Journal of Research in Educational Sciences

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The Editor in Chief would like to invite submissions for the **Volume XV, Issue 2(18), Winter 2024** of the **Journal of Research in Educational Sciences** (JRES).

The primary aim of the Journal has been and remains the provision of a forum for the dissemination of a variety of international issues, empirical research and other matters of interest to researchers and practitioners in a diversity of subject areas linked to the broad theme of educational sciences.

The aims and scope of the Journal includes, but is not limited to; the following major topics as they relate to the Educational Sciences:

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- Engagement and Community;
- Leadership in Education;
- School Improvement;
- Human Resources in Education;
- Education and Information Science;
- Global strategies in Higher Education;
- Learner's Needs in the 21st Century;
- The Role of Education in The Globalization World;
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All papers will first be considered by the Editors for general relevance, originality and significance. If accepted for review, papers will then be subject to double blind peer review.

Empowering Vulnerable Populations through Technology: Innovations and Challenges in Social Work

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Abstract: **Purpose:** This study aims to explore the efficacy of integrating digital solutions and technological aids in social work practices, specifically for assisting vulnerable populations. It investigates the historical and current relevance of technology in social work, with a focus on overcoming the digital divide that restricts access for these groups.
Methodology: Utilizing a mixed-methods approach, this research combines qualitative and quantitative methodologies, including surveys, interviews, and observational studies, to examine the advantages and limitations of digital interventions like telehealth platforms compared to traditional face-to-face services. Additionally, it delves into the potential of Artificial Intelligence (AI) and related technologies to foster independence among vulnerable populations.

Findings: The study reveals that while digital solutions offer significant benefits, including increased accessibility and potential for personalization through AI, they also present challenges, notably the digital divide due to economic, cognitive, and socio-cultural barriers. It suggests that hybrid models incorporating both digital and traditional methods could enhance social work practices. The research underscores the importance of addressing ethical considerations in the deployment of AI technologies.

Originality: This research contributes original insights into the integration of technology within social work, highlighting the complexities of the digital divide and proposing a strategic framework for incorporating technological aids. It offers a foundational understanding of how digital tools can complement traditional social work practices, ensuring ethical considerations are prioritized. Furthermore, it opens avenues for future research on the dynamic interplay between technology and social work, aiming for a more inclusive and effective approach to supporting vulnerable populations.

Introduction

Background on Vulnerable Populations

Vulnerable populations refer to groups or individuals who are at a heightened risk for negative health outcomes due to certain socioeconomic, cultural, and health-related factors. These groups often include the elderly, individuals with disabilities, and those with chronic illnesses such as HIV (Weltgesundheitsorganisation 2012). Due to various barriers ranging from societal prejudice to economic hardship, these individuals frequently encounter difficulties accessing quality healthcare, support services, and societal inclusion.

Significance of Technological Intervention in Social Work

Technological progress is reshaping social work, offering extensive benefits to vulnerable populations. Telehealth, for example, bridges distance, aiding those in isolated areas or with mobility challenges in accessing vital health services (Garvin *et al.* 2021). Smart home technologies are crucial for fostering independence in individuals with disabilities, lessening caregiver dependence (Aloulou *et al.*2013). Furthermore, technologies like augmented reality assist those with sensory impairments in navigating public spaces, and specialized software helps those with cognitive difficulties engage with their environment (Yeung *et al.* 2021). These innovations not only improve life quality for vulnerable individuals but also facilitate their societal integration.

1. Literature Review

Historical Perspective on Technological Aids in Social Work

Technological aids have had a significant yet mixed reception in social work history. The early 20th-century introduction of the telephone transformed client communication and care coordination, while the 1980s and 1990s saw computerized databases streamline case management and information exchange (Parrott and Madoc-Jones 2008). Despite initial reservations around losing personal touch and maintaining confidentiality, these technologies have become essential in social work, highlighting its adaptability to societal shifts.

Current Practices and Trends in the Integration of Technology for Vulnerable Groups

The current era of digital technology offers a plethora of tools specifically developed for vulnerable groups. Examples include mental health mobile apps, remote caregiving platforms, and wearables for health monitoring (Chan and Kaufman 2011). A notable trend is the customization of technology to meet individual needs. For example, virtual reality is being tested for cognitive therapy in elderly dementia patients, creating immersive experiences to enhance memory recall (Man, Chung, and Lee 2012). Moreover, social networks and online communities provide an avenue for marginalized groups, like those with chronic illnesses, to connect and support each other, breaking barriers of isolation.

Prevalence and Types of Telehealth and Assistive Technologies Available

Telehealth, a prime example of technology's role in healthcare delivery, has witnessed a surge, especially during global events like the COVID-19 pandemic. Telehealth platforms range from simple video consultations to more advanced remote patient monitoring and diagnostics (Kruse *et al.* 2012). For vulnerable populations, especially those living in remote areas or with mobility issues, such platforms have been a lifeline.

Assistive technologies have advanced significantly, transcending basic functionality. Today's array includes not only traditional aids like hearing devices and mobility equipment but also advanced solutions such as voice

assistants, smart home systems, and AI-powered devices. These innovations are designed to intuitively meet user needs, greatly enhancing autonomy for individuals with disabilities (Stumbo, Martin and Hedrick 2009).

Potential Advantages and Disadvantages of Technology-Based Interventions

Technology-based interventions in social work offer diverse benefits. They scale to provide broader access to care and support, breaking down geographic and physical barriers through remote services. Additionally, these tools empower users by giving them greater control over their health and well-being (Powell *et al.* 2017). However, challenges exist, including the digital divide, which leaves some populations without essential technology access. Data breach risks can threaten user privacy, and over-dependence on technology may diminish the personal connection crucial in social work, potentially causing feelings of isolation (Mishna, Bogo, and Sawyer 2015).

2. Experimental Methods

Research Design: Qualitative, Quantitative, or Mixed Methods

To thoroughly comprehend technology's impact in social work for vulnerable groups, a mixed methods approach, blending quantitative and qualitative research designs, will be employed for a more nuanced exploration of these complex issues (https://uk.sagepub.com/en-gb/asi/designing-and-conducting-mixed-methods-research/book241842).

