in terms of patterns which had to be discussed at this stage. The fact that numerous pieces of critique compare a book to similar works or authors, acts as an important element, motivating students to recognise thematic and stylistic patterns, even to understand the structure and to assess, in their turn, the value of different pieces of art with their own words, but using the terms specific to this particular activity. For instance, expressions such as *reminiscent of Orwell's dystopian vision* or *as gripping as a Hitchcock thriller* are linguistic items

introducing students to contextual vocabulary and literary connections, whereas the use of quotations and exemplifications may encourage more extensive research when inquiring about meaning and form.

As observed from different textual samples, critics display repetitive behaviour, as they normally include direct quotes from the book to support their opinions, highlighting their ideas, a persuasive technique derived for Logos, known also under the name of proof. This exposure to a multitude of passages that are rigorously written and the contact with a wide variety of stylistic choices enriches students' vocabulary by demonstrating word usage in context, as well as meaning selection and shifting within a given context.

4. Research Findings and Data Interpretation

During the process of data collection, we made the following observations, detailing the results and the evolution of the participants, as we may observe from the following tables and charts.

The first 2 tables concern the group from Bacau, as they were monitored for 4 sessions in achieving the necessary knowledge for performing well in these parts of the exam.

Student initials	Results in Part 5 (single review, multiple choice question)_ session 1	Results in Part 5 (single review, multiple choice question)_ session 2	Results in Part 5 (single review, multiple choice question)_session 3	Results in Part 5 (single review, multiple choice question)_ session 4
M.M.E	3 items out of 6 (50%)	3 items out of 6 (50%)	5 items out of 6 (83,33%)	5 items out of 6 (83,33%)
D.I.	1 item out of 6 (16,67%)	4 items out of 6 (66,67%)	6 items out of 6 (100%)	6 item out of 6 (100%)
P.A.	4 items out of 6 (66,67%)	5 items out of 6 (83,33%)	5 items out of 6 (83,33%)	6 items out of 6 (100%)
D.M.	0 items out of 6 (0%)	2 items out of 6 (33,33%)	4 items out of 6 (66,67%)	4 items out of 6 (66,67%)
P.M.E.	4 items out of 6 (66,67%)	4 items out of 6 (66,67%)	6 items out of 6 (100%)	5 items out of 6 (83,33%)
T.R.C.	5 items out of 6 (83,33%)	4 items out of 6 (66,67%)	6 items out of 6 (100%)	6 items out of 6 (100%)
H.V.	3 items out of 6 (50%)	5 items out of 6 (83,33%)	6 items out of 6 (100%)	6 items out of 6 (100%)

Table 3. The results obtained by the candidates enrolled from Bacau, in Part 5, during the 4 mock tests

(November 2024 to February 2025)

Student initials	Results in Part 6 (4 reviews, matching task)_session 1	Results in Part 6 (4 reviews, matching task)_ session 2	Results in Part 6 (4 reviews, matching task)_session 3	Results in Part 6 (4 reviews, matching task)_session 4
M.M.E	2 items out of 4 (50%)	2 items out of 4 (50%)	3 items out of 4 (75%)	4 items out of 4 (100%)
D.I.	0 items out of 4 (50%)	1 item out of 4 (25%)	4 items out of 4 (100%)	4 items out of 4 (100%)
P.A.	1 item out of 4 (25%)	3 items out of 4 (75%)	3 items out of 4 (75%)	4 items out of 4 (100%)
D.M.	0 items out of 4 (0%)	2 items out of 4 (50%)	2 items out of 4 (50%)	3 items out of 4 (75%)
P.M.E.	2 items out of 4 (50%)	2 items out of 4 (50%)	4 items out of 4 (100%)	3 items out of 4 (75%)
T.R.C.	3 items out of 4 (75%)	2 items out of 4 (50%)	4 items out of 4 (100%)	4 items out of 4 (100%)
H.V.	1 item out of 4 (25%)	3 item out of 4 (75%)	4 items out of 4 (100%)	4 item out of 4 (100%)

Table 4. The results obtained by the candidates enrolled from Bacau, in Part 6, during the 4 mock tests (November 2024 to February 2025)

The data collected from four successive mock test sessions taking place between the beginning of November 2024 and the end of February 2025 illustrates a clear direction of improvement among the students preparing for the CAE (C1) language exam. The analysis, as shown in these tables, focused on two key areas: (1) the performance in part 5 (single review, multiple-choice questions), (2) the performance in part 6 (four reviews, matching task).

It was clear that were some initial struggles, as seen in the case of two students. Additionally, the majority of students scored below 70%, with some performing significantly lower, whereas the highest-scoring student managed to get 5 out of 6 correct answers (83.33%), suggesting an initial disparity in comprehension skills within the group, even though the results of the placement test were in the same range of knowledge.

In this respect, there is clear progress observed especially for students whose performance, at the beginning of the sessions was very low. After a discussion on the main challenges, we have reached an agreement analysing the reviews together, whilst preparing materials and lists of terms and specialised concepts concerning book reviews. We adopted a strategy based on the

enrichment of vocabulary by offering the students the possibility of interacting multiple times during a session with different samples discussed together. To this purpose, we have selected random book reviews from the American sites of reviews, in order to create a similar practical framework for the students to experiment.

By December, the average performance increased, with several students achieving above 66% accuracy. Students who had initially struggled showed slow, but steady improvement, as they had to work on additional samples, in comparison to their other mates. Their performance showed improvement, though progress was still uneven.

By January 2025, five students achieved scores of 83% or higher, indicating substantial growth in their ability to analyse and interpret book reviews.

The final stage showed even more significant progress, as four students achieved perfect scores (6/6, 100%), while the rest scored no lower than 66%.

One student, who initially scored 16.67%, showed remarkable improvement, reaching 100% by January 2025. Due to their involvement in studying and assessing language and meaning within various book reviews, the managed to shift the initial result to a perfect score.

On the other hand, other candidates consistently demonstrated high performance, maintaining scores throughout the sessions.

With respect to the performance displayed within the second part of the exam, the results have a somewhat resemblance to the formerly discussed part. The first session demonstrated inconsistent performance, with some students managing 50% accuracy, while for others overall average accuracy was around 35%, indicating that students found the task of synthesising multiple perspectives more challenging than single review comprehension, despite the fact that, at a first glance, the latter task seemed shorter and easier to be solved, in comparison to the former.

The second session came with a few encouraging results, as more students achieved 50% accuracy or higher, a fact which demonstrates a developing ability to identify thematic links

across multiple reviews due to a closer contact with the language of literary critique. In this respect, some students' scores improved from 25% to 75%, marking a significant cognitive shift; their initial poor performance could be also linked to the lack of contact with such tasks.

By the last session, five students achieved a perfect score (4/4, 100%), and none scored below 75% accuracy; these results suggest that the candidates became proficient in recognising underlying themes as they began to be more acquainted with the pattern, the structure, the discourse and the overall language of book reviews.

Overall, concerning the evolution of the first group, the one from Bacau, we may mention some key aspects, starting with the fact that the candidates exhibited the most significant improvement in part 6, suggesting that exposure to multiple reviews enhanced their ability to compare and contrast perspectives, in comparison to their performance in part 5. Also, the structured focus on contextual vocabulary acquisition and critical reading strategies contributed to steady progress in both sections, whilst the overall exposure to literary critique enhanced their abilities and developed their critical thinking, forcing them to analyse and correctly assess meaning within books reviews. Certain trainees who initially struggled with comprehension later showed remarkable improvement, due to iterative exposure to book reviews, targeted discussions and vocabulary-building exercises based on various samples selected from the resourceful internet sites. The progressive structure of the study reinforced lexical retention, leading to an almost perfect performance in the final session. These being mentioned, the presented data strongly suggests that consistent engagement with book reviews has significantly improved students' analytical reading skills and vocabulary acquisition, fact will be explored in the following sections, when navigating the entire process development in this instructional incursion, all based upon entries and comments made for each task and additional practice development by the candidates. The main point extracted from this section only reinforces the importance of literary critique as a tool for linguistic and cognitive development in exam preparation contexts.

In assessing, observing and interpreting the progress of the second group, from Focsani, as seen

in the following table, we need to mention that this group started courses one session later than the ones from Bacau, which meant that their progress will have a shorter period of observation, namely three sessions instead of four.

Student initials	Results in Part 5 (single review, multiple choice question)_ session 1	Results in Part 5 (single review, multiple choice question)_ session 2	Results in Part 5 (single review, multiple choice question)_session 3
L.A.	3 items out of 6 (50%)	4 items out of 6 (66,67%)	4 items out of 6 (66,67%)
B.M.C.	4 items out of 6 (66,67%)	5 items out of 6 (83,33%)	6 items out of 6 (100%)
C.T.	4 items out of 6 (66,67%)	6 items out of 6 (100%)	6 items out of 6 (100%)
C.A.	2 items out of 6 (33,33%)	2 items out of 6 (33,33%)	4 items out of 6 (66,67%)
B.D.M.	5 items out of 6 (83,33%)	6 items out of 6 (100%)	6 items out of 6 (100%)
R.V.E.	3 items out of 6 (50%)	3 items out of 6 (50%)	6 items out of 6 (100%)
B.M.E.	3 items out of 6 (50%)	4 items out of 6 (66,67%)	5 items out of 6 (83,33%)
I.C.E.	4 items out of 6 (66,67%)	4 items out of 6 (66,67%)	6 items out of 6 (100%)
C.A.	2 items out of 6 (33,33%)	2 items out of 6 (33,33%)	4 items out of 6 (66,67%)

Table 5. The results obtained by the candidates enrolled from Focsani, in Part 5, during the 3 mock tests (December 2024 to February 2025)

Student initials	Results in Part 6 (4 reviews, matching task)_session 1	Results in Part 6 (4 reviews, matching task)_ session 2	Results in Part 6 (4 reviews, matching task)_session 3
L.A.	2 items out of 4 (50%)	4 items out of 4 (100%)	4 items out of 4 (100%)
B.M.C.	2 items out of 4 (50%)	4 items out of 4 (100%)	4 items out of 4 (100%)
C.T.	3 items out of 4 (75%)	4 items out of 4 (100%)	4 item out of 4 (100%)
C.A.	0 items out of 4 (0%)	1 item out of 4 (25%)	3 items out of 4 (75%)
B.D.M.	3 items out of 4 (75%)	3 items out of 4 (75%)	4 items out of 4 (100%)
R.V.E.	2 items out of 4 (50%)	2 items out of 4 (50%)	2 items out of 4 (50%)
B.M.E.	1 item out of 4 (25%)	3 items out of 4 (75%)	3 items out of 4 (75%)
I.C.E.	1 item out of 4 (25%)	2 items out of 4 (50%)	3 items out of 4 (75%)
C.A.	1 item out of 4 (25%)	3 items out of 4 (75%)	3 items out of 4 (75%)

Table 6. The results obtained by the candidates enrolled from Focsani, in Part 6, during the 3 mock tests (December 2024 to February 2025)

Similar to the first group, the data offered useful insights regarding the impact of the language of literary critique upon the manner in which students enrich their vocabulary. In this respect, the first session established that were different struggles, as scores ranged from 33.33% to 83.33%, with most students performing within the 50-66% range. The lowest score was only 2/6 (33.33%), indicating difficulties in comprehension and inference making, in comparison to the highest initial score (83.33%), demonstrating strong analytical skills from the start, therefore, a more skilful manner of exercising their vocabulary knowledge.

In contrast to the first group, there has been a visible improvement registered in the second session, as the following results sustain this particular statement. Most students improved by 1-2 correct answers, with 2 of them reaching perfect scores (6/6, 100%), whereas another 3 improved their accuracy, showing increased confidence in textual analysis. By contrast, one student maintained a 33.33% accuracy, suggesting a constant struggle with comprehension. During the

last session, five students achieved perfect scores 6/6 (100%). The performance of the student who recorded the lowest score initially also improved, from 2/6 (33.33%) to 4/6 (66.67%), showing clear gains in reading comprehension. The overall group average increased significantly, with no student scoring below 66.67%. Most students reached 100% accuracy by the final session, showing that repeated exposure to literary analysis significantly enhanced their ability to interpret book reviews. The structured study approach allowed even mid-range performers to reach high proficiency levels.

Concerning part 6, the first stage had a debut similar to the former part, with scores ranging from 0% to 75%, indicating some students' difficulty in synthesising information from multiple sources. The middle session has come with some changes in progress, with five students achieving perfect scores, 4/4 (100%), demonstrating increased ability to identify thematic connections and compare perspectives. Meanwhile, one of the students who seriously struggled initially improved slightly (from 0% to 25%), showing early signs of progress in handling multiple texts, whilst others improved their accuracy from 25% to 50%, reflecting stronger reading comprehension skills. In the last session, six students have achieved high scores (75%-100%), including the one who initially scored 0%, indicating enhanced textual analysis skills. However, the only student whose score did not exceed 50% encountered some difficulties with comparative analysis.

The sharp increase in scores throughout our observative research indicates that the usage of literary critique significantly enriches analytical and comparative skills. Students who initially had difficulties in reading comprehension struggled showed substantial progress over time, confirming the effectiveness of continued exposure to literary critique. The matching task proved initially more challenging than the multiple-choice section, but students adapted well with guided practice.

In summing up all the observations made so far, the hypothesis stating that "the language of literary critique encountered in the book reviews included in the fifth and sixth parts of the

Reading and Use of English sections of the C1 Advanced English exam has a direct impact upon the students' ability of enriching their vocabulary *"* was confirmed.

5. Conclusions

This research focused upon functions and usage of a particular form of literary critique, the one of book reviews and its involvement in language learning and assessment

This research insisted upon the manner in which digital platforms permit access to critical discourse, allowing young people to engage with analyses acting at a more professional level outside traditional academic spaces. As literary critique bridges the gap between specific groups and the general public, it plays an essential role in developing adolescent literacy by nurturing thoughtful, socially conscious individuals.

This study investigated book reviews as a specialised register through vocabulary research and pattern recognition, focusing on their role in advancing language skills. Register analysis served as the core methodology, studying how variations in style, tone and formality impact the effectiveness of communication in reviews. The research uses a corpus-based approach, drawing on texts from the Cambridge English Advanced exam reading section, more specifically parts 5-6, as primary data, complemented by systematic observation and linguistic analysis.