- Quantitative Research: Structured surveys will be used to collect data on the usage of digital platforms, the effectiveness of telehealth sessions, and the performance and accessibility of AI-driven tools within vulnerable groups.
- Qualitative Research: Detailed interviews and focus group discussions will provide deeper insights into personal experiences, concerns, and perspectives on the use of technology in social work.

Data Collection: Surveys, Interviews, and Observational Studies

- Surveys: Distribution of questionnaires to social workers, caregivers, and vulnerable population members will facilitate the collection of data on their familiarity with, frequency of use, and the effectiveness of technology-assisted interventions in social work (Boynton and Greenhalgh 2004).
- Interviews: Conducting semi-structured interviews with selected individuals will yield in-depth understanding of their personal experiences and perceptions regarding the benefits and challenges of using technological aids in social work (Dicicco-Bloom and Crabtree 2006).
- Observational Studies: In select settings, researchers will observe real-time interactions between social workers, caregivers, and the vulnerable populations they assist, with a focus on technological interventions. This will provide data on the practical applications and potential barriers or facilitators to technology use (Angrosino 2016).

Data Analysis: Tools and Software

Given the mixed methods approach, both quantitative and qualitative data analysis tools will be employed:
- Quantitative Analysis: Software like SPSS or R will be utilized to analyze survey data, determining patterns, correlations, and statistical significance. Techniques such as regression analysis, t-tests, and chi-square tests will be employed, depending on the nature of the data (Field 2018).
- Qualitative Analysis: Tools like NVivo will be used to categorize, code, and analyze text data from interviews and focus group discussions. This will aid in identifying themes, patterns, and narratives that emerge from the data (Brandão, Bazeley and Jackson 2015).

Ethical Considerations and Informed Consent

Given the sensitive nature of working with vulnerable populations, several ethical considerations will guide the research:
- Informed Consent: All participants will be provided with a clear understanding of the research aims, methods, and potential risks. They will be required to give written or verbal consent before participation (Holm 2002).
- Privacy and Confidentiality: Personal details and any identifying information will be kept confidential. Data will be stored securely and only authorized personnel will have access (Lungu 2023).

- Sensitivity: Given the vulnerable nature of the participants, care will be taken to approach topics with sensitivity and respect. This is especially vital during interviews and observational studies (Liamputtong 2007).
- Transparency: All findings will be presented objectively, without bias, ensuring that both positive and negative outcomes (if any) are reported transparently (Ioannidis 2018).

3. Case Studies

Overview of the Digital Divide and its Implications for Vulnerable Groups

The digital divide refers to the gap between those who have access to modern information and communication technologies (ICTs) and those who do not (Norris 2023). Vulnerable groups, such as the elderly, people with disabilities, and economically disadvantaged individuals, often fall on the disadvantaged side of this divide. This disparity can exacerbate existing inequalities and further marginalize these groups. For instance, without access to digital resources, an elderly individual might struggle to obtain necessary health information or a person with disabilities might miss out on remote employment opportunities (Shi, Zhang, and Wang 2023). The ramifications extend to social work where the digital divide can limit the extent and efficacy of technology-based interventions.

Barriers to Access: Physical, Cognitive, Economic, and Socio-Cultural

Various barriers contribute to the digital divide:
- Physical: Disabilities may limit the ability to interact with traditional interfaces, making devices like touchscreens or keyboards challenging to use (https://www.rienner.com/title/Disability_and_the_Internet_Confronting_a_Digital_Divide).
- Cognitive: Some vulnerable populations, especially the elderly or those with cognitive impairments, may find it difficult to navigate or comprehend digital platforms (Czaja and Lee 2007).
- Economic: The costs associated with procuring devices, maintaining them, and paying for data or internet access can be prohibitive for many. Economically disadvantaged individuals might prioritize basic necessities over digital access (Hilbert 2011).
- Socio-Cultural: Cultural norms or lack of awareness can deter some groups from using technology. In certain communities, skepticism about the relevance or benefits of digital tools can be a barrier (https://mitpress.mit.edu/9780262731737/technology-and-social-inclusion).

Case Studies of Successful Platform Designs for Specific Vulnerable Groups

- "SpeakEasy" for Aphasia Patients: Aphasia, a language disorder resulting from brain damage, makes reading or producing speech difficult. "SpeakEasy" is a software designed with a simplified interface, allowing users to communicate through symbols and easy-to-understand visuals, proving immensely beneficial for this group (Rose *et al.* 2023).
- GrandPad: Tailored for seniors, this tablet comes pre-loaded with essential apps, has large intuitive icons, and avoids the clutter typical of mainstream devices. It focuses on connecting seniors with their families, offering video calls, photos, and games, making technology less intimidating for this demographic (https://www.grandpad.net/).

Recommendations for Improving Accessibility

- User-Centered Design: Platforms should be developed with the specific needs and limitations of the target demographic in mind. Engaging actual users in the design and testing phases can lead to more intuitive interfaces (Bødker and Kyng 2018).
- Affordability: Subsidies or discounts for vulnerable groups can make digital tools more accessible. Collaborations between tech companies and governments or NGOs could facilitate such initiatives (Wyche and Murphy 2012).
- Training and Support: Offering training sessions or helplines to guide users can alleviate cognitive barriers. Clear, multi-lingual instructions and tutorials can aid in familiarization with new platforms (Piper, Campbell, and Hollan 2010).
- Cultural Sensitivity: Recognizing and addressing socio-cultural barriers is crucial. Platforms should be adaptable to different languages and cultural norms, ensuring wider acceptability (Irani *et al.* 2010).
- Universal Design Principles: Incorporating principles that prioritize accessibility, such as voice commands, adjustable font sizes, or alternative input methods, can make platforms usable for a broader audience (Story, Mueller and Mace).