The study has revealed two vital outcomes, the first acting at the communicative level, in order to prove that exposure to critical registers improves performance on exam tasks involving review analysis; at a more interactive level, reviews create a learning environment which enhances metalinguistic awareness, while enabling students to match terms with contextual meanings while internalizing grammatical and lexical patterns.

These findings highlighted that literary critique's dual role is to act both as an academic subject and a tool for language education. Its structured, yet adaptable nature makes it highly effective in fostering critical thinking and linguistic precision in more academic learning environments.

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The Efficiency of Teamwork in Medical Electronics Laboratories

Bianca-Alexandra Zîrnă[1], Denis Mihailovschi[2]

1. Faculty of Medical Engineering, National University of Science and Technology POLITEHNICA Bucharest, bianca.zirna@upb.ro

2. Faculty of Electronics, Telecommunications and Information Technology, National University of Science and Technology POLITEHNICA Bucharest, denis.mihailovschi@upb.ro

Abstract

With so many teaching strategies available today that enhance students' learning, it might be difficult to decide which one to implement in electronics laboratories at a faculty. Is the most effective method still the straightforward, traditional, team-based work, or are the new methods—flipped classroom, role play, gamification, etc.—suitable for students? Do students perform better working individually or in a team of people that share the same interests? The participants of this study are second-year students who worked either in free-chosen teams of two to three people or in pre

established teams of three to four people in the medical electronics laboratories of the Faculty of Medical Engineering over the course of a year. The goal of this paper is to answer these questions regarding the optimal teaching and learning strategy for university students by using a form with different questions about their perspective on teamwork.

Keywords: Teamwork, University students, Laboratory classes, Close-ended questions form

1. Introduction

These days, most universities emphasize that to fulfil the academic, professional, and personal requirements for a successful career, both hard and soft skills must be taught. Soft skills are interpersonal abilities, often known as an individual's set of social skills and personal features, whereas hard skills are the technical knowledge and abilities necessary for performing a job. Teamwork is one of the most valuable skills that employees can have because collaborative structures are becoming more prevalent in organisations (Rudawska, 2017). It has been shown that teamwork skills are great allies for academic as well as professional environments, helping students feel more balanced and confident (De prada et al., 2024). Since teamwork skills are seen as vital skills in a world that is becoming more dynamic, interconnected, and complex, they have been getting a lot of attention lately. New employees are questioned about their ability to work in a team, address certain problems at work, or possess the necessary abilities to deal with the new difficulties that come with modern society (Prada et al., 2022; Baneres & Conesa, 2017). Employers in Australia, for example, underline that graduates' capacity to work as a team is equally essential as having technical skills required for a specific job. This is why teamwork skills are appearing in a variety of fields in Australia, including engineering and health. According to employers, universities must do more to better train graduates for team-based work (Riebe et al., 2016, 2017).

A key pedagogical strategy that gives students the tools they need to learn and makes them better job candidates is teamwork (Omar & Plumb, 2023). Universities are increasingly incorporating teamwork skills and team-based learning as a teaching method in their curricula, as they are considered essential to success on all levels—personal, academic, and professional (Prada et al., 2022; Angu, 2019). In some fields, such as the healthcare sector, teamwork has emerged as the most effective work method for handling complex health problems and ensuring high-quality patient care (Angu, 2019). Moreover, a substantial connection between extracurricular activities and the development of essential teamwork skills has been demonstrated by studies such as the

one proposed by de Prada Creo et al. (2021), which examined if college students are effectively learning or improving teamwork skills through a range of extracurricular activities, including sports, music, volunteering, international group work experiences, and professional practices.

There are numerous advantages when using a teamwork-based approach with college students. It offers students the opportunity to explore new things and learn skills that they will need in their future careers, such as leadership, negotiation, teamwork, interpersonal communication, group problem-solving, and time management. Also, learning is more profound and relevant when teamwork is used in an active methodology environment. Positive impacts have also been proven on students' motivation, attitudes toward learning, and academic performance. Students have also highlighted some of these benefits, indicating that collaborative projects and active learning techniques are more stimulating, enjoyable, and favourable to learning than traditional teaching (Marin-Garcia & Lloret, 2008).

Even though teamwork has become a crucial skill, as previously noted, many students contest academic assignments that require collaboration. The need to be able to adapt to the many and different personalities of team members is one of these difficulties. It involves organising many activities through solid management and effective communication, as well as constructively responding to various learning attitudes and behaviours. Students who are not used to this method of working may be hesitant or confused in some situations, or they may believe that these activities require a significant amount of their time (Angu, 2019; Marin-Garcia & Lloret, 2008). Other participants may get unsatisfied if one person dominates the conversation because they feel excluded from the deliberations and choices. Other group members may end up performing as free riders and depending too much on the active members as a result, either of their own choice or insecurity in stepping forward (Omar & Plumb, 2023).

The aim of this study is to investigate the importance of teamwork in medical electronics laboratories of the Faculty of Medical Engineering, National University of Science and Technology POLITEHNICA Bucharest in Bucharest, Romania. The main purpose of these

laboratories is for students to improve their practical skills in the field of electronics with medical applications. The focus is on creating and developing circuits, powering them, performing measurements, commanding them through code, etc., with first having a base of theoretical knowledge. In order to be able to find out the answer, we used a form to collect responses from the participants (our second-year students) after one year of medical electronics laboratories, where they work in various team configurations (free-chosen or pre-established teams with two to four members). Besides the scientific and statistical purposes, the outcomes of this study can also help us to better organise the laboratories in the future.

2. Literature Review

Universities all around the world have embraced teamwork as a teaching strategy. According to the Randstad Workmonitor, which examines 34 countries worldwide, Romanian workers, regardless of their generation, are the most capable of interacting with their coworkers (Marica, 2018). Lincă et al. (2023) investigated, using a questionnaire, how Romanian students' demographic characteristics, such as age and education, varied depending on the level of development of their teamwork skills, concluding that as students' chronological age and level of education increased, so did their teamwork skills.

In her study, Rudawska (2017) determined how the teamwork experiences of some Polish master's students have influenced their attitudes toward collaborative work, using questionnaires. It concludes that to promote a positive attitude regarding teamwork, teachers should encourage teamwork projects, and the university should cultivate a collaborative environment. Contrary to the general opinion that Iranians are not particularly interested in teamwork, the results of a survey about teamwork that was given to students in three large Iranian universities showed that Iranian students have moderately positive attitudes toward teamwork, being more concerned with how teamwork is evaluated (Beigi & Shirmohammadi, 2012). According to Angu (2019), the Health Professions Council of South Africa identifies

teamwork as one of the fundamental skills for being prepared for the workforce, and university students, particularly those studying the health sciences, must demonstrate this ability.

The study conducted by Huang (2022), which was based on quantitative survey data obtained from a general chemistry laboratory course, assessed how students' attitudes toward teamwork, willingness to try new things, and problem-solving and collaboration skills changed. By the end of the course, more experienced students had formed negative attitudes toward problem-solving and teamwork, while novice students with a lower starting point for team-based problem-solving reported more learning achievements than more experienced students. Furthermore, it was determined that both novice and experienced learners' team-based problem-solving skills improved with deeper study. Omar & Plumb (2023) focused on teamwork in practical sessions, investigating how teamwork helps students learn, factors which promote student engagement, and the optimal group size. After a teamworking laboratory, students were asked to complete a questionnaire, and after an analysis of the responses, it was determined that the most important aspect of improving team engagement and performance was communication. Student involvement was also found to be greatly influenced by the members' cooperation, communication, and interaction. The activity's complexity and nature decided the optimal group size, as it is also mentioned by Beck et al. (2025). It was concluded that successful teamwork greatly improves student learning and helps them acquire essential skills for employment (Omar & Plumb, 2023).

Ionescu (2007) describes how the teamwork component of the laboratory classes in a third-year unit of the civil engineering degree contributed to the improvement of soft skills. According to the students' survey conducted over a three year period, the practical sessions and teamwork helped them to increase their technical knowledge, and they enhanced their interpersonal and communication skills and became more conscious of their own strengths and weaknesses when working in teams. The method of organized pairing for forming student teams in engineering laboratories for first-year electrical and computer engineering students is explained by Fila &

Loui (2014). This method is adapted from pair programming, which has been shown to increase computer science students' self-confidence, satisfaction, and retention. As a more intriguing and motivating alternative to conventional laboratory teaming techniques, this structured pairing reported noticeably greater confidence in laboratory activities as well as satisfaction with the course and collaborative activities.

3. Materials and Methods

Based on the studies in the literature, we decided to use a form to collect responses from the participants after one year of medical electronics laboratories, where they work in various team configurations.

3.1.Participants

In this study, there were 46 participants; their participation was optional and anonymous. Moreover, there is no other detail about them but the fact that they are second-year students who worked, over a year, either in free-chosen or in pre established teams in the electronics laboratories at the Faculty of Medical Engineering, National University of Science and Technology POLITEHNICA Bucharest, Bucharest, Romania.

3.2. Form

The form consisted of 12 close-ended questions, as is presented in **Table 1**. The close-ended questions were selected because they are brief, require minimal time (Sanchez, 2024), and enable the development of statistics based on the responses received. Two of the questions (Q5 and Q6) had the *Other* option field, where they can freely complete an answer. Moreover, these questions accepted multiple answers, compared to the others that accept only one. For each participant, only one submission was accepted. The form was anonymous, and there was no question regarding personal details about the respondents. No personal data that could identify the respondent was required or saved. There was no time limit for completing the form, and it

was open for several days.

No.	Question	Possible answers (A/B/C/D/E)
Q1	Do you think that teamwork in practical laboratories, such as electronics, is more effective than individual work?	Yes / No
Q2	Do you prefer to work in free-chosen or pre-established teams?	Free-chosen / Pre-established
Q3	How many people are necessary on a team in an electronics laboratory?	2 / 3 / >3
Q4	Do you constantly change teams or keep the same teammate(s) for the whole year?	Change / Keep
Q5	What criteria do you apply when choosing your teammate(s)?	Friendship / Knowledge / Common interests / Other
Q6	What factors, in your opinion, help a team in an electronics laboratory develop an effective collaboration?	Friendship / Interest in the subject / Good communication / Equal effort / Other
Q7	Does a conflict that takes place outside of the faculty affect the laboratory team's work?	Yes / No
Q8	Do you prepare for exams individually or in a team?	Individually / In a team / It depends on the exam
Q9	Do you think you learnt something from your teammate(s) as a result of working together?	Yes / No
Q10	When you were required to work in a certain team, did you get along with your teammate(s) and adapt to the team?	Yes / No
Q11	When you were required to work in a certain team, did you build a friendship with your teammate(s)?	Yes / No
Q12	Do you consider keeping the teams that have been formed in the electronics laboratories for the upcoming laboratories?	Yes / No

Table 1. Questions and possible answers that have

been used in the form

4. Results

The form was completed by 46 participants (all of them being second-year students from the same faculty, as mentioned above); the mean submitting time was 2:29 min. The results are centralised in **Table 2**. For questions that accept multiple answers (Q5 and Q6), the percentages expressed represent the total number of choices of that answer.

No.	Possible answers				
	A	**B**	**C**	**D**	**E**
Q1	87%	13%	-	-	-
Q2	98%	2%	-	-	-
Q3	48%	48%	4%	-	-
Q4	2%	98%	-	-	-
Q5	83%	57%	54%	2%	-
Q6	57%	59%	96%	87%	0%
Q7	46%	54%	-	-	-
Q8	33%	15%	52%	-	-
Q9	89%	11%	-	-	-
Q10	74%	26%	-	-	-
Q11	57%	43%	-	-	-
Q12	83%	17%	-	-	-

Table 2. Results after completing the form

For better visualization and interpretation, the results are graphically displayed in **Figure 1**. As it can be seen, in some cases most of the participants chose the same answers. This control of the outcomes and the possibility of performing statistical tests and graphics represent advantages of

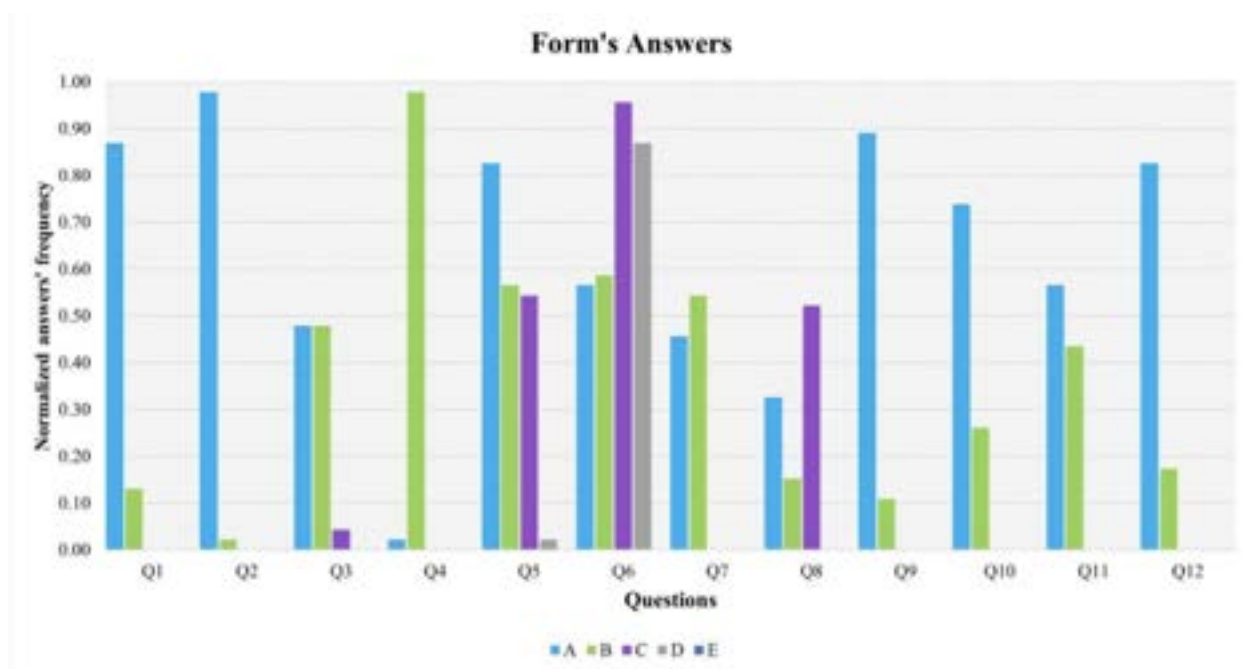using close-ended questions in the form given to the participants.