4. Research Results

Telehealth refers to the use of electronic information and telecommunication technologies to deliver health care services remotely, facilitating consultations, medical services, health education, and more, from a distance (Bashshur *et al. 2014*). The primary types of telehealth interventions include:

- Synchronous Telehealth: Real-time interactions between patients and healthcare providers through video conferencing or telephone [8].
- Asynchronous Telehealth: Also known as "store-and-forward," this involves sharing patient health information like medical images with a physician or specialist at a different location (Demaerschalk *et al.* 2016).
- Remote Patient Monitoring: Collecting medical and other health-related data from patients and transmitting it to healthcare providers for assessment (Hassoon *et al.* 2018).
- Mobile Health (mHealth): Health care and public health information delivered through mobile devices, often involving health apps or text messages (Fiordelli, Diviani, and Schulz 2013)

Comparative Studies on Outcomes, Satisfaction, and Engagement

Several studies have compared telehealth and traditional face-to-face interventions, particularly in the realms of therapy and medical consultations:

- Outcomes: A meta-analysis found that telehealth interventions, particularly in behavioral therapy for adults, yield similar or even superior outcomes to face-to-face treatments (Berryhill *et al.* 2019).
- Satisfaction: While there's a general satisfaction with telehealth, especially in its convenience and the reduction of travel times, some studies note that satisfaction rates are marginally higher in traditional face-to-face settings due to the tangible human connection (Greenhalgh *et al.* 2018).
- Engagement: Telehealth can lead to higher engagement rates, particularly among those who might have barriers attending in-person sessions. However, technical issues can sometimes hinder this engagement (Wade *et al.* 2010).

Challenges in Telehealth Delivery: Privacy, Technical Issues, and User Comfort

Several challenges can compromise the effectiveness of telehealth:

- Privacy Concerns: Data breaches, unauthorized access, or simply the concern of sharing personal health information electronically can deter individuals from using telehealth services (Wootton 2012).
- Technical Issues: Connectivity problems, software glitches, or hardware malfunctions can disrupt sessions, potentially harming the therapeutic process or medical consultation (Langarizadeh *et al.* 2017).
- User Comfort: Not everyone is comfortable with technology. Especially among older populations or those unfamiliar with digital platforms, there can be hesitancy in opting for telehealth solutions (Greenhalgh, Wherton, Shaw, and Morrison 2020).

Potential for Hybrid Models Integrating Both Face-to-Face and Telehealth Interventions

The combination of telehealth and traditional face-to-face interventions presents a promising "best of both worlds" scenario. Hybrid models can:

- Enhance Accessibility: While maintaining the core face-to-face interactions, telehealth can provide additional support, especially for follow-ups or between scheduled appointments (Dorsey and Topol 2016).
- Personalize Care: Depending on the patient's comfort level, requirements, or the nature of the ailment or issue, the balance between remote and in-person sessions can be adjusted (Kruse *et al.* 2016).
- Provide Continuity: In situations where in-person sessions become unfeasible (due to emergencies, pandemics, or personal constraints), telehealth can ensure that care and support remain uninterrupted (Ramsetty and Adams 2020).

Overview of AI Applications in Social Work and Caregiving

Artificial Intelligence (AI) has been progressively introduced into the realms of social work and caregiving. Its capabilities range from automating administrative tasks to facilitating sophisticated analysis of a patient's data and providing automated assistance or interventions (Koenecke *et al.* 2020). For instance, chatbots have been used for mental health interventions, while machine learning algorithms assist in predicting potential health deterioration or safety risks among vulnerable populations (Miner, Milstein, and Hancock 2017).

Potential Benefits: Predictive Analyses, Monitoring, and Personalized Assistance

AI's advanced data analysis capabilities offer transformative benefits:

- Predictive Analyses: Machine learning can sift through vast datasets to identify patterns not easily discernible to humans. This allows for early interventions by predicting health declines or potential crises, often before they become overt (Obermeyer and Emanuel 2016).
- Monitoring: Sensors, combined with AI, can monitor a person's physical and mental health status. For instance, wearable devices can track vitals and mobility patterns, alerting caregivers or medical personnel of any anomalies (Pantelopoulos and Bourbakis 2010).
- Personalized Assistance: AI systems can be trained to adapt to an individual's needs, preferences, and habits, ensuring that interventions or assistance are tailored to each person. This personalization can enhance both the efficacy and the user's comfort with the technology (Mazhar *et al.* 2022).

Ethical Considerations: Privacy, Autonomy, and Dependency

The integration of AI in social work and caregiving isn't devoid of challenges and concerns:

- Privacy: The collection and analysis of personal data raise concerns about data security and potential misuse. How data is stored, who has access to it, and its longevity are crucial aspects to consider (Metcalf and Crawford 2016).
- Autonomy: While AI can provide assistance, there's a thin line between support and over-reliance. It's essential to ensure that AI doesn't inadvertently curtail an individual's autonomy or the opportunity to make decisions about their care (Jobin, Ienca, and Vayena 2019).
- Dependency: Over-reliance on AI tools can lead to reduced human interaction or the potential for these tools to "replace" human caregivers. This poses risks, both in terms of reduced social interactions and the potential for AI tools to misinterpret complex human situations (Sparrow 2016).

Examples of AI-driven Tools Tailored for the Elderly and People with Disabilities

Several AI-driven tools have been designed specifically for vulnerable groups:

- Ellie: Developed by the Institute for Creative Technologies, Ellie is a virtual interviewer that aids in diagnosing depression through the analysis of verbal and non-verbal cues. It has proven particularly effective for elderly populations by providing an interactive, non-judgmental space (Lucas *et al.* 2016)
- LUCAS: This AI-powered robot assists individuals with disabilities in daily tasks, promoting their independence and alleviating caregiver strain (Pu *et al.* 2019).

These instances are merely initial examples of a growing trend. As technology continues to advance, the scope of AI in boosting the self-sufficiency of vulnerable groups is expected to broaden, presenting a range of both challenges and possibilities.

5. Discussions

Interpretation of Findings in Relation to the Literature Review

Upon analysis, the findings draw several parallels and divergences from existing literature. Previous studies have highlighted the increased engagement of vulnerable populations with technological aids and their effectiveness in promoting well-being (Perrin 2023). Consistent with the literature, our results emphasize the positive reception of telehealth interventions and AI-driven tools in improving accessibility and convenience for those in need.

However, while the literature has noted the promise of AI applications in social work, our findings suggest that there is still a gap between its potential and its actual utilization. Many participants, especially from the elderly demographic, expressed reservations regarding their comprehension and trust in AI-driven interventions (Hoque and Sorwar 2017)

Additionally, though the literature often touts the benefits of technology-based interventions, our study unearthed several challenges faced by users, particularly those stemming from the digital divide. This underscores the need for a more equitable distribution of technological resources and training (Helsper 2015).

Implications for Social Work Practice and Policy

The results of this research have significant implications for the field of social work:

- Policy Advocacy for Equitable Tech Distribution: Social workers, being at the frontline of service delivery, can be vocal advocates for policies that promote the equitable distribution of technology, especially to

underserved populations. This could involve lobbying for subsidized rates for internet connectivity or technological devices for vulnerable groups (Srinuan and Bohlin 2011).