Figure 1. The graphical display of the form's answers

Most of the participants (87%) consider that teamwork in practical laboratories, such as electronics, is more efficient than individual work, and 84% of them want to keep the same teams as in the medical electronics laboratories. Only 2% of the participants prefer to work in a pre-established team rather than in a free-chosen one and consider they got along with their partners and adapted to the team, even built a friendship, and they had something to learn from their partners. However, they do not consider keeping the teams that have been formed in the electronics laboratory for the upcoming ones. Most of the participants (98%) confirm that, in general, they prefer to keep their teams rather than constantly changing them, but only 87% of them want to keep these particular teams. The opinions are equally divided when it comes to the optimal number of teammates (two or three); only 4% of the participants have chosen more than

three people in a group.

The most important criterion applied when choosing a teammate is friendship (83%), followed, almost equally, by knowledge (57%) and common interests (54%); 1% chose "Other". Moreover, friendship was the only criterion for approximately 20% of the participants. However, the factors that help a team in an electronics laboratory to develop an effective collaboration are good communication (96%) and equal effort (87%), then followed by interest in the subject (59%) and friendship (57%). A conflict that takes place outside of the faculty might almost equally affect the laboratory team's work (46%) or not (54%). More than half of the participants (52%) say that, when it comes to preparing for an exam, it depends on the exam if they choose to learn individually or in a team, while 33% of them prefer to learn individually no matter the exam, and only 15% choose to learn in groups.

As a result of working together, 89% of the participants agree they had something to learn from their teammate(s). When they were required to work in a pre-established team, 74% of them managed to get along with their teammates and adapted to the teams, but only 57% managed to build a friendship.

5. Conclusions

Based on these results, we can conclude that teamwork is more efficient than individual work when it comes to medical electronics laboratories. For a good, long-term collaboration, the students should be able to decide their own team members and also the number of members (which came to be two or three). Even though friendship is the most common criterion applied when forming a team, the factors that help a team to develop an effective collaboration are good communication and equal effort. A conflict that takes place outside of the faculty is likely to affect the team. However, when talking about an exam, 15% choose to learn in groups, and half of them say that it depends on the exam. Since 89% of the participants agree they had something to learn from their teammate(s), the teamwork has proven to be beneficial. Even though most of

the participants preferred to work in free-chosen groups, 74% of them managed to get along with their teammates and adapted to the pre-established teams, and 57% of them even managed to build a friendship.

Due to the database's reduced dimensions, this study also had a few limitations. In order to determine if teamwork can represent a general solution for university laboratories or if there are distinct criteria and outcomes in other laboratories, we intend on including more participants in our future research, as well as students from various laboratories. Analysing an entire generation of students from their first to their last year to determine if their skills have improved over the four years of faculty is another future objective.

The main benefit of this type of study is that the outcomes can help us, and teachers in general, to better organise the laboratories, based on students' opinions. We consider that these kinds of surveys should be constantly conducted during an academic year or after a semester because this way, the teaching methods could be improved or modified in real-time according to that generation's opinions and preferences.

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Exploring Risk Factors of Early School Leaving in the Republic of Moldova

Mariana Crîşmaru

Academy of Economic Studies of Moldova, National Institute for Economic Research

crismaru.mariana@ase.md / mariana.crismaru@yahoo.com, ORCID

Abstract

This study explores the determinants of early school leaving in the Republic of Moldova, with a focus on individual-level and contextual risk factors that shape young people's educational trajectories. Based on data from the 2020 Generations and Gender Survey and using binary logistic regression, the analysis identifies key predictors associated with increased likelihood of educational discontinuation among youth.

The results highlight the significant impact of parental education, with youth whose parents have completed only lower secondary education being more likely to leave school early. Rural residence also emerges as a strong predictor, reflecting disparities in access to educational and transport infrastructure, as well as broader socio-economic disadvantages in non-urban areas. Gender differences are evident, with boys more likely to disengage from education, pointing to the influence of gendered socialization patterns. Additionally, early parenthood (before the age of 19) and growing up in larger families (three or more children) are significantly associated with higher odds of early school leaving. These findings emphasize the need for targeted, inclusive, and context-sensitive educational policies that address both structural inequalities and individual-level vulnerabilities.

Keywords: education, early school leavers, logistic regression, determinants.

JEL Classification: I21, I24, J13.

1. Introduction

Education is widely recognized as a key driver of social integration, economic development, and individual well-being. Beyond its role in transmitting knowledge and skills, it fosters the development of human capital and promotes social mobility. In this context, the quality and accessibility of education are critical determinants not only of individual life trajectories, but also of a nation's competitiveness at regional and global levels (Baciu, 2014). Education also functions as a key mechanism for reducing social inequality by promoting equal opportunities and mitigating intergenerational disadvantage (Lauder et al., 2006). However, early school leaving constitutes a major disruption in educational trajectories, significantly limiting the education system's capacity to act as a driver of social integration and human capital development.

Early school leaving (ESL) is commonly defined as the situation in which young people aged 18 to 24 have attained at most lower secondary education, corresponding to level 2 or below of the International Standard Classification of Education (ISCED), and are no longer enrolled in any formal education or training (European Commission, 2013). This operational definition is also used in the Republic of Moldova across national statistical reporting (National Bureau of Statistics, 2024), strategic education policy documents (Guvernul Republicii Moldova, 2023), and international monitoring frameworks (ETF, 2020). ESL reflects the premature disengagement of young people from the education system, occurring prior to the acquisition of qualifications and competencies required for effective labor market integration or continued educational participation.

The socioeconomic context, demographic shifts, and evolving education policies have exerted a significant influence on the education system in the Republic of Moldova. While there has been a

measurable increase in educational attainment among the youth population, ESL continues to represent a persistent structural issue. This paper investigates the determinants of ELS in the Republic of Moldova, with particular attention to individual characteristics and some contextual factors that influence young people's educational trajectories. By identifying and analyzing the key risk factors associated with school disengagement, the study aims to generate a more nuanced understanding of the mechanisms that hinder educational attainment and contribute to the reproduction of social inequality.

2. Literature Review

Early school leaving is a multidimensional phenomenon influenced by a combination of individual, social, and institutional factors, widely studied in both academic and policy contexts. These include poor academic performance, low motivation, socio-economic disadvantage, low parental education, grade repetition, school segregation, and weak career guidance. Its long-term consequences include increased unemployment, social exclusion, and reduced access to services (European Commission/EACEA/Eurydice/Cedefop, 2014).

Recent EU-level research reinforces that ESL results from the interplay between individual, institutional, and national contextual factors. Socio-economic disadvantage, low parental education, minority background, rural residence, and weak support systems remain key risk factors across Member States. Institutional variables, such as poor teacher-student interaction, grade repetition, and lack of career guidance, further amplify dropout risk (van der Graaf et al., 2019).

Studies on Romania reveal that ESL is strongly associated with a cluster of micro-level risk factors, including gender (male), ethnicity (especially Roma), absenteeism, academic underachievement, low school motivation, deviant behavior, and negative attitudes toward education. Children with special educational needs or disabilities are particularly vulnerable, as are those involved in early marriage, household labor, or caregiving roles. Family-related factors

such as low socio-economic status, low parental education, poor parental involvement, and family instability (e.g., divorce, migration, or unemployment) further increase the risk. The presence of school dropout or early school leaving models within the family also plays a significant role in shaping children's educational trajectories (Alexa & Baciu, 2021).

National reports concerning the Republic of Moldova show that ESL rate has remained persistently high over recent decades, averaging approximately 21%, with a moderate decline to 17.5% in 2023 (National Bureau of Statistics, 2024). Despite this downward trajectory, the national ESL rate continues to exceed the 2023 EU average of 9.5% (Eurostat, 2024). Pronounced disparities are observed by area of residence and gender, with higher rates in rural areas and among boys. According to the European Training Foundation (2020), Moldova faces broader systemic challenges in the education sector, including a sharp decline in student enrolment, intensive youth migration, and a relatively static educational infrastructure. In rural areas, in particular, the network of educational institutions no longer corresponds to the actual distribution of the school-age population, reflecting inefficiencies in resource allocation and accessibility constraints.

A secondary analysis of the 2014–2015 School-to-Work Transition Survey data revealed that ESL remains a persistent phenomenon in the Republic of Moldova, with 21–22% of youth aged 18–24 having left the education system prematurely. These individuals as a rule possess no more than lower secondary education and are not engaged in any formal or non-formal training. The main self-reported reasons for leaving school include economic hardship (20%), lack of interest in school (15%), desire to work (10.7%), and learning difficulties (10%). Regression analysis identified significant predictors of early school leaving, including rural residence, self-perceived poor household economic status, and low parental education levels. The probability of remaining at a low educational level increases with age, particularly for youth from socio-economically disadvantaged backgrounds (Gagauz, Buciuceanu-Vrabie, & Pahomii, 2017).

Empirical evidence from national research indicates also that early school leaving is a key predictor of NEET status among young people in the Republic of Moldova. A significant share of those not in employment, education, or training are former early school leavers who possess only lower levels of education and lack professional qualifications (Gagauz & Crîşmaru, 2024). This limited educational attainment substantially reduces their chances of integration into the formal labor market and increases their exposure to informal employment and long-term economic vulnerability. The likelihood of remaining outside education or training rises with age, reinforcing patterns of marginalization and perpetuating socio-economic disadvantage throughout the life course (Crîşmaru, Gagauz, & Buciuceanu-Vrabie, 2018).

Thus, in the context of the Republic of Moldova, ESL is not only widespread but also strongly associated with socio-economic vulnerability, limited access to educational and employment opportunities, and heightened risk of becoming NEET. While previous research has identified key risk factors and structural disparities, further empirical investigation is needed to deepen the understanding of how these variables interact and to identify the most vulnerable youth profiles.

3. Data and Methods

This study aims to examine the determinants of early school leaving in the Republic of Moldova, with a specific focus on identifying individual-level and some contextual risk factors that influence young people's educational trajectories. It draws on data from the Generations and Gender Survey (GGS, 2020), conducted in the Republic of Moldova on a probabilistic sample, which included 202 Primary Sampling Units and 19,948 households. The survey is nationally representative (excluding the Transnistrian region) and allows for disaggregation by area of residence (urban and rural) and development regions (North, Centre, South, and Chişinău municipality). The GGS dataset provides a robust empirical basis for the analysis of early school leavers, enabling the examination of a wide range of individual-level socio-economic characteristics, as well as contextual factors related to the social and family environment. The

analysis relies on weighted data adjusted for age and sex, ensuring the statistical representativeness of the sample and the validity of inferences regarding early school leaving in the Republic of Moldova.

Two groups of early school leavers were delineated for the purpose of the analysis: individuals aged 18–24 (n = 325) and, as a control group, individuals aged 25–35 (n = 1128). Both groups include only those who have completed at most lower secondary education and who are not currently enrolled in any form of education or vocational training.

To identify the factors that increase the likelihood of belonging to either group of early school leavers, binary logistic regression was employed. This method models the relationship between multiple independent variables and a dichotomous dependent variable. The model included socio-demographic (sex, age, marriage, parenthood, educational attainment), and social and family-related predictors relevant to the young population (place of residence, household composition, and parental education). The regression was estimated using the Enter method, which involves entering all selected predictor variables into the model simultaneously. This approach allows for assessing the independent contribution of each variable while controlling for the effects of the others, ensuring a comprehensive analysis of the factors influencing early school leaving in both age cohorts.

4. Results

Binary logistic regression models were applied to identify the individual and contextual determinants associated with early school leaving among two distinct age cohorts: individuals aged 18–24 and, as a reference group, those aged 25–35. Both groups include individuals with no more than lower secondary education who were not enrolled in any form of education or vocational training at the time of the survey. The inclusion of the 25–35 age group as a reference cohort is based on the assumption that, by the age of 25, the vast majority of young people have exited the education system. As such, this group allows for a more stable and complete

assessment of educational attainment and related outcomes. It offers an analytical baseline for examining the long-term effects of early school leaving and for identifying the structural and individual-level factors that contribute to sustained low levels of education. The comparison between the two age groups thus facilitates a better understanding of the persistence and evolution of educational disadvantage over time.

The results for the 18–24 age group (n = 325) indicate that rural residence is one of the most significant predictors, with individuals living in rural areas being nearly three times more likely to leave school early compared to those residing in urban settings (OR = 2.921; $p < .001$). Another strong predictor is early marriage, with those who married between the ages of 15 and 19 having over four times higher odds of early school leaving than those who married later (OR = 4.342; $p < .001$). Family size also appears to play a role; respondents with more than two siblings show a significantly lower likelihood of school retention (OR = 0.586; $p < .05$), possibly reflecting constraints on household resources or limited parental support. Other variables, such as parental education, early parenthood, and sex, did not reach statistical significance in this younger cohort, although the father's level of education approached the significance threshold (**Table 1**).

	Exp(B)	Sig.	IC 95%
Sex (ref.=female)	.837	.518	.488 - 1.435
Area of residence (ref.= urban)	2.921	.000***	1.650 - 5.170
Father completed only lower secondary education (ref.=upper secondary or higher)	1.633	.071	.959-2.781
Mother completed only lower secondary education (ref.=upper secondary or higher)	1.405	.219	.817 - 2.417
First marriage at age 15–19 (ref.= ≥20)	4.342	.000***	2.489- 7.574
First parenthood at age 15–19 (ref.= ≥20)	.836	.558	.459 - 1.522
Number of siblings (ref. = ≤2)	.586	.022*	.371 -.927
Number of observation = 325			

*Table includes only statistically significant predictors (p < 0.05) from the full model.
The initial model included a broader set of individual-level covariates.
All variables are binary; reference categories are indicated in parentheses. Exp(B) represents the odds ratio.
*** p < 0,001; ** p < 0,01; * p < 0,05
Source: Generation and Gender Survey (GGS), 2020.