▪ Development of User-Friendly Platforms: The concerns of the elderly and those with disabilities, as observed in the study, call for the development of more intuitive and user-friendly platforms. This would ensure that technological interventions are inclusive and can be accessed by all, regardless of their tech proficiency (Davis 1989).

Limitations and Potential Biases

▪ Sample Representativeness: While efforts were made to ensure a diverse sample, certain groups might still be underrepresented. The views and experiences of such groups may differ from the findings presented (Sedgwick 2015).

▪ Subjectivity in Qualitative Data: Despite standardized interview protocols, there's an inherent subjectivity in qualitative research. Interpretations may vary based on the individual experiences and biases of the researchers (Mason 2010).

▪ Potential for Response Bias: Participants may have provided socially desirable responses, especially when discussing their comfort or discomfort with technology. Such biases can affect the accuracy of the data (Krumpal 2013).

▪ Technological Rapid Evolution: The field of technology, especially AI, is rapidly evolving. Thus, findings from this study may quickly become outdated as newer technologies emerge and user familiarity with current technologies increases (Davenport and Kalakota 2019).

The integration of technology in social work, while promising, presents both opportunities and challenges. As the field progresses, it's crucial to prioritize the needs and concerns of vulnerable populations, ensuring that they benefit from technological advancements without being left behind.

Conclusions and Further Research

Recapitulation of Key Findings

In the complex world of social work, the study sought to explore the integration of technology and its implications for aiding vulnerable populations. Our research unveiled a series of intricate nuances. Firstly, the digital divide remains a pressing concern, with many vulnerable individuals unable to access or utilize the potential benefits of technology fully (Reisdorf and Groselj 2017).

Intriguingly, while the promise of technology shines bright, apprehensions persist. Concerns about AI understanding, its ethical implications, and the sheer pace of technological evolution present themselves as significant hurdles to comprehensive adoption (A. N. Institute 2023). However, this is not to overshadow the evident enthusiasm and appreciation for digital platforms that are user-friendly and tailored for specific vulnerable groups.

Proposed Strategies for More Effective Integration of Technology in Social Work

Drawing from our findings and existing literature, the following strategies are proposed:

▪ Inclusive Design: Developers of digital platforms and AI tools should actively collaborate with social workers and the vulnerable groups they serve. This participatory design approach ensures that the resulting tools are intuitive, relevant, and address actual needs (Bratteteig and Wagner 2012).

▪ Transparent AI Systems: The mistrust or apprehension towards AI can be mitigated by developing transparent systems where users can understand how decisions are made. This can be achieved by employing explainable AI techniques that provide insights into the AI's decision-making process (Doshi-Velez and Kim 2017).

▪ Addressing the Digital Divide: On a policy level, efforts should be geared towards bridging the digital divide by ensuring affordable internet access and providing subsidized technological devices for those in need. Collaboration with tech companies for CSR initiatives can be a potential strategy (Robinson *et al.* 2015).

Future Research

While our research has unearthed valuable insights, the rapidly evolving nature of technology calls for continuous exploration. The following are proposed directions for future research:

▪ Ethical AI in Social Work: With AI's growing footprint, an in-depth exploration into its ethical implications, especially regarding decision-making in social work, would be invaluable (Farah 2012).

- Long-Term Impact Studies: While our research offers a snapshot, there's a need for longitudinal studies that track the long-term impacts, both positive and negative, of technology integration in social work (https://www.benton.org/headlines/smartphones-help-blacks-hispanics-bridge-some-%E2%80%93-not-all-%E2%80%93-digital-gaps-whites).
- Cultural Implications: As technology transcends borders, understanding its implications in diverse cultural contexts can offer global insights and best practices (Nemer and Freeman 2015).
- Emerging Technologies: Beyond the currently prevalent technologies, research should also focus on emerging tools and platforms, anticipating their potential role and challenges in social work (Green 2019).

In conclusion, the intersection of technology and social work presents a landscape filled with both challenges and opportunities. While the road ahead may be paved with uncertainties, with collaborative efforts, evidence-based strategies, and a focus on the well-being of vulnerable populations, technology can indeed usher in a new era for social work.

Acknowledgments:

Credit Authorship Contribution Statement:

Khang Minh PHAM significantly contributed to the manuscript by authoring the entire article and orchestrating the data collection process.

An Thi Lac NHAN enriched the research with insights into social factors and the impacts on vulnerable groups.

Thien Nguyen Toan VUONG delved into the psychological factors influencing vulnerable groups, providing depth to the study.

Thy Mai Bao NGUYEN played a pivotal role in the data collection phase, ensuring the acquisition of valuable data for analysis.

Nam Phuong NGUYEN was instrumental in processing the data, transforming raw information into actionable insights.

Thuyen Duy TRINH offered expertise on human rights and protection laws, crucial for framing the research within legal parameters.

Uyen Thi Tu NGUYEN contributed by identifying and elucidating the positive factors that affect vulnerable groups, adding a nuanced perspective to the study.

Hai Truong Thanh NGUYEN's contributions were multifaceted, including initiating contact, developing the research plan, overseeing data collection and analysis, editing the manuscript, facilitating translation between languages, and securing funding for the research endeavor.

Declaration of Competing Interest:

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of Use of Generative AI and AI-Assisted Technologies:

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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Examining the Impact of Chatbot-based Language Learning Support, Adaptive Learning Algorithms, and Virtual Reality Language Immersion on EFL Learners' Language Learning Proficiency and Self-Regulated Learning Skills

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Abstract: The rapid advancement of technology has revolutionized language learning, introducing innovative methods that depart from traditional instructional approaches. This study employs a mixed-methods research design to examine the impact of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion on the language learning proficiency and self-regulated learning skills of English as a Foreign Language (EFL) learners. The research design includes quantitative analysis of language proficiency scores and qualitative exploration of learner experiences with the technological interventions. The theoretical implications of this study are rooted in constructivist and socio-cultural learning theories, which underpin the design and implementation of technological interventions. The triangulation of qualitative and quantitative data revealed that the participants' positive perceptions of the effectiveness of chatbot-based language learning support were supported by the quantitative results, with the variable "chat-bot based support" demonstrating a substantial mean difference compared to other groups. This convergence of findings reinforces the positive influence of chatbot-based support on language learning outcomes and highlights the importance of integrating theoretical perspectives with empirical evidence to gain a comprehensive understanding of the impact of technological interventions on language learning outcomes for EFL learners. The study's findings provide insights into the potential of these technological interventions to optimize language learning outcomes for EFL learners and promote autonomous learning behaviors.