Table 1. Key predictors of early school leaving, 18-24 years (logistic regression model) *

In contrast, the model for the 25–35 age group (n = 1128) identifies a broader and more robust set of statistically significant predictors. Male respondents are significantly more likely to be early school leavers than their female counterparts (OR = 1.833; p < .001), indicating a persistent gender gap. Rural origin remains a powerful risk factor (OR = 2.053; p < .001), consistent with the findings observed in the younger group. Additionally, both father's and mother's lower levels of education are strongly associated with an increased likelihood of early school leaving (OR = 1.994 and OR = 2.258, respectively; p < .001), underlining the intergenerational transmission of educational disadvantage. Early parenthood also plays a significant role, with those becoming parents before the age of 20 having substantially higher odds of early school leaving (OR = 1.797; p < .01). In this older cohort, family size also functions as a risk factor: respondents with more than two siblings are more likely to have discontinued their education prematurely (OR = 1.637; p < .001). Unlike in the younger group, early marriage is not a statistically significant predictor among respondents aged 25–35, which may be explained by the greater variability in life trajectories and compensatory mechanisms that occur over time (**Table 2**).

	Exp(B)	Sig.	IC 95%
Sex (ref.=female)	1.833	.000***	1.456 - 2.308
Area of residence (ref.= urban)	2.053	.000***	1.638 - 2.575
Father completed only lower secondary education (ref.=upper secondary or higher)	1.994	.000***	1.565 - 2.541
Mother completed only lower secondary education (ref.=upper secondary or higher)	2.258	.000***	1.773 - 2.877

First marriage at age 15–19 (ref.= ≥20)	.921	.623	.663 - 1.279
First parenthood at age 15–19 (ref.= ≥20)	1.797	.001**	1.267- 2.548
Number of siblings (ref. = ≤2)	1.637	.000***	1.314 -2.040
Number of observations = 1128			
*Table includes only statistically significant predictors (p < 0.05) from the full model. The initial model included a broader set of individual-level covariates. All variables are binary; reference categories are indicated in parentheses. Exp(B) represents the odds ratio. *** p < 0,001; ** p < 0,01; * p < 0,05 Source: Generation and Gender Survey (GGS), 2020.			

Table 2. Key predictors of early school leaving, 25-35 years (logistic regression model) *

5. Discussions

The results of this study, along with the comparative analysis of the two age cohorts, reveal both converging and diverging patterns in the predictors of early school leaving. Rural residence consistently emerges as a significant determinant in both age groups, underscoring persistent spatial inequalities in access to education. However, other factors, such as parental education and early parenthood, exert a stronger and more statistically robust influence among individuals aged 25–35, suggesting a cumulative effect whereby early disadvantages consolidate into long-term educational outcomes. The fact that sex is a significant predictor only in the older cohort may indicate that gender-based vulnerabilities become more pronounced or entrenched over time. Furthermore, the number of siblings demonstrates a contrasting effect across the two groups: while it appears as a protective factor in the 18–24 age group, it acts as a risk factor in the 25–35 cohort, potentially reflecting shifts in household dynamics and resource allocation across the life course.

These findings support the broader argument that increasing access to education alone does not eliminate structural inequalities. The family environment remains a key determinant of young people's educational trajectories, shaping their opportunities and constraints in line with

socio-economic status. Concepts such as *stratified socialization*, *stratified agency*, and *stratified opportunities* illustrate how values, decision-making capacities, and access to resources are distributed unequally across social groups. Families not only transmit educational aspirations but also mediate access to key resources, such as quality schooling, health services, and social capital, which collectively shape life chances and reinforce existing disparities (Billari, Hiekel, & Liefbroer, 2019).

Place of residence further amplifies these patterns of inequality. Early school leaving is significantly more prevalent among youth in rural areas, where access to educational and transport infrastructure remains limited. Additionally, rural communities are often characterized by lower levels of adult educational attainment, which reduces the availability of learning support within the household and perpetuates intergenerational educational disadvantage (Crîșmaru, Gagauz, & Buciuceanu-Vrabie, 2018).

The study also reaffirms the existence of gender disparities, particularly among older youth. Males are significantly more likely to leave school early, a finding that may be explained by gender-specific socialization processes and prevailing attitudes toward education and work. Early parenthood, especially childbirth before the age of 19, emerges as a strong predictor of educational discontinuity, likely due to the increased caregiving responsibilities and reduced institutional support. Finally, young people from large families (three or more children) are more likely to attain only low levels of education, possibly due to limited household resources and lower parental investment per child.

However, this study has certain limitations, as it does not account for broader structural and institutional factors that may influence early school leaving. For example, previous research based on qualitative data has shown that the perceived lack of employment prospects following graduation can discourage young people from continuing their education, contributing to educational disengagement and long-term disadvantage (Crîșmaru, Gagauz, & Buciuceanu-Vrabie, 2018). Thus, beyond family-related and residential factors, labor market conditions play a significant role in shaping young people's decisions to pursue further education

or vocational training. Depending on the broader economic context, the labor market can act either as an incentive or a disincentive for continued educational engagement. Large-scale analyses across OECD regions further demonstrate that ESL is closely linked to regional labor market dynamics. A higher availability of low-skilled employment opportunities often serves as a pull factor, drawing young people out of education prematurely. In contrast, policies such as delayed vocational tracking, early access to pre-primary education, and sustained investment in teacher training are consistently associated with lower dropout rates (Bonnet & Murtin, 2024).

Furthermore, numerous studies emphasize that reducing ESL requires more than general investment in education. Instead, the effectiveness of national responses depends on the implementation of coherent, evidence-based policies that integrate prevention, early intervention, and reintegration strategies (European Commission/EACEA/Eurydice/Cedefop, 2014; van der Graaf et al., 2019). Research also shows that strong welfare systems, inclusive education policies, and coordinated support services are essential for improving outcomes, particularly among vulnerable groups such as rural youth, low-income families, and early parents (Anghel, Voicu, & Neacșa, 2023).

6. Conclusions

This study reaffirms the central role of educational trajectories in shaping key life-course events such as marriage, parenthood, and labor market integration. The level of education attained by young people is strongly correlated with their socio-professional status, with family background emerging as a critical determinant of educational outcomes. A lack of social and economic capital within the family environment negatively affects both school participation and long-term social mobility. Young individuals from materially disadvantaged households, particularly those with low-educated parents, are significantly more likely to leave school early, reinforcing the intergenerational cycle of poverty and social exclusion.

The findings also underscore the significance of spatial and contextual factors. The degree of urbanization and local economic development substantially influence access to education, employment, and public services. The disproportionate concentration of early school leavers and inactive NEET youth in rural areas reflects a concerning trend toward the "ruralization" of educational disadvantage and a growing territorial polarization in youth opportunities.

Nevertheless, certain limitations of the present study must be acknowledged. While the analysis focuses on individual and family-level predictors, it does not fully capture the broader institutional, structural, and labor market dynamics that influence educational outcomes. In Moldova, the situation is particularly complex, shaped by high rates of youth migration, persistent economic instability, and limited employment prospects—factors that may discourage educational engagement and require further investigation.

However, to address early school leaving and its root causes effectively, education and training systems must become more preventive, inclusive, and responsive to the diverse needs of youth. This calls for a deeper understanding of the skills required for a successful transition to adulthood, and for ensuring equitable access to learning and professional development pathways. Education and employment institutions must recognize and support the aspirations, needs, and capabilities of all young people, particularly those facing structural disadvantage.

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The Contribution of Early Childhood Education Services in Supporting the Balance Between Work and Family Life

Chistruga-Sînchevici Inga

Academy of Economic Studies of Moldova

chistruga_sinchevici.inga@ase.md, ORCID

Abstract

Parents' balancing act between work and life presents a major challenge, especially for those with young children. One of the most significant obstacles they face is finding trustworthy and affordable help. The importance of childcare services for working parents cannot be overstated, as these services provide parents with the flexibility and time needed to continue their careers, while also ensuring the well-being and development of their children.

This article explores the contribution of early childhood education services in supporting the work-life balance and highlights the essential benefits they offer. Additionally, it emphasizes how these services generate flexibility for parents, reduce stress, and facilitate the integration of professional and family responsibilities. Public policies and adequate funding for early childhood education are also analyzed as vital for promoting a more balanced future for families. The findings underscore the necessity for authorities to focus more on structural changes and the development of accessible early childhood education and care services, as well as expanding these services both in rural and urban areas. The article concludes with case studies and concrete examples of best practices, illustrating the importance of early childhood education within the context of work-family balance.

Keywords: child, parent, work-family balance, preschool education services.

1. Introduction

Shifts in the labor market and family structures create a context where parents increasingly struggle to develop successful strategies for integrating professional and familial responsibilities. Early childhood education services play a crucial role in supporting work-life balance, offering multifaceted benefits for children, parents, employers, and society. These services enable parents to pursue their professional careers without compromising their children's development and well-being.

In the current context, where career pressures are increasingly intertwined with personal life, access to nurseries, kindergartens, and other forms of childcare for young children becomes an essential precondition for parental labor market participation without undermining family life quality and children's harmonious development.

2. Literature Review

Scientific literature indicates that work-family conflict involves a series of complex consequences reflected across four dimensions: the professional sphere, the familial domain, physical and mental health, and the socioeconomic realm (Chistruga-Sînchevici, 2021). Work-family balance is essential to support women's dual roles, particularly in attending to their children's development and education during the early years and maintaining the quality of their professional activities (Hijriyani et. all., 2022). It's also noted that a working mother who fails to balance family and work will exhibit poor parenting skills, which will negatively influence child development (Handayani & Munawar, 2015).

Some studies highlight the issue of the "motherhood penalty" due to difficulties in reconciling family life with professional life (Daviesa & Gae¨lle, 2005), considering that women returning from maternity leave may face lower pay and reduced opportunities for career advancement. As

such, developing childcare services for children aged 0–2 and 3–6 years, alongside the introduction of extended paid parental leave (for up to two years), contributes to reducing the "motherhood penalty" (Budig et. all., 2016).

Therefore, policies promoting high-quality childcare services with flexible hours and affordable costs not only encourage mothers to work full-time but can also ensure a higher level of satisfaction in managing family responsibilities, thus having positive effects on both the labor market and other areas (Arpino & Luppi, 2020). The availability of Early Childhood Education and Care services improves the perception of achieving work-life balance (Matei et. all., 2024).

3. Some Aspects of the Labor Market in the Republic of Moldova

Analysis of employment rate data for the Republic of Moldova and other European countries in 2024, for the population aged 15-64, reveals that the Republic of Moldova has an employment rate of 52.3%, the lowest among all analyzed countries (**Table 1**). This indicates a relatively underdeveloped labor market with a significantly lower level compared to the European average. Countries with the highest employment rates are Iceland (85.3%), the Czech Republic (75.4%), Estonia (75.7%), and Poland (72.5%). These states are characterized by active labor markets with high rates for both men and women. In some countries with high employment rates, such as Iceland, Estonia, and the Czech Republic, there is also a high level of access to preschool education services. This facilitates parents, especially mothers, to successfully combine work and childcare, thereby supporting their flexibility and participation in the labor market. In most countries, men have higher employment rates than women, reflecting persistent gender inequalities in the labor market, with the exception of Finland and Sweden, where the differences are smaller.

	Total	Masculine	Feminine
Republic of Moldova	52,3	53,7	51,1
Austria	74,1	77,5	70,7
Belgium	66,8	70,2	63,3
Czechia	75,4	81,2	69,5
Estonia	75,7	76,2	75,2
Finland	72,6	72,8	72,4
France	69	71,7	66,7
Germany	77,4	80,8	74
Greece	63,3	72	54,7
Hungary	75,1	78,7	71,4
Iceland	85,3	88,1	82,3
Italy	62,2	71,1	53,3
Poland	72,5	77,9	67,2
Portugal	72,8	75,4	70,4
Spain	66,1	70,6	61,6
Sweden	76,7	78,1	75,2

Table 1. Employment Rate in the Republic of Moldova and Other European Countries in 2024 Among the

Population Aged 15-64

Source: National Bureau of Statistics of the Republic of Moldova, www.statistica.md; OECD,

https://data-explorer.oecd.org

The Labor Force Survey conducted by the National Bureau of Statistics reveals that the total employment rate in the Republic of Moldova has steadily increased from 47.6% in 2015 to 60.6% in 2023 for the population aged 20-49 years. This positive trend is observed for both men and women, increasing from 46.8% to 62.5% and from 48.4% to 58.8%, respectively, indicating a general improvement in the labor market integration of young adults. However, the presence of preschool children (0-6 years) contributes to a greater engagement of fathers in the labor force and, conversely, "removes" mothers from the labor market (**Table 2**). Thus, pregnancy, childbirth, breastfeeding, and childcare are difficult to reconcile with work responsibilities.

Data for the years 2015, 2020, and 2023 demonstrate that the existence of a preschool child in the family significantly influences the position of men and women in the labor market.

Individuals without young children have a considerably higher employment rate compared to those with at least one preschool child. For example, in 2023, the employment rate among women without preschool children is 69.4%, in contrast to women with young children, who have an employment rate of only 44.9%, indicating a significant impact of motherhood on their labor market participation.

This marked difference suggests that women face real obstacles in maintaining or resuming professional activity after childbirth, unlike men, who are not only not negatively affected by the presence of young children but even appear to be more professionally active under these conditions. In 2023, men with preschool children have an employment rate of 65.5%, compared to 60.6% for those without children.

This situation is largely explained by the withdrawal of women from the workforce due to the lack of available facilities for young children. The availability of public childcare options is a necessary prerequisite for freeing up mothers' time to engage in paid employment. If they remain confined to family care obligations, they forgo an important source of income and self-fulfillment. In the absence of sufficient solutions, women choose to leave the labor market after childbirth for a longer period than to face working conditions that do not allow them to balance their professional and family responsibilities. Children of this age require more care compared to older children, who are more independent and spend most of the day at school. Therefore, the presence of a preschool child imposes higher costs in terms of the mothers' available time (Chistruga-Sînchevici, 2021).