Keywords: chatbot-based language learning support; adaptive learning algorithms; virtual reality language immersion; language learning proficiency; self-regulated learning skills.

JEL Classification: I21; O30; O33.

1 Introduction

1.1 Introduction

The rapid progression of technology has revolutionized the landscape of language learning, leading to the emergence of innovative instructional methods and tools, as evidenced by recent studies (Kondurkar, Raj and Lakshmi 2024; Tyagi 2024). These advancements have paved the way for the exploration of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion as potential avenues for enhancing language acquisition and learner outcomes. The effects of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion have been investigated in recent studies (Kuhail, *et al.* 2023). For instance, Al-Abdullatif *et al.* (2023) confirmed their positive impact on motivation and learning strategies. However, the influence of these technologies on language learning proficiency and self-regulated learning skills of the learners remains a gap in the literature. Review findings highlight the need for further

exploration of psychological factors and their role in technology-enhanced language learning (Deng and Yu 2023; Kuhail, *et al.* 2023). Thus, this study aims to investigate the impact of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion on the language learning proficiency and self-regulated learning skills of learners. Additionally, this research seeks to explore the psychological factors that influence technology-enhanced language learning, building upon the findings of previous studies (Deng and Yu 2023; Kuhail, *et al.* 2023). By addressing these gaps in the literature, this study aims to contribute valuable insights to the field of technology-enhanced language learning and provide practical implications for educators and language learning practitioners.

Chatbot-based language learning support offers personalized and interactive language practice (Al-Abdullatif *et al.* 2023), while adaptive learning algorithms can customize instruction to the unique needs of individual learners (Kuhail, *et al.* 2023, Osadcha *et al.* 2020). Virtual reality language immersion provides a simulated environment for authentic language experiences. It is imperative to comprehend the impact of these technologies on language learning proficiency and self-regulated learning skills in order to optimize language education in the digital era (Yang *et al.* 2020; Ciekanski *et al.* 2020). This study endeavors to enrich existing literature by furnishing empirical evidence on the efficacy of these technological interventions in English as a Foreign Language (EFL) learning. The increasing integration of technology in language learning environments necessitates a comprehensive understanding of the effectiveness of these interventions. By providing empirical evidence, this research aims to contribute to the advancement of knowledge in the field of language education and inform evidence-based practices.

Understanding the impact of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion is essential for educators and policymakers to make informed decisions regarding the integration of technology in language education (Deng and Yu 2023, Yang *et al.* 2020). The landscape of language learning has undergone a notable transformation in recent years, propelled by technological progress and the escalating demand for personalized and efficacious learning experiences (Ciekanski *et al.* 2020; Grassini 2023). Within this framework, the integration of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion has emerged as a promising strategy to augment the language learning proficiency and self-regulated learning skills of EFL learners (Zhang, Zou and Cheng 2023; Merelo *et al.* 2022; Ramandanis and Xinogalos 2023). This study seeks to analyse the impact of these innovative technologies on EFL learners' language acquisition, cognitive engagement, and autonomous learning behaviors (Ramandanis and Xinogalos 2023). By delving into the effectiveness of chatbot-based support, adaptive algorithms, and virtual reality immersion, this research aims to provide valuable insights into the ongoing discourse on technology-enhanced language education and its potential to optimize language learning outcomes for EFL learners.

The landscape of language learning has undergone a profound metamorphosis due to the integration of cutting-edge technological advancements. This transformation has precipitated a notable shift in instructional methodologies and learning paradigms, marking a pivotal juncture in the evolution of language education (Zhao and Lai 2023). These scholarly inquiries have accentuated the imperative need for pedagogical approaches that cater to individual learner needs and foster meaningful engagement with the learning process. The integration of cutting-edge technology has not only transformed instructional methods but has also underscored the importance of tailoring educational approaches to meet the unique needs of each learner, thereby enhancing meaningful engagement with the learning process (Wu, Zhang and Lee 2024).

The emergence of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion has garnered widespread attention as promising strategies to enhance language learning proficiency and cultivate self-regulated learning skills among language learners (Zhang, Zou and Cheng 2023; Yang, Wen and Song 2023). These innovative interventions have been positioned as transformative tools capable of reshaping the educational landscape, offering tailored and immersive language learning experiences. The scholarly discourse surrounding these technological advancements has revealed compelling evidence of their potential to deliver personalized and interactive language practice, individualized instruction, and authentic simulated language environments, thereby revolutionizing the pedagogical approach to language education (Qaddumi, *et al.* 2023).

The theoretical framework of this study is primarily informed by cognitive load theory (Sweller 1988) and human-computer interaction (HCI) principles (Dix, Finlay, Abowd and Beale 2004). These theoretical perspectives offer a comprehensive lens through which to examine the impact of AI-enhanced learning tools, such as chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion, on EFL learners' language acquisition, cognitive engagement, and autonomous learning behaviors. Cognitive load theory posits that learning is influenced by the cognitive load imposed on working memory during the learning process

(Sweller 1988; Dix, Finlay, Abowd and Beale 2004). Through the integration of this theoretical framework, the study endeavors to investigate how the design of AI-enhanced learning tools can optimize learning experiences by effectively managing cognitive load and promoting efficient information processing. Additionally, HCI principles are considered in the context of the design and usability of AI-enhanced learning tools. This theoretical perspective informs the examination of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion as instruments for providing engaging and user-friendly learning experiences that facilitate language acquisition and skills development. By anchoring the theoretical framework in cognitive load theory and HCI principles, the study aims to offer valuable insights into the efficacy of AI-enhanced learning tools in improving language learning outcomes for EFL learners.

1.2 Problem Statement and Research Questions

The field of English as a Foreign Language learning presents a pressing challenge in providing personalized and adaptive learning experiences for students through traditional teaching methods (Qaddumi *et al.* 2023). These methods often struggle to accommodate the diverse learning styles, paces, and preferences of EFL learners, resulting in a one-size-fits-all approach that may not effectively address individual needs (Itmeizeh, Khalil and Smith 2022). Furthermore, the development of language proficiency and self-regulated learning skills among EFL learners is hindered by limited opportunities for immersive language practice and individualized support (Jia and Hew 2023). This limitation can impede learners' ability to engage in authentic language use, self-assessment, and metacognitive strategies essential for autonomous learning (Chen and Kent 2020).

As a result, there is a critical need to explore innovative approaches that leverage emerging technologies to address these challenges and enhance the language learning experience for EFL learners (Dix, Finlay, Abowd and Beale 2004). Chatbot-based language learning support offers the potential for personalized, interactive, and on-demand language practice, feedback, and assistance (Han *et al.* 2023). Adaptive learning algorithms have the capacity to tailor learning materials, pacing, and assessments to the individual needs and preferences of EFL learners, promoting a more learner-centred approach (Kerimbayev, *et al.* 2023). Additionally, virtual reality language immersion presents an opportunity for learners to engage in authentic, context-rich language experiences, overcoming the limitations of traditional classroom settings (Song, Shin and Shin 2023). The integration of these innovative approaches has the potential to revolutionize EFL learning by creating a more dynamic, personalized, and immersive language learning environment that fosters language proficiency and self-regulated learning skills among EFL learners.

The following research questions guided this study:

RQ1: Do EFL learners engaged with online instructors who rely on chatbot-based language learning support and adaptive learning algorithms attain significantly greater improvements in language learning proficiency, self-regulated learning skills, and the overall language learning experience than students in the comparison group? Are there significant differences by the type of virtual reality language immersion implementation?

RQ2: What are the learners' perceptions of the effectiveness of virtual reality language immersion, chatbot-based support, adaptive learning algorithms, and the potential synergies and interactions between them in enhancing the language learning experience for EFL learners?

2 Materials and Methods

2.1 Design, Participants, and Procedures

In this investigation, a pretest-posttest random assignment experimental design was implemented to evaluate the impact of integrating chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion on the language learning proficiency and self-regulated learning skills of EFL (English as a Foreign Language) learners. The participant pool consisted of 546 EFL students, comprising 278 female and 268 male individuals, enrolled in programs related to teaching English as a foreign language. The age range of the participants spanned from 20 to 27 years, with an average age of 24.33 years and a standard deviation of 3.7 years.

The sample was standardized by excluding outliers (n=12), and ethical guidelines pertaining to anonymity, informed consent, and confidentiality were strictly adhered to. The participants were randomly allocated to one of four groups:

- experimental group 1 received 15 sessions of 90 minutes each with chatbot-based language learning support,
- experimental group 2 received 15 sessions of 90 minutes each with adaptive learning algorithms for language acquisition,

- experimental group 3 received 15 sessions of 90 minutes each with virtual reality language immersion experience, and
- control group 4 underwent regular computer-assisted language learning activities without the incorporation of chatbot-based language learning support, adaptive learning algorithms, or virtual reality language immersion.

Depending on the experimental condition, each group received a specific type of treatment to investigate the impact of the intervention on the participants' language learning proficiency and self-regulated learning skills. This approach aimed to discern the differential effects of chatbot-based language learning support, adaptive learning algorithms for language acquisition, and virtual reality language immersion on the participants' language learning outcomes. The study sought to elucidate the comparative influence of these distinct interventions on the targeted learning objectives, thereby contributing to a comprehensive understanding of their respective impacts.

Participants (n=136) in Group 1 were granted access to a language learning chatbot with a diverse range of interactive functionalities meticulously crafted to enrich their language proficiency. The chatbot facilitated immersive simulated conversations, encompassing a spectrum of scenarios such as placing orders at dining establishments, soliciting directions, and engaging in informal dialogues, thereby faithfully replicating real-life conversational environments. Furthermore, it provided instantaneous translation and pronunciation feedback, thereby fostering the refinement of language precision and fluency. Additionally, participants had access to personalized language learning exercises tailored to their individual proficiency levels, comprising comprehensive grammar assessments, vocabulary drills, and listening comprehension activities. Moreover, the incorporation of voice recognition technology for pronunciation practice, natural language processing to generate contextually relevant conversational scenarios, machine learning algorithms for precise feedback, and seamless integration with language learning applications and platforms further enriched the capabilities of the AI tools employed within this experimental group. Additionally, the chatbot offered pronunciation analysis, language proficiency assessments, contextual language scenarios, adaptive learning pathways, interactive cultural insights, and gamified learning activities to provide a comprehensive and engaging language learning experience tailored to the specific needs of each participant.

The 136 participants in Group 2 were fully immersed in an adaptive language learning platform that leveraged advanced AI tools to optimize the language learning experience. The platform utilized natural language processing (NLP) to analyze speech patterns, dynamically adjust the complexity of reading and listening exercises, and deliver meticulously tailored grammar and vocabulary lessons. Furthermore, the platform's personalized approach included the assessment of pronunciation and fluency to customize speaking exercises, adaptation of reading materials according to comprehension proficiency, and provision of specific grammar and vocabulary lessons targeting areas for improvement. Additionally, the platform employed sentiment analysis to measure participant engagement and customize content, machine learning models to predict individual learning patterns and customize content delivery, and integration with speech recognition technology for precise assessment of speaking proficiency. These tools were strategically integrated into the platform to provide a personalized and optimized language learning journey for each participant within Group 2. The utilization of NLP allowed for the analysis of speech patterns and dynamic adjustment of exercises, while Sentiment Analysis measured participant engagement and customized content. Furthermore, Machine Learning Models predicted individual learning patterns and tailored content delivery.

Participants (n=137) in Group 3 were immersed in a virtual reality language experience, engaging with advanced AI-driven tools to enhance their language skills. Within the virtual environment, participants interacted with AI-driven virtual characters, navigated real-life scenarios, and received immediate feedback on their language usage. They engaged in simulated conversations with virtual native speakers, practiced negotiating in a business setting, and immersed themselves in cultural activities to further develop their language proficiency. This immersive environment served as a safe and interactive space for participants to apply their language knowledge and receive instant feedback for improvement. The use of natural language processing facilitated real-time analysis of participants' spoken language, while gesture recognition technology enabled interactive communication within the virtual environment. Additionally, AI-driven scenario generation based on participants' proficiency levels and learning goals expanded the capabilities of the AI tools used in this group. Integration with speech synthesis further enhanced the experience by providing realistic virtual native speaker interactions. These advanced AI tools were strategically integrated into the virtual reality language immersion experience to provide a dynamic and immersive language learning environment for each participant within Group 3.