At the same time, the increase in employed women with at least one preschool child from 2015 to 2023 by approximately 7% may also be due to changes in the provision of allowances and childcare leave. Until 2019, there was only one option – granting the allowance up to 3 years at 30% of the calculation base. Currently, the following options are offered: a) until the child reaches the age of 3 years; b) for a period of 24 months; c) for a period of 12 months. According to Government Decision No. 1478 on allowances granted to families with children, in the case of

the option up to the age of 3 years, the amount of the monthly allowance for raising the child constitutes 30% of the calculation base. In the case of the option for a period of 24 months, the amount of the monthly allowance for raising the child is 60% of the calculation base for the first 12 months and 30% for the next 12 months. In the case of the option "for a period of 12 months", the amount of the monthly allowance for raising the child constitutes 90% of the calculation base. These adjustments were made specifically to stimulate women's participation in the labor market and to limit the period of absence on childcare leave.

	2015			2020			2023		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
Total	47,6	46,8	48,4	51,2	54,9	47,7	60,6	62,5	58,8
Individuals without a Preschool-Aged Child	48,2	42,9	54	53,2	50,7	55,8	65	60,6	69,4
Individuals with at Least One Preschool-Aged Child	46,3	56,1	38,1	47,8	63,3	35,8	54	65,5	44,9

Table 2. Employment Rate of the Population Aged 20-49 in 2015, 2020, and 2023 Based on the Presence of Preschool-Aged Children (in %)

Source: National Bureau of Statistics of the Republic of Moldova, www.statistica.md.

4. The Contribution of Early Childhood Education (ECE) Services in Supporting Parents in Managing the Work-Life Balance

Early childhood education services are a key element in promoting a balance between professional and family life, constituting a fundamental objective in underpinning public policies dedicated to the family. The implications of these services are multifaceted and complex, specifically:

- They facilitate parental labor force participation. Early education services assume a portion of childcare responsibilities, enabling parents to allocate time more efficiently between work and

family, which leads to better organization of daily life. The absence of these services is associated with decreased employment rates and increased difficulties in reconciling the two spheres.

- They promote the participation and retention of women in the labor market. Access to affordable and high-quality childcare and early education services allows mothers to return to work or maintain their jobs after childbirth.

- They reduce gender disparities because care responsibilities no longer fall exclusively on women. Therefore, full participation of women in the labor market supports family economic stability and reduces the risk of social exclusion.

- They support work-family balance by offering concrete support to professionally active parents. An efficient system of early education services constitutes an indispensable resource for working parents, providing them with the assurance that, during working hours, their children benefit from adequate care, supervision, and educational stimulation. The balance between work and family life thus becomes easier to manage, allowing parents to better focus on professional tasks, reducing stress and anxiety associated with childcare during the workday.

- They bring economic benefits for employers by contributing to increased employee retention, productivity, reduced costs associated with personnel turnover because parents can work with less worry about the safety and well-being of their children.

- Reduction of work-family conflict and family-work conflict by providing a safe, organized, and educational environment for children during the parents' work schedule, which reduces stress and pressure on them and diminishes the conflicts generated by simultaneously managing family and professional responsibilities.

- Early education services are a stimulating environment, tailored to the learning and development needs of children. Early participation in education has positive long-term effects on socio-emotional development, health, and socio-economic integration.

- They improve the psychological state of parents and consequently have a greater motivation to work because they trust that their children are cared for in a safe environment.

- Strengthening bonds between parents and children. When parents are less stressed by the pressure of juggling career and childcare, they can be more emotionally present and more involved in the moments spent together with their children.

The aspects presented above reveal that investment in such services brings long-term benefits for families, employers, and society as a whole.

Although essential for child development, preschool education services can sometimes contribute to an imbalance in the professional and family lives of parents, especially in contexts marked by structural deficiencies and limited resources. **In this context, the main factors that accentuate this problem are:**

- **Limited availability of places in preschool institutions**. In Chisinau, in certain sectors, demand exceeds the number of available places. This access crisis forces parents to choose between reducing their work schedule, seeking help from relatives, or resorting to expensive private services. In 2024, 72 children were assigned to 100 places in early education institutions nationwide. In Chisinau, the ratio is 99 to 100, but in certain sectors of the city, this ratio is even higher, which contributes to parents enrolling their children in kindergartens far from home.

- **Insufficient educational infrastructure for children under 3 years old, namely the reduced number of available nurseries**. Despite the undeniable importance of early childhood education services, access to quality services remains limited for many families. This significant deficit of places in public nurseries creates enormous pressure on young families, who are forced to find alternatives, often costly or suboptimal. Overcoming this challenge requires a concerted effort from authorities, communities, and the private sector to develop and implement innovative and accessible solutions that meet the real needs of families. The availability and accessibility of services are key factors supporting the integration of parents into the workforce.

Analysis of data on the proportion of children enrolled in pre-primary education (up to 3 years) and preschool education (3 years and over) in 2024 highlights the fact that the percentage of children up to 3 years old included in the early education system remains very low. Nationally, only 12.7% of children in this age group are enrolled in forms of pre-primary education, indicating an extremely modest coverage for this crucial stage of child development, and in Chisinau, where the enrollment rate is higher, this share is only 10.1%.

	Total	Chisinau Municipality	North	Center	South	UTA Găgăuzia
up to 3 years old	12,7	10,1	14,1	13,4	14,6	13,7
3 years and over	87,3	89,9	85,9	86,6	85,4	86,3

Table 3. Share of Children Enrolled in Pre-Primary Education (Up to 3 Years) and Preschool Education (3 Years and Over), by Region, in 2024

Source: National Bureau of Statistics of the Republic of Moldova, www.statistica.md.

- **The schedule of preschool educational institutions does not align with the work schedules of parents** working in shifts in sectors such as healthcare, commerce, industry, or other branches of the economy. This reality is particularly challenging for many parents with full-time employment. Parents working night shifts or with extended schedules face difficulties in finding care services that meet their needs, which amplifies the conflict between professional and parental responsibilities. The inability to synchronize the professional schedule with that of kindergartens or nurseries often leads to tense situations and the need to find improvised solutions, which can affect both job performance and the relationship with the child.

- **The high cost of private alternatives**. The lack of qualified nannies or the exorbitant prices of private nurseries are other reasons why many parents are forced to stay at home with their children until they reach the age of three. For families with medium or low incomes, private

childcare options often remain financially inaccessible, dramatically reducing the possibilities of reconciling professional life with personal life.
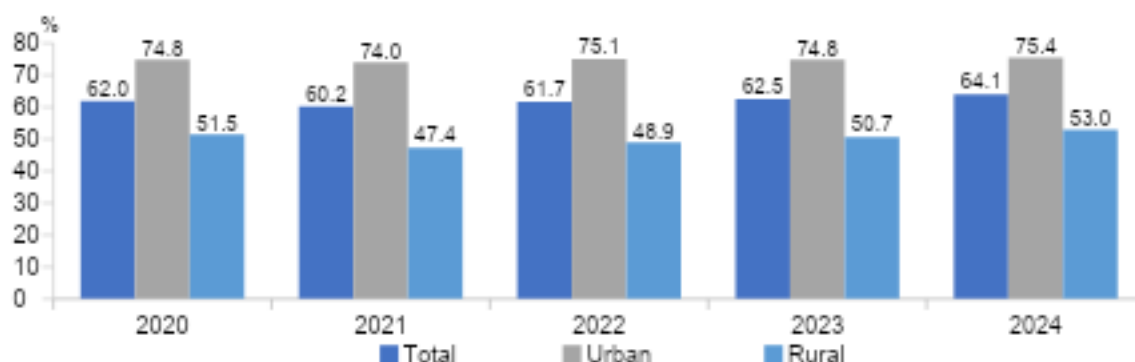

Figure 1. Share of Teaching Staff with Higher Education in Early Education Institutions, by Place of Residence

Source: National Bureau of Statistics of the Republic of Moldova, www.statistica.md.

- **Problems related to the functioning of preschool educational institutions – overcrowding, staff shortages, low levels of staff qualification/training, etc**. These problems make it difficult for children to adapt to these institutions. In early education institutions in the Republic of Moldova, the share of teaching staff with higher education is relatively low, especially in rural areas. This indicates a significant discrepancy between the quality standards of educational services and the academic training level of the staff employed, which can directly affect the quality of early education (Figure 1). The stress generated by separation, fear of the unknown environment, and new habits can lead parents to temporarily suspend their professional activity or redistribute their tasks, disrupting productivity.

- **The selection by parents of a preschool institution with a very good reputation (qualified staff, educational resources, etc.) but located far from home**. In these situations, daily commutes can lead to fatigue, additional transportation costs, and less free time for the

family. As a result, such situations do not facilitate achieving a balance between the two spheres of work and family.

Significant problems are encountered by parents of children with special educational needs, as they are not always accepted and integrated into preschool institutions. Children with disabilities often require adjustments and additional resources to participate effectively in kindergarten activities. These may include specialized personnel, adapted educational programs, or specific equipment. Many kindergartens lack the infrastructure necessary to accommodate children with disabilities. Educators and auxiliary staff must be prepared to work with children with special needs. Thus, it is difficult for many parents to find a suitable kindergarten and maintain a stable job due to the schedule required for their children's care.

Work-life balance can be a significant challenge for parents from single-parent families due to the lack of partner support, which is accentuated when preschool education services have a schedule that does not meet the needs of parents who work full time. This makes it difficult to provide continuous supervision for children.

The difficulties mentioned above indicate that more parents are facing problems in accessing adequate and affordable care that meets the needs of both parents and their children. This aspect constitutes a problem from the perspective of parental participation in the labor market. Thus, due to the reduced level of nursery services and even the lack of the segment of quality services for the care of preschool children, some parents must sacrifice themselves professionally to take care of their children (Chistruga-Sînchevici, 2021).

Some parents who return to work resort to support from grandparents and relatives for the care and education of children. Even if they are free and flexible, exclusive dependence on unpaid care, provided by grandparents, other family members, or friends, can generate problems related to continuity and difficulties in ensuring long periods of care. Thus, formal childcare services may be preferred by some families because they offer continuity and superior quality compared

to other forms of care (Arpino&Luppi, 2020). This once again underlines the need to increase the quality and accessibility of preschool education services.

5. Solutions for Supporting the Work-Family Balance from the Perspective of Developing Preschool Education Services

Following legal framework changes in 2018, early education includes two cycles: pre-preschool education for children aged 0 to 2 years; and preschool education for children aged 2 to 6 (7) years. This change aims to ensure access for children aged 2 years and up to preschool education services, thus contributing to the reintegration of parents into the workforce. Despite this change, the number of nurseries and places in them has not increased, as there is no plan to expand nursery services and to implement these legislative changes.

At the request of parents, local public administration authorities can organize pre-preschool education with funding from local budgets. However, this is not feasible if there are no resources.

Although private preschool educational institutions have been operating in the Republic of Moldova for several years, the legal framework regarding their activity is not clearly and thoroughly established. These institutions, as a rule, operate without registration or with the status of NGOs or development centers.

In the legislation of the Republic of Moldova (through the approval of the Law on Alternative Childcare Services), three alternative forms of childcare were introduced in 2022, which can be organized for children aged 0-3 years: individualized care services – regulated and formalized "nanny" services; family-type care services – mini-nurseries organized for a limited number of children at the caregiver's home/temporary residence; services organized by the employer at the workplace – childcare services provided by the employer to its employees at the workplace.

Preschool educational services function as a key support for reconciling professional and family life in multiple countries, through policies tailored to the diverse needs of parents.

In Denmark, the Børnepasning (Childcare) project influences local authorities to make childcare services available for parents whose work schedules require services outside normal hours and on weekends. The project contributes to extending the operating hours of nurseries and facilitates the reconciliation between professional and family life. The initiative to provide 24-hour childcare services was initiated by Aalborg Hospital and the municipality of Aalborg to meet the needs of nurses and doctors working at the hospital. The institution opened in 1994, being one of the first facilities of this type in Denmark, and since 1998 it has also operated on weekends. This institution is a good example of a solution for childcare for working parents. Older siblings (up to the age of 10) can also be brought in the evening and at night, and parents can put the children to bed or wake them up if this fits with their work schedule (European Institute for Gender Equality, 2014).

In Norway, children are guaranteed a place in nurseries from the age of 1 year, and the majority of operating costs are covered. Parents pay approximately $190 per month for the first child in kindergarten and less for additional children. Here, childhood is perceived as a period of intrinsic value that should be full of joy and respect. Universal access to kindergartens allows families to allocate time to their careers without worrying about excessive costs (Mader, 2024).

In the UK, starting in September 2025, parents who work at least 16 hours per week may be eligible for 30 hours of funded childcare for their children aged at least nine months, until the start of first grade. If you are not eligible for 30 hours, the child may be entitled to 15 hours of funded childcare each week. All parents with children between 3 and 4 years old in England can access a universal offer of 15 hours of government-funded early education, regardless of the number of hours worked by parents or their salary level (Department for Education UK, 2025).

In Sweden, from the day children turn one, they are entitled to a place in kindergarten, with a modest fee. Most children attend kindergarten at some point until the autumn of the year they turn six, i.e. when compulsory school begins. The effect of this accessible care system is that

most parents in Sweden choose to enroll their children in kindergarten and return to work after parental leave (Swedish Institute, 2025).

In France, nurseries accept children for day care immediately after the end of maternity leave, i.e. from the age of two or three months, and are open for most of the day (between 7:00 and 18:00). Nursery schools (écoles maternelles) are a key component of general childcare provision. Services in these institutions are free for parents, except for lunch (Thevenon, 2009). Enrollment requests for écoles maternelles for two-year-olds often exceed supply, reflecting the high opinion that French families have of childcare programs, as well as parents' preferences regarding returning to work. The enrollment rate for children aged 3-5 years is 100% in the écoles maternelles system. There are also additional services available before and after school hours, during school holidays.