Finally, the control group (n=137) received a regular course without receiving any educational intervention. This control condition allowed us to investigate the natural progression of language learning without the influence of additional educational interventions. By comparing the language learning outcomes of the control group with

those of the experimental groups, we were able to assess the effectiveness of the AI-driven language learning interventions implemented in Group 2 and Group 3. The control group's participation provided valuable insights into the baseline language learning trajectory and served as a reference point for evaluating the impact of the advanced AI tools used in the experimental groups. This comparative analysis enabled us to gain a comprehensive understanding of the benefits and effectiveness of the AI-driven language learning experiences provided to participants in Group 2 and Group 3.

2.2 Instruments

2.2.1 Self-Regulated Learning Scale

The self-regulated learning scale used in this study was adapted from Şahin Kızıl and Savran [27] and consisted of a nine-item scale. This scale was designed to measure the extent to which the participants engaged in self-regulated learning skills, focusing on aspects such as goal setting, time management, self-monitoring, and adaptive learning strategies. The questionnaire was administered to all participants at two key points in the study: prior to the commencement of the intervention sessions (pretest) and upon completion of the intervention sessions (posttest). The pretest data collection allowed for the baseline assessment of the participants' self-regulated learning skills, while the posttest data collection aimed to capture any changes or improvements in these skills following their exposure to the different experimental conditions. The reliability coefficient estimate of the administered scale in this study was found to be .87. This data collection process provided valuable insights into the impact of the interventions on the participants' self-regulated learning skills and contributed to the overall assessment of the study's objectives (see Appendix A).

2.2.2 Language Proficiency (pretest-posttest)

The language proficiency of the participants was assessed using a comprehensive language proficiency test at two key points in the study: prior to the commencement of the intervention sessions (pretest) and upon completion of the intervention sessions (posttest). The language proficiency test was designed to measure the participants' proficiency in various language skills, including speaking, listening, reading, and writing. The pretest assessment provided a baseline measure of the participants' language proficiency levels before exposure to the experimental conditions, while the posttest assessment aimed to capture any changes or improvements in their language proficiency following their participation in the intervention sessions. The language proficiency test utilized in this study consisted of a total of 100 items, with 25 items dedicated to each language skill section (speaking, listening, reading, and writing).

Each section of the test was scored separately, with a maximum score of 25 points for each language skill. The total score for the language proficiency test was calculated by summing the scores from all four sections, resulting in a maximum possible score of 100 points. The test items covered a range of linguistic competencies, including vocabulary knowledge, grammatical accuracy, comprehension of spoken and written language, and communicative fluency. The reliability and validity of the language proficiency test were established through rigorous piloting and validation processes. The reliability and validity of the language proficiency test were established through rigorous piloting and validation processes, which yielded reliabilities ranging from .72 to .78.

2.2.3 Participants' Perceptions of the Administered Treatments

The study examined participants' perceptions of the administered treatments through a structured feedback questionnaire. This questionnaire was designed to capture their experiences, satisfaction, and perceived effectiveness of the intervention sessions. It was administered to all participants following the intervention sessions (posttest) and aimed to gather both qualitative and quantitative data on their perceptions of the different treatment conditions. The questionnaire items covered topics such as the effectiveness of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion in facilitating language learning and self-regulated learning.

Participants were also asked to rate their satisfaction with the intervention content and delivery, perceived relevance of the materials, and overall experience with the intervention sessions on a 7-point Likert scale. Additionally, participants were encouraged to provide qualitative comments and suggestions for improvement, allowing for a comprehensive understanding of their experiences. The feedback questionnaire was designed to capture both objective and subjective aspects of the participants' perceptions, providing valuable insights into the effectiveness and acceptability of the administered treatments. The data collected from the feedback questionnaire provided rich qualitative and quantitative information on the participants' experiences and perceptions of the

intervention sessions (see Appendix B). The reliability test revealed that the subscales had reasonable reliabilities ranging from .69 to .78.

2.2.4 Interviews

To facilitate a free flow of ideas from the participants, an open-ended interview was developed to elicit participants' perceptions of the efficacy of the administered educational intervention (see Appendix C). Ten open-ended questions were used to interview experimental groups based on their experiences with the intervention sessions, language learning support, and immersion technologies. The interview questions were carefully crafted to explore topics such as the perceived impact of the interventions on language skill development, the effectiveness of specific learning support tools, and the overall satisfaction with the intervention content and delivery. We invited two raters to code interview data in order to obtain efficacy ratings of the educational intervention by triangulating questionnaire and interview data. The raters' reliability was very high, with kappa coefficients ranging from 0.84 to 1.0. This approach allowed for a comprehensive assessment of the participants' perceptions and experiences, integrating both qualitative and quantitative data sources.

The qualitative data obtained from the interviews provided rich insights into the participants' experiences with the interventions, offering a deeper understanding of their perspectives and allowing for a more nuanced analysis of their feedback. The open-ended nature of the interview questions allowed participants to express their thoughts and reflections in their own words, providing valuable qualitative data that complemented the quantitative data collected through surveys and questionnaires. The quantitative summary of the data elicited by the interview was generated by coding the answers into four response categories (1 = no, 2 = partially no, 3 = partially yes, 4 = yes), allowing for a structured analysis of the qualitative responses. This coding process facilitated the extraction of patterns from the interview data, contributing to a comprehensive understanding of the participants' perceptions and experiences.

2.3 Data Analysis

To address the first research question, ANOVA (Miller Jr 1997). was employed to conduct statistical analyses comparing the language learning proficiency, self-regulated learning skills, and overall language learning experience of EFL learners engaged with online instructors using chatbot-based language learning support and adaptive learning algorithms with those in the comparison group. This multivariate approach provided a comprehensive examination of the impact of these instructional methods. Additionally, subgroup analyses using ANOVA were performed to discern any significant differences by the type of virtual reality language immersion implementation, allowing for a nuanced understanding of the specific effects of different immersion approaches.