The examples presented above reveal that preschool educational services are a fundamental support for promoting a balance between professional and family life in various countries, being adapted to the diverse needs of parents. The implemented projects and initiatives demonstrate the importance of a flexible and accessible system that ensures both support for parents in critical periods and a quality experience for children.

6. Conclusions

Problems such as limited availability of places, misalignment of schedules with parental needs, high costs, and variable service quality can hinder the achievement of work-family balance. The lack of reconciliation between family and professional life contributes to the emergence of the phenomenon of "deferred motherhood," meaning that more women employed in the labor market are less likely to become mothers at a younger age. Reconciliation problems are factors that prevent couples from having many children, thus contributing to a decrease in fertility rates. A low fertility rate has a negative influence on economic growth as well as on the stability of social protection systems.

In the context of declining labor force, decreasing fertility rates, and aging populations, the adoption of measures and policies to support employees with family responsibilities - accessible and quality care services - constitutes a socioeconomic necessity and an objective of interest for a significant proportion of the population. The existence and accessibility of quality early education services facilitate the participation of parents, especially mothers, in the labor market, contributing to the financial stability of the family and the harmonious development of children. Investments in these services must be supported by clear, transparent, and equitable public policies, as well as adequate funding, to ensure access for all children, regardless of their socio-economic background. The diversity of family and socio-economic contexts requires flexible and locally adapted approaches, taking into account the specific characteristics of communities and the specific needs of parents. Such measures could lead to the harmonization of professional life with family life and, implicitly, to the increase of fertility and employment rates among women.

The balance between work and family life is not only an individual problem, but a societal priority, with profound implications for the well-being of current and future generations. Investing in quality early education services is, therefore, not only support for working parents, but also an investment in the future of society as a whole.

Acknowledgement

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Fostering Computational Thinking Through Educational Robots

Emilia-Felicia Coșniță[1], Păun Antonescu[2]

1. National University of Science and Technology Politehnica Bucharest, Romania, emilia.cosnita@stud.mec.upb.ro

2. National University of Science and Technology Politehnica Bucharest, Romania, panton38@hotmail.com

Abstract

The study analyzes the development of computational thinking and technical skills through educational robots, combining theoretical instruction with the development of haptic robotic devices. It proposes a teaching framework that facilitates learning through robotics projects, using force-feedback haptic devices, enabling students to acquire essential skills, improve their digital abilities, and adapt to real-world challenges.

The study evaluates the impact of integrating educational robots on cognitive development within an appropriate teaching environment, utilizing the equipment in the robotics lab. The results indicate an improvement in deduction and reasoning abilities, programming skills, use of haptic interfaces, as well as in building and manipulating robots. The implementation of robots and haptic devices has led to significant changes in both teaching strategy and the students' learning process.

Keywords: computational thinking; educational robots; project-based learning; haptic; teacher.

JEL Classification: C63, C69**,** I21, I290.

1. Introduction

Computational thinking refers to the approach of problem-solving and information processing in a way that can be addressed through algorithms and computers. It involves identifying, representing, and solving problems in a form that can be processed by a computer system. Additionally, it entails discovering solutions by breaking down problems into smaller steps (dividing and conquering complexity), recognizing patterns, and applying mathematical logic to develop optimal solutions (Wing, 2006). According to Jeanette Wing, a prominent advocate of computational thinking, it is an essential tool not only in the field of computer science but also in other disciplines, as it provides a method for structuring critical thinking and facilitating the understanding of the complexity of the world (Wing, 2006; Grover & Pea, 2013). Furthermore, computational thinking promotes the development of higher cognitive skills, such as problem-solving, creativity, and abstract thinking, which are crucial in preparing students for the challenges of the 21st century (Barr & Stephenson, 2011).

Educational robotics activities enable students to practice essential skills such as problem decomposition, abstraction, algorithm design, debugging, iteration, and generalization, representing six key facets of computational thinking (Shute et al., 2017). The use of educational robots in learning activities contributes to enhancing students' cognitive abilities. Through robot-assisted learning, students gain a better understanding of programming concepts such as sequencing, conditions, and loops, thus promoting problem-solving skills (Evripidou et al., 2021).

This study aimed to assess five competencies of computational thinking in students participating in a robotics club, where they practically built educational robots in the form of force-feedback haptic devices, compared to students who engaged in formal activities within a formal setting. At the end of the study, feedback was gathered from students, and conclusions were drawn.

2. Literature Review

Students who participated in robot-assisted learning activities demonstrated a better understanding of programming concepts and developed problem-solving skills (Chen & Chung, 2023). These activities provide constructive learning experiences by stimulating the visual, auditory, and tactile senses, thereby facilitating the development of cognitive skills and computational thinking (CT) in students.

A proposed model for educational robotics activities is the CCPS (Creative Computational Problem Solving) model, which integrates the process of creative problem-solving with the use of educational robots. This model includes phases such as understanding the problem, generating ideas, formulating the robot's behavior, programming the behavior, and evaluating the solution, thus promoting the development of CT skills in students (Romero et al., 2017).

Pou, Canaleta & Fonseca integrated educational robotics activities and computational thinking within a project-based learning (PBL) framework in a secondary school in Barcelona, Spain. Students used visual programming platforms, such as Scratch, to develop CT skills and competencies in the fields of science, technology, engineering, arts, and mathematics (STEAM). The study's results showed a significant improvement in these concepts and skills compared to other educational methodologies, highlighting the effectiveness of integrating educational robots into the school curriculum.

3. Methodology

The methodology used was project-based learning (PBL). The goal of PBL is to transform the educational process through the integration of digital tools, thereby facilitating the development of essential skills for the 21st century. This approach aims to personalize learning, allowing students to learn at their own pace and access diverse educational resources tailored to their individual needs.

Students presented the results of their project-based learning (PBL) in the form of a haptic device with force-feedback, using the Arduino programming environment. As students from the mathematics and computer science specialization who participated in the robotics club, there was no need to provide them with a conceptual introduction to the content of the programming environment. They were able to access and use various information sources, including online resources and technical databases, to enhance their knowledge and find solutions to the challenges they encountered. The teacher acted as a guide, clarifying doubts and supporting them in creating a final product.

In the PBL methodology, collaboration among peers is crucial, involving the sharing of knowledge for the benefit of the group, to achieve a common goal. Additionally, trial and error are considered essential factors in the process.

The study included 104 students (69.23% boys, 30.77% girls) aged between 14 and 18 years. They were divided into two groups, one control group (CG) and one study group (SG), with 52 students in each. In each group, 8 teams were formed, four with 6 students and four with 7 students.

The same curriculum was applied to all groups. The proposed activities took into account the theoretical knowledge taught in formal activities within compulsory education, age-related characteristics, and the available components in the robotics club. Some of the components were 3D printed using the lab's printer. Collaboration among peers and cooperative learning were encouraged to help students better identify concepts, analyze problems, and build relationships with their colleagues.

3.1. The aim of the research

The study aims to analyze the performance of students who built educational robots in the form of force-feedback haptic devices in a non-formal setting at the robotics club, compared to students who studied programming using traditional training methods in a formal environment.

It examined how the development of computational thinking through the integration of educational robotics can occur naturally, without overburdening the teacher or the computer scientist, as well as how teaching can become more effective in the process.

3.2. The objectives of the research

O1. Establishing the theoretical concepts corresponding to the competencies aimed at developing computational thinking (CT) and selecting the hardware components to be used in building educational robots.

O2. Developing the teaching scenarios and identifying their stages for non-formal sessions.

O3. Comparing the performance of students in the control group with that of students in the study group after the completion of the force-feedback haptic devices built as educational robots.

3.3. Aspects of the Assessed Competencies

Type	Description
C1. Problem Decomposition	C1.1. Identifying and defining the problem: students learn to recognize and clearly formulate problems, which is essential for finding appropriate solutions. C1.2. Analyzing and structuring information: involves organizing and evaluating available data to better understand the problem. C1.3. Generating and evaluating solutions: students are encouraged to propose multiple solutions and critically analyze them to choose the most effective approach.
C2. Abstraction	C2.1. Identifying the essential elements of a problem: students learn to distinguish relevant information and isolate it from insignificant details, thereby facilitating a general understanding of the problem. C2.2. Abstract representation of a problem: involves formulating the problem in a generalized manner, using concepts and symbols that allow the application of solutions in various contexts. C2.3. Generalizing solutions: students are encouraged to apply the solutions found in new contexts, demonstrating the transferability and efficiency of the approaches developed.
C3. Algorithm	C3.1. Analyzing the problem statement and establishing the steps to solve it: involves

| Type	Description
Design	clearly understanding the problem's requirements and identifying the necessary stages to reach the solution. Students learn to break complex problems into simpler subproblems, facilitating the development of an efficient algorithm. C3.2. Representing algorithms in pseudocode: students learn to express algorithms in a semi-formal form using pseudocode, which allows a clear understanding of their logic before actual implementation in a programming language. C3.3. Adhering to structured programming principles in algorithm development: refers to applying structured programming principles, such as the use of sequencing, selection, and iteration, to create efficient and easily understandable algorithms. Students learn to apply these principles to develop clear and efficient solutions to given problems.
C4. Iteration	C4.1. Applying loops for repeating instructions: students use loops (such as for, while) to repeat code sequences, thus streamlining the process of solving repetitive problems. C4.2. Testing and adjusting solutions: involves evaluating the obtained results and modifying algorithms to improve their performance or correctness. C4.3. Continuous improvement of solutions: students are encouraged to review and enhance their solutions through successive iterations, thereby developing self-assessment and continuous improvement skills.
C5. Generalization	C5.1. Identifying recurring patterns: students learn to recognize common patterns and structures in various problems, thereby facilitating the application of similar solutions in new contexts. C5.2. Applying solutions in varied contexts: involves using learned strategies and techniques to solve problems in different fields, demonstrating flexibility and adaptability. C5.3. Transferring knowledge between domains: students are encouraged to apply concepts and methods learned in one field to solve problems in other fields, thereby developing knowledge transfer skills.
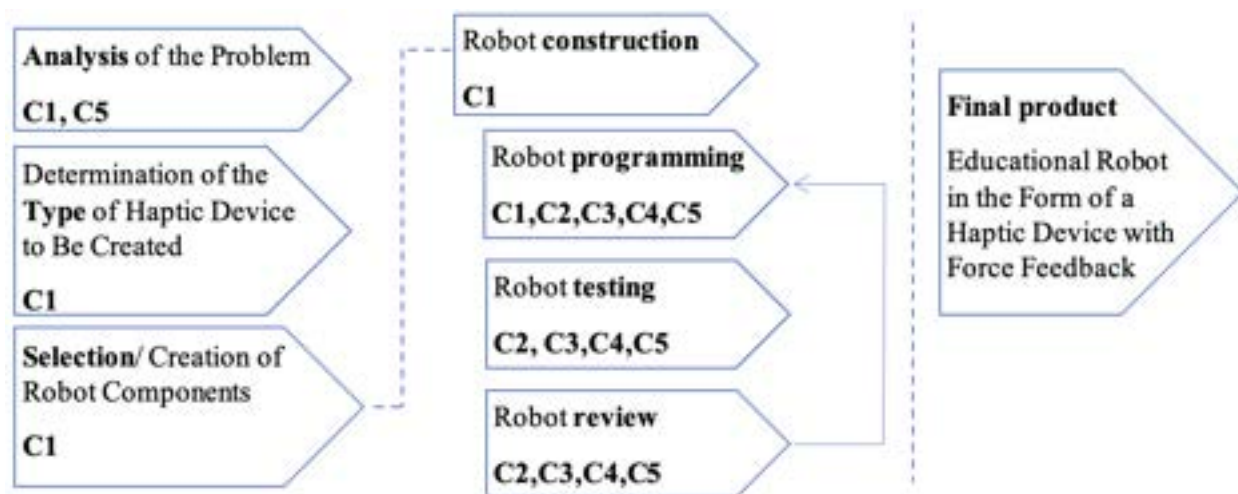
Figure 1. Design of the Educational Robot as a Haptic Feedback Device

3.4. Research steps for non-formal activities

STEPS	Activities	Teacher	Student
1. Introduction to haptic feedback concept	o Explaining the operating principle of haptic devices and their applications in various fields. Presenting the basic components: resonant linear actuators, development	o Explains the operating principle of haptic devices and their applications in various fields. Presents basic components: resonant linear actuators, development boards, and	o Listens to explanations, asks questions, and expresses ideas

	boards, and Arduino microcontrollers.	Arduino microcontrollers. Provides examples of the use of haptic devices in various fields.	
2. Planning and designing the device	o Establishing the purpose of the haptic device. Modifying the device design, selecting the type of actuator, and determining the mode of user interaction.	o Guide students in defining the project's purpose and technical requirements. Assist in identifying the necessary resources and establishing the work plan. Encourage critical thinking and creativity in the design process.	o Collaborating in groups to establish the desired functionality of the device. Drawing sketches and diagrams of the proposed device. Identifying technical solutions
3. Assembling the hardware	o Mounting components on a development board (breadboard). Connecting the breadboard, Arduino board, sensors, and	o Demonstrates proper assembly techniques, supervises student work to ensure safety and accuracy, and provides assistance with	o Assembles components on a breadboard, connects wires according to circuit diagrams, and tests connections for

		technical issues.	correct operation.
	actuators according to the circuit diagrams. Verifying connections to prevent assembly errors.		
4. Programming the device	o Writing and uploading the code in Arduino IDE to control the intensity and pattern of vibrations. Using libraries to access predefined effects. Testing and adjusting the code to achieve the desired feedback.	o Explains basic Arduino programming concepts, introduces functions and libraries for haptic feedback control, provides example code, and assists with debugging.	o Writes and uploads code using the Arduino IDE, tests and adjusts code to achieve desired feedback, and documents modifications and improvements.
5. Testing and evaluating the device	o Conducting tests to assess the effectiveness of haptic feedback under real-world usage conditions. Gathering user feedback to improve the device.	o Organizes testing sessions, provides evaluation criteria and constructive feedback, and encourages reflection on the learning process	o Actively participates in real-world testing, collects data, observes device performance, and suggests improvements based on

		and outcomes.	feedback received.
6. Reflection and continuous improvement	o Analyzing the learning process and identifying possible improvements. o Encouraging students to propose changes and experiment with different hardware and software configurations.	o Facilitates discussions about lessons learned and challenges encountered, encourages students to identify ways to enhance the project, and supports documentation of the process and results.	o Reflects on the learning experience and progress made, identifies strengths and areas for improvement in the project, and proposes ideas for future projects or further development of the device.

4. Results and Discussions

The study lasted five months and involved 104 students from grades IX-XII, 52 from formal education and 52 who voluntarily enrolled in the robotics club and built educational robots in the form of haptic devices with force feedback. In programming (software component), the graphical interface of the Arduino IDE environment and the C++ programming environment were used. The two groups consisted of 32 girls (30.77%) and 72 boys (69.23%), who were equally divided by age and gender.

Pre-testing and post-testing were conducted with 30 items each, targeting the five competencies of computational thinking, which had varying degrees of difficulty. Each competency was scored with 20 points. No points were awarded automatically. Knowledge from the mandatory curriculum of formal education was not assessed. Both tests focused on cognitive development

and did not refer to practical aspects or robot construction. No additional points were awarded for functional robots.

At the beginning of the research, the hypothesis was tested, according to which there was no significant difference between the variations of the sample in the CG and SG groups across the five competencies.

Competences	df	C1		C2		C3		C4		C5	
		Mean	SS	Mean	SS	Mean	SS	Mean	SS	Mean	SS
Between groups	1	2.2193	2.2193	1.7127	1.7127	0.7073	0.7073	1.5396	1.5396	0.1659	0.1659
Within groups	102	9.146	932.868	8.600	877.188	9.576	976.752	8.053	821.4075	8.4943	866.41
Total (n-1)	103		935.0869		878.9006		977.4589		822.947		866.58
F			0.24266		0.19915		0.07387		0.19119		0.01953
p			0.623352		0.656351		0.786338		0.662857		0.889128

Table 1. Levene test for pre-test

For all five competencies, the p-value is quite large (C1: 0.62335, C2: 0.656351, C3: 0.786338, C4: 0.662857, C5: 0.889128), demonstrating that there is no statistically significant difference in the knowledge levels between students in the GC and SG groups. For C1, C2, C3, C4, C5, the independent sample F-statistic is small (C1: 0.24266, C2: 0.19915, C3: 0.07387, C4: 0.19119, C5: 0.01953). The difference between the variations of the sample in the two groups for the five competencies is not large enough to be statistically significant. The hypothesis was valid. k=2 groups, n=104 subjects.

At the end of the robotics club sessions, post-testing was conducted. We considered the hypothesis that the difference between the variations of the sample in the GC and SG groups is not significant. The hypothesis was tested using Levene's test.

Competences	df	C1		C2		C3		C4		C5	
		Mean	SS	Mean	SS	Mean	SS	Mean	SS	Mean	SS
Between groups	1	23.2317	23.2317	31.367	31.367	26.5412	26.5412	51.4566	51.457	37.560	37.5601
Within groups	102	7.1207	726.316	9.442	963.083	8.2606	842.577	8.0273	818.78	8.0423	820.32
Total (n-1)	103		749.548		994.45		869.12		870.239		857.876
F			3.26254		3.32208		3.21301		6.41022		4.67031
p			0.07383		0.07129		0.07602		0.01287		0.03303

Table 2. Levene test for post-test

For C1, C2, C3, the hypothesis was validated, but the p-value is very close to the 0.05 threshold (C1: 0.0738, C2: 0.07129, C3: 0.07602). For C4 and C5, the hypothesis was NOT validated. The p-value (C4: 0.012872, C5: 0.03303) indicates that there is a statistically significant difference in the knowledge levels between students in the CG and SG groups.

To verify the differences between the results obtained by students who built educational robots in the form of haptic devices with force feedback in a non-formal setting, at the robotics club, and those who studied programming using traditional training in a formal environment, Pearson's correlation coefficient was used (**Table 3**).

Competences		C1	C2	C3	C4	C5
Control group (CG)	Means scores	10.212	11.327	10.827	11.212	10.442
	Stand.dev.	1976.67	1627.44	1467.44	1362.67	1392.83
Study group (SG)	Means scores	9.462	9.827	10.154	11.404	9.788
	Stand.dev.	1502.92	1735.44	2014.77	2036.52	2074.67
Pearson coef. (R)		-0.108	0.0446	0.006	-0.304	-0.0466

Table 3. Pearson correlation coefficient calculated by competencies

For the competencies C1: -0.108, C4: -0.304, C5: -0.0466, no significant correlation was found. The other competencies, although they have a positive correlation (C2: 0.0446, C3: 0.006), according to Davies, these competencies have a weak relationship. There is a fragile relationship between the results of students who built educational robots in the form of haptic devices and those of students who only did traditional implementation.

5. Conclusions

The study aimed at developing computational thinking demonstrated that fundamental competencies such as problem decomposition and abstraction, as well as algorithm design, are not strongly correlated with building educational robots. These skills are critical for understanding and addressing complex problems, and their development occurs gradually, without significant jumps between learning stages (Grover & Pea, 2013). Between the students in the CG and SG groups, competencies that involve the ability to break down complex problems into smaller subproblems and to identify the essence of a problem by eliminating irrelevant details—processes essential for efficiently solving these problems—showed no remarkable differences. This supports Wing's (2006) conclusion, which emphasizes that problem decomposition is a fundamental foundation in computational thinking because it facilitates the organization and management of complex information in a systematic manner.

In contrast, the competencies of generalization and iteration showed significant improvements in cognitive development, indicating a substantial enhancement in logical thinking and the ability to apply solutions to a broader set of problems. Barr and Stephenson (2011) highlight that developing the ability to generalize and iterate solutions significantly contributes to improved problem-solving skills and a deeper understanding of complex concepts. Generalization involves identifying common patterns across different problems, while iteration refers to the repeated use of procedures or algorithms to refine solutions. Research in computer science education shows that these skills are essential for developing a flexible and creative thinker (Grover & Pea, 2013).

Thus, the significant differences in the development of these competencies are related to the nature of the learning process, where generalization and iteration are much more intensive and challenging, stimulating a higher level of critical thinking and the ability to adapt solutions to various contexts.

The study validated the conclusions from Romero et al. (2017), demonstrating that structured interventions based on CCPS can reduce trial-and-error behaviors and stimulate cognitive processes related to problem understanding, idea generation, and solution formulation.

At the end of the study, the students from the CG group demonstrated fundamental knowledge in the fields of electrical engineering and electronics, having a solid understanding of the essential principles underlying these disciplines. They were also familiar with the basics of robotics, with sufficient skills to understand key concepts such as control systems, sensors, and actuators. Their mathematical skills were at a basic level, which allowed them to apply simple mathematical concepts in solving technical and scientific problems.

Another important aspect was compliance with current health and safety regulations in the workplace, with students having a good understanding of the safety standards required for practical activities. They also demonstrated the ability to organize the workspace according to ergonomic requirements, ensuring that the work environment was adequate and comfortable, thus contributing to accident prevention and the efficiency of the activities carried out. These fundamental competencies contributed to their preparation for addressing more complex tasks in the field of robotics and related technologies, and their integration into the learning processes was essential for the success of the study.

When presenting the educational robot (final project), students from the SG group demonstrated advanced skills in:

- Explaining the specific terminology used in the robot construction process, highlighting key terms and fundamental concepts.
- Describing the applications of haptic devices, as well as identifying various areas of

daily life where these can be implemented, such as medicine, industry, or education.

- Recognizing robot typologies based on the structure of the kinematic unit, which allowed them to classify different types of robots according to their movement modes.

- Classifying robots based on their field of application, demonstrating an understanding of their diversity in sectors such as manufacturing, healthcare, or home automation.

- Detailing the process of constructing educational robots, including the essential steps and technologies used in their creation.

- Explaining the electrical connection interface of robots, highlighting how various electrical components are integrated to ensure the proper functioning of robotic systems.

- Describing the essential technical parameters of educational robots, such as motorization, sensor control, and interaction with the external environment.

These competencies reflect an advanced level of understanding and application of knowledge in the field of robotics, preparing students for both a practical and theoretical approach to emerging technologies.

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Perceived Social Support through Students' Drawings in the Fundamental Learning Stage

Grigoriță Mălina-Elena

Faculty of Psychology and Educational Sciences, Iași

malinagrigorita@yahoo.com

Abstract

This study explores how students in the early years of primary education (preparatory class, first grade, and second grade) understand and perceive social support in the school environment through the analysis of their drawings and verbal explanations. Students were asked to draw "a day at school when someone helped them," and the analysis focused on the content of the drawings, the use of symbols, colours, emotions, and depicted relationships, as well as the students' verbal presentations. The results revealed that students perceive social support as largely provided by peers and teachers, in the form of concrete assistance (such as lending a pen, sharing a snack) and emotional encouragement. A positive perception of their social environment was reflected through symbols (hearts, stars, the sun, and butterflies) and warm colours (red, yellow, and pink). The larger drawings of certain figures indicate their emotional significance. This study highlights that drawing is a highly useful tool for teachers, allowing them to identify students' emotional and social needs, particularly among young children, and providing a natural means of expression. Drawing can be used both individually and in group settings to observe the

dynamics of relationships, but it is important that interpretations are approached with caution and with careful respect for the child's privacy.

Keywords: perceived social support, students, drawing, teacher-student relationship, emotional support.

1. Introduction

At the age of fundamental acquisition (6–8 years), primary school students form their basic skills and develop their social-emotional skills. More often than not, pupils express and communicate through drawing, especially if it is about feelings and emotions. Not infrequently, the class teacher receives a special drawing as a token of gratitude from the pupil who wanted to express his/her appreciation for the support.

In the literature (Barrera et al., 1981; Coffman & Gilligan, 2002; Vedder et al., 2005), *social support* is a set of emotional, informational, and instrumental resources provided by a social network (family, friends, colleagues, and teachers) that helps a person cope with difficult situations, regulate emotions, and maintain psychological well-being, thus contributing to adaptation in various social contexts, personal development, and, in general, life satisfaction.

2. Literature Review

A study by Rautanen et al. (2020) analysed how primary school children's perceived social support (from teachers, parents, and friends) affects their participation and engagement in activities in an educational context. The results showed that children's participation in learning is largely influenced by perceived social support, which contributes to their motivation, energy and commitment to school. We found that teachers have the greatest impact among all sources of support. Students who receive emotional (encouragement, appreciation), informational (advice, feedback), and instrumental (resources needed for studying) support typically have a more

positive attitude towards school, are more resilient in the face of obstacles, and invest a consistent effort in academic activities. Even when other socio-demographic characteristics are taken into account, social support from parents and instructors has a noteworthy and favourable effect on students' resilience; in addition, children who report higher levels of support usually have better overall health (Stewart & Sun, 2004).

In general, social support has a positive impact, but in relation to students from socio-economically sensitive backgrounds, its valences are articulated, being an important variable. Having a formative and emotionally supportive role, especially for vulnerable children, social support is considered a preventive factor; it is directly related to self-regulation, life satisfaction and reduction of risk behaviours (Veteška et al., 2020).

At the age of fundamental acquisition, creativity is often expressed through drawing. In this sense, drawing has the potential for multimodal expression in that it is not limited to its artistic function but also to others, such as communication, cognitive development and exploration of the world around us (Hall, 2009).

It is important to address John Bowlby's attachment theory (1989) because it underscores the importance of early and stable relationships between the child and primary attachment figure (traditionally mother but not necessarily). John Bowlby shows us that such affective bonds are not merely emotional but are very important for the child to physically survive and socially develop. Secure attachments supply the child with a 'secure base' (Bowlby & Solomon, 1989, p.156) that they are able to use for actively exploring the world but insecure attachments result in emotional and behavioural problems. Attachment development has the following number of stages: first, the baby prefers his mother's voice and face and as time goes on, an emotional closeness develops which is sustained through twitching, crying, smiling and clinging. If the separation is to happen, then the child's emotional reactions (protest, despair, then apparent detachment) are accepted as natural, they are a part of and a process of the establishment of an 'internal working model' (Bowlby & Solomon, 1989, p.155) of self and others.

Vygotsky's sociocultural theory (1972) provides a useful basis for understanding how social support and drawing as a means of communication help promote children's development at the stage of fundamental acquisition (ages 6–8 years). Vîgotski argued that children's cognitive skills are acquired through the support of more competent adults or peers; therefore, learning is deeply rooted in social interactions (Vîgotski apud Pathan et al., 2018).

The multi-dimensional analysis by Clabaugh, G. K. (2010), who explored Lev Vygotsky's socio-cultural theory, states that in Vygotsky's view, society is the bearer of cultural heritage, without which cognitive development is impossible and therefore plays an important role in the development of the child's mind. According to him, every child's higher mental ability emerges first at the social (interpersonal and interpsychological) level and is then absorbed at the personal (intrapsychological) level. He emphasises that education should be seen as a process based on real social and cultural contexts, not as an artificially produced environment only.

Applying Vygotsky's theory in the context of the present research, we will refer to the Zone of Proximal Development or ZPD: when a child draws, when she has this material to use, she can explore ideas, concepts and emotions above her current level, but accessible with help of an adult (parent, teacher) or peer. For instance, a child is going to draw a complicated story; for his idea to be completed, he will need directed questions ("what's going on here?", "what does the house look like?"), or practical assistance ("can you add windows here?"). Relying on step by step scaffolding (adult support) the child progress from simple graphic play to drawing for more sophisticated purposes: storytelling, expressing emotions, explaining concepts. In these connections, children enhance their graphic skills, as well as their language skills, narrative thinking, planning and self-regulation.

Development during the period of fundamental acquisition depends to a large extent on social support, which is also closely linked to school performance and emotional and social well-being. The essential components for school adjustment and the acquisition of cognitive skills, confidence, motivation and a sense of belonging are built partly through supportive interactions

with adults (parents, teachers) and peers. From the perspective of Vygotsky's socio-cultural theory, social support on a daily basis helps the child and shapes learning, thus widening the zone of proximal development. Therefore, social support is not a direct protective element but rather a necessary component in the child's formation and development in school and beyond.

3. Research Methodology

The present study aims to explore how 64 students from the basic acquisition curricular cycle (preparatory, first and second grade) perceive social support in the school environment, using as the main method the analysis of the drawings they made, as well as the way of presenting the drawing. The students participating in the study had to draw a picture based on the task, "Draw a day at school when you felt that someone helped you," in 45 minutes.

Ethical and deontological principles were taken into account in the conduct of the study, permission was obtained from the student's parents to participate, anonymity was also ensured and the participation and results were used strictly in the context of the research.

In interpreting the drawings in relation to the social support (Burkitt, 2004; Farokhi & Hashemi, 2011):

→ the presentation of the drawing by the drawer;

→ integration of elements as a whole;

→ attention to repetition and recurring symbols;

→ attention to colour and size;

→ relation to the social environment;

→ feelings emphasised.

The aim of the study is to identify and understand the pupils' perceptions of the social support offered in the school environment in the basic acquisition cycle, as reflected both in the content of the drawings and in the way they are presented verbally. The study aims to highlight the role that support from teachers, peers and other adults plays in children's lives and how these

relationships are internalised and expressed through the graphic representations. At the same time, the research aims to explore the potential of drawing as a qualitative method of investigation in the study of children's subjective perceptions and experiences.

The objectives of the study are:

- To analyse students' drawings in order to identify their perceptions and representations of social support in the school environment.
- To identify the feelings associated with social support as reflected in the drawing and in the verbal presentation (e.g., joy, security, fear, isolation).
- To identify the main sources of social support perceived by children (teachers, peers, parents) and how these are reflected in the graphic and symbolic elements of the drawings.
- To formulate practical recommendations for teachers on the use of drawing as a tool for understanding pupils' emotional and social needs.

4. Results and Discussions

In the 64 drawings made by students, the following can be highlighted:

→ Most of the drawings show colleagues, friends or family members (mom, dad or siblings), and in some there are also figures of adults who are presented as teachers.

→ In many cases, the support comes from peers, indicating the importance of equal, equitable relationships (34 of the drawings).

→ In other cases, the central figure is the teacher, offering protection or guidance (30 of the drawings).

→ Social support is provided through concrete support (figures/characters appear giving objects or standing nearby, suggesting cooperation), affective elements (hearts and expressions on the faces – smiles – indicate affection, symbolic hugs, and understanding), and support through talking (some drawings include dialogue lines, balloons or gestures suggesting conversation).

→ Smiles on the drawn faces are predominant, suggesting an overall positive mood perceived by the pupils, expressing feelings of integration, support.

→ One drawing shows neutral or more serious faces, which could suggest either concentration or a more sober context.

→ The feelings conveyed through the drawings are those of joy, security, tranquillity, affection, gratitude, trust, enthusiasm, cheerfulness, courage, belonging, contentment, and relaxation.

→ The absence of detailed faces in some works indicates either the stage of graphic development or a focus on other elements (context, action).

→ The symbols used are hearts (clear symbols of affection and love), stars, butterflies, rainbow, suns (symbols of joy, optimism and hope), houses, and schools (indicating the safe and familiar environment in which social support occurs).

→ Warm and bright colours (red, yellow, pink) predominate and indicate a positive perception of the social environment in which they carry out their activities (58 drawings).

→ Colour balance and lack of crowding suggest harmony and a perceived positive social environment.

→ The repetition of hearts and human figures in pairs or groups shows the children's emphasis on affective relationships and belonging.

According to the analysis of the students' drawings, social support, expressed through friendly relationships with teachers, peers, and even family members, is seen as a fundamental component of their school lives. Children reflect their fundamental need for security and belonging by illustrating social support in their drawings through help received, gestures of emotional support and the reassuring presence of close people. The bright colours and symbols, such as hearts, stars, and butterflies, indicate a good overall picture of these relationships; the larger size of some characters suggests their emotional relevance. Repetition of themes, including groups of friends or the presence of sunshine and hearts, promotes children's vision of constant and consistent social support in their lives. Therefore, the drawings reflect lived reality

and provide access to understanding how students view, internalise, and communicate the supportive relationships that impact their emotional and social development.

The drawings made by pupils in the basic acquisition curriculum cycle provide a complex picture of how they perceive social support in the school environment, especially as it is a form of indirect exploration of social support, given the age range (6-8 years). These drawings show not only the actual relationships but also the symbols and emotional needs through which these relationships are internalised. From an integrative perspective, we link the presence of peers, teachers, and occasionally family to social support. Peers are mainly represented by mutual help and play, teachers by guidance and protection, and family by affective support and emotional protection.

Interestingly, in addition to these visual cues, the way the drawings are presented verbally confirms and amplifies the symbolic meanings, providing details about the feelings experienced and the relevant social context. Vygotsky's (1972) socio-cultural theory emphasises the role of social interactions in children's emotional and cognitive development; drawings are a means of symbolic expression and mediation of children's experiences. The results also show that drawing can be used not only as a tool for assessing emotions but also as an educational method through which teachers can help students to discuss their own emotions, identify unmet needs and promote social inclusion. This integrative approach confirms that drawing is a means to access children's inner world. It provides both relevant qualitative data for research and a useful tool for educational interventions that focus on pupils' social-emotional needs.

Regarding the students' descriptions of the drawings, we summarize in **Table 1** some of their descriptions in order to highlight the correlation with perceived social support.

No.	Drawing Description	Perceived Social Support
1.	"Here I am with my friend, they help me when I don't know what to do at school and we play together."	Support from peers through concrete help and emotional support, cooperation, and group integration.
2.	"Here I am with my classmate; she gave me a pencil when I didn't have one, and I was very happy, so I drew a heart and stars."	Material help, accompanied by appreciation and affective gratitude (symbolised by the heart and stars).
3.	"I drew myself with my teacher. She helps me learn and explains things when I don't understand. I drew a heart on her blouse to show I love her and feel good with her. She's holding a stick to show us lessons."	Educational and emotional support from the teacher, perceived through explanations and encouragement; positive perception of school the teacher's role.
4.	"I drew my classroom, where the teacher helps all of us."	Collective support from the teacher towards the entire class; feeling of protection and safety from the adult figure.
5.	"I drew a beautiful day at school, with a rainbow and sun, and below is the school where my friend helped me when I didn't know something."	Support from a friend in solving a difficulty at school, in a positive context (rainbow, sun), suggests a secure, optimistic environment.
6.	"It's me with my teacher, who helps me with my homework."	Support from the teacher, perceived as concrete help with learning tasks.
7.	"I'm here with my teacher, who held my hand when I was sad."	Emotional support from the teacher, expressed by the gesture of holding hands, is a sign of closeness and reassurance.
8.	"I drew my school and my friend who gave me food when I forgot my lunch."	Practical and emotional help from a peer (sharing food), associated with empathy and care.
9.	"In the drawing is the day when I felt sick and the teacher helped and cared for me."	Emotional and practical support from the teacher in a vulnerable situation (illness), showing care and safety.
10.	"This is the day when the teacher called us with the bell and my friend held my hand to go together into the classroom."	Emotional and social support manifested through guidance and reassurance, reinforcing a sense of belonging.

Table 1. Descriptions of students' drawings

The students' descriptions, as well as their interpretation according to criteria from the literature, show that perceived social support in the school environment varies and includes both concrete help (borrowing an object, homework help, and sharing food) and emotional support (encouragement, hand-holding and affectionate gestures). Relationships with teachers are associated with cooperation, friendship, and belonging to the group, whereas relationships with peers are perceived as a source of protection, safety, and support. Affective symbols, such as stars and hearts, together with the positive context of the drawings, such as rainbows and sunshine, convey a positive and optimistic image of the school environment. In general, pupils' drawings and explanations emphasise the importance of social support in creating a sense of emotional security and social integration at school.

By using drawing as a tool to learn about students' emotional and social needs, teachers can learn about their students' needs, offering them a natural and easy means of expression. At the same time, teachers can suggest that students draw as a standard activity, both in moments of relaxation and in guided situations, to describe their experiences, situations or relationships that are important to them. However, teachers should be attentive to the symbols and colours used, as well as the facial expressions drawn, as these can reveal how the child is feeling. As important as it is to encourage children to talk about their drawings, verbal communication will also highlight essential points associated with children's experiences and perceptions. Teachers can analyse drawings to identify appropriate social relationships with students, including peers, and can observe these relationships in dynamics. However, it is crucial to interpret drawings cautiously, respecting the child's privacy and avoiding hasty and incorrect conclusions. Furthermore, drawing in group activities can enhance social cohesion and provide the teacher with the opportunity to detect how students cooperated and shared roles. In cases of anxiety, isolation, or conflict identified in drawings, teachers can collaborate with the school counsellor to transform the drawing from a mirror of the emotional state into a starting point for effective and specific interventions.

5. Practical Implications for Teachers

Drawings can also present palpable indications of students' emotional and social needs; thus, teachers should apply this method not only as an artistic activity but also as an observation method and educational and emotional support tool. The use of this method should be done carefully by teachers to experience the benefits of drawing as a form of education and emotional support. Thematic drawing guidance can be used by the students to depict a given scenario, for example, a school day when they got a helping hand or had fun. The exercise may enable them to easily access their thoughts and experience and provide a non-invasive and natural medium for expression. Prompts on the meaning of characters and symbols in the drawings help to verbalise and strengthen emotional reflection with pupils. Teachers need to understand drawings in context, avoid vague conclusions, and supplement their visual observations with information from other educational and behavioural sources. Drawing, individual and group, can become a useful aid to observing how relationship dynamics work and determining social-emotional needs with the goal of establishing a compassionate and open school environment which contributes to the child's overall full development.

The use of drawing in educational activities may prove to be an effective way of discovering pupils' emotional and social needs and giving them a natural and easy method of expression. For the realisation of maximum potential for this method, teachers should be structured and sensitive in their attitude towards drawing-based activity, allowing free expression as well as close "reading" of drawings.

A first strategy could be the use of guided thematic drawing: in this way, the pupils are invited to draw specific situations, for instance, 'Draw a day at school when you felt helped' or 'Draw a moment when you were pleased with your classmates'. This activity provides teachers with information about pupils' perceptions of social support in their school environment and with glimpses of interpersonal relationships in the school environment. To achieve the same, another suggested approach involves the development of a portfolio of social-emotional drawings, where

pupils are encouraged to create familiar drawings of school-related experiences as a regular exercise. An analysis of these works can enable observation of the emotional and social development of every child and the possible relational or emotional problems.

After interpreting the drawings, students should engage in a guided discussion where they can articulate and clarify the visual representations they have made. This dialogue will help them to understand their intentions and meanings, hence avoiding their preconception of symbolic meanings. It is also possible to use drawing in the activities of school counselling as a kind of opening up channels of communication with pupils, especially with the more shy or withdrawn pupils, by using drawing as a framework of non-verbal communication of feelings.

Teachers are recommended to use a few methodological guidelines for interpreting drawings in an ethical and effective manner. First off, it would be helpful to ask the pupil what the drawing meant, to comment on common recurring patterns in several drawings of the same child and to refrain from conclusions based on an isolated work. Secondly, consider the drawing in the context of the student's relationships with their family, peers, and school. Finally, privacy for the child and avoiding intrusive or evaluative interpretations are a must to keep him/her safe emotionally and maintain his/her trust.

It is important for drawing to not be regarded as the only source of pupils' emotional or social state assessment but as the means that can be used in addition to other assessment and observation methods. Utilising drawing as a method of expression and reflection, teachers can support the creation of an empathic and inclusive climate, emotional safety, and deep awareness of pupils' needs and nurture their holistic development.

6. Conclusions

Social support can play a crucial role in shaping students' impressions and experiences during the foundational learning cycle, being associated with both emotional support and practical assistance obtained within the educational environment. According to the findings, students

identify teachers, classmates, and, to a lesser extent, parents as the main sources of social support. These figures play significant roles in their daily learning and shared play activities. The manifestations of support range from affective gestures, such as hugs, emotional reassurance, and encouragement, to tangible assistance with academic tasks or social events. The use of warm colours (red, yellow, pink), along with frequently recurring symbols (hearts, stars) that convey a positive impression of the school's social environment, suggests that this environment is perceived as highly desirable.

Teachers are therefore given the task to use drawing not as a solitary assessment tool but as a member of a larger educational team. Individual or group sessions discussing drawing as a guided procedure may help pupils to formalise their intentions and voice verbally the course of events and plans visualised graphically. In situations where the drawings are suggesting anxiety, isolation or conflict, the teacher can then work with the school counsellor, turning it into a point of departure for individualised interventions and specific emotional support.

At the same time, drawing can be used as a form of promoting social cohesion by way of shared actions that favour sharing and discussion of the experiences portrayed graphically. In that sense the pupils' drawings do not only represent a lived reality but actually become a means of communicating and deepening our perception of kids' emotional and social needs.

Moreover, the drawings depicting groups or pairs suggest that the underlying motivation for social integration is to ensure a sense of security. But they also show how little kids understand that such a sense of security can only be produced by a confluence of factors. The study thus highlights not only the instrumental but also the emotional significance of social support in children's lives, which has a major impact on their well-being, motivation, and school engagement. The findings support Vygotsky's theoretical perspectives on the role of social interaction in learning and development, confirming this effect. It is demonstrated that fostering a warm and supportive educational environment can play a crucial role in the social, emotional, and educational development of young students.

The study presents several important limitations that must be acknowledged to properly understand the value and applicability of its findings. Specifically, the small number of participants and the homogeneity of the sample, drawn from a single educational context, limit the generalisability of the conclusions. Additionally, the interpretation of the drawings involves an inevitable degree of subjectivity, even though it was guided by references from the specialised literature. The absence of complementary methods, such as interviews with parents and teachers or direct observations, further narrows the perspective on children's perceptions of social support. Moreover, the young age of the participants may influence their ability to express emotional and relational nuances through drawing, and the context in which the drawings were created (the child's mood, the physical environment) was not controlled. Furthermore, the study did not examine gender or class differences, factors that could have provided additional relevant insights. Therefore, the findings should be regarded as exploratory, offering valuable indications, but they cannot be considered universally applicable.

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