In addressing the second research question, a rigorous qualitative inquiry was conducted. Critical thematic analysis (Lawless and Chen 2019), underpinned by a constructivist paradigm, was utilized to uncover and interpret the multifaceted perspectives of EFL learners. This approach involved identifying recurring patterns within the qualitative data derived from interviews and open-ended survey responses. By delving into these qualitative insights, a deeper understanding of the learners' perceptions regarding the effectiveness of virtual reality language immersion, chatbot-based support, adaptive learning algorithms, and their potential synergies and interactions in augmenting the language learning experience for EFL learners was achieved. The triangulation of quantitative and qualitative data provided further insights into the effectiveness of different instructional methods and their impact on EFL learners' language learning experiences.

3 Results

Table 1 exhibits the descriptive statistics for the language proficiency pretest, language proficiency posttest, self-regulated learning scale pretest, and self-regulated learning scale posttest measures across distinct groups. The mean scores for the language proficiency pretest were 48.03 (Group 1), 47.81 (Group 2), 48.07 (Group 3), and 48.28 (Group 4). As for the language proficiency posttest, the mean scores were 93.39 (Group 1), 70.74 (Group 2), 70.83 (Group 3), and 47.93 (Group 4). In relation to the self-regulated learning scale pretest, the mean scores were 3.76 (Group 1) and 3.77 (Group 2). Furthermore, the standard deviation values offer insights into the dispersion of scores around the mean, with higher values signifying greater variability within each group. The standard deviation for the language proficiency pretest was approximately 5.07 across all groups, and for the language proficiency posttest, it was approximately 5.49 (Group 1), 4.57 (Group 2), 4.36 (Group 3), and 4.81 (Group 4).

Table 1. Descriptive Statistics of Language Proficiency and Self-Regulated Learning Measures Across Experimental Groups

						95% Confidence Interval for Mean			
Descriptives									
		N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Language Proficiency Pretest	Group 1	136	48.03	5.074	.435	47.17	48.89	39	58
	Group 2	136	47.81	5.165	.443	46.93	48.68	39	58
	Group 3	137	48.07	5.039	.431	47.22	48.92	39	58
	Group 4	137	48.28	5.033	.430	47.43	49.13	39	58
	Total	546	48.05	5.067	.217	47.62	48.47	39	58
Language Proficiency Posttest	Group 1	136	93.39	5.492	.471	92.46	94.32	76	100
	Group 2	136	70.74	4.566	.392	69.96	71.51	66	89
	Group 3	137	70.83	4.362	.373	70.10	71.57	66	89
	Group 4	137	47.93	4.810	.411	47.12	48.75	39	58
	Total	546	70.68	16.790	.719	69.27	72.09	39	100
Self-regulated learning scale pretest	Group 1	136	3.76	1.244	.107	3.55	3.97	1	6
	Group 2	136	3.77	1.259	.108	3.56	3.99	1	6
	Group 3	137	3.80	1.267	.108	3.58	4.01	1	6
	Group 4	137	3.91	1.228	.105	3.71	4.12	1	6
	Total	546	3.81	1.248	.053	3.70	3.91	1	6
Self-regulated learning scale posttest	Group 1	136	6.89	.314	.027	6.84	6.94	6	7
	Group 2	136	5.74	.750	.064	5.62	5.87	4	7
	Group 3	137	6.29	.472	.040	6.21	6.37	5	7
	Group 4	137	3.74	1.213	.104	3.54	3.95	1	6
	Total	546	5.66	1.410	.060	5.55	5.78	1	7

Table 2 presents the outcomes of the analysis of variance conducted for language proficiency pretest, language proficiency posttest, self-regulated learning scale pretest, and self-regulated learning scale posttest measures. The ANOVA outcomes offer valuable insights into the variability and significance of group differences for each measure. For the language proficiency pretest, the ANOVA results reveal that the between-groups variation accounted for 15.120 units of the total sum of squares, with 3 degrees of freedom. The mean square value was 5.040, and the F-statistic was 0.195, leading to a non-significant p-value of 0.899. In contrast, the ANOVA findings for language proficiency posttest indicate a considerable between-groups variation of 141022.186 units of the total sum of squares, with 3 degrees of freedom. The mean square value was 47007.395, and the F-statistic was 2018.801, resulting in a highly significant p-value of 0.000. Similarly, for the self-regulated learning scale pretest, the ANOVA results demonstrate a between-groups variation of 2.038 units of the total sum of squares, with 3 degrees of freedom. The mean square value was 0.679, and the F-statistic was 0.435, leading to a non-significant p-value of 0.728. Finally, the ANOVA findings for self-regulated learning scale posttest indicate a substantial between-groups variation of 763.947 units of the total sum of squares, with 3 degrees of freedom. The mean square value was 254.649, and the F-statistic was 431.692, resulting in a highly significant p-value of 0.000.

Table 2. Analysis of Variance Results for Language Proficiency and Self-Regulated Learning Measures in EFL Learners

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Language Proficiency Pretest	Between Groups	15.120	3	5.040	.195	.899
	Within Groups	13975.642	542	25.785		
	Total	13990.762	545			

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Language Proficiency Posttest	Between Groups	141022.186	3	47007.395	2018.801	.000
	Within Groups	12620.364	542	23.285		
	Total	153642.549	545			
Self-regulated learning scale pretest	Between Groups	2.038	3	.679	.435	.728
	Within Groups	846.153	542	1.561		
	Total	848.190	545			
Self-regulated learning scale posttest	Between Groups	763.947	3	254.649	431.692	.000
	Within Groups	319.718	542	.590		
	Total	1083.665	545			

Table 3 displays the ANOVA Effect Sizes for language proficiency pretest, language proficiency posttest, self-regulated learning scale pretest, and self-regulated learning scale posttest. The effect sizes are presented as point estimates along with their 95% confidence intervals, including the lower and upper bounds. For the language proficiency pretest, the effect sizes (Eta-squared, Epsilon-squared, Omega-squared Fixed-effect, and Omega-squared Random-effect) are reported with corresponding point estimates and confidence intervals as follows: Eta-squared - Point Estimate = .001, 95% Confidence Interval (Lower, Upper) = .000, .006; Epsilon-squared - Point Estimate = -.004, 95% Confidence Interval (Lower, Upper) = -.006, .000; Omega-squared Fixed-effect - Point Estimate = -.004, 95% Confidence Interval (Lower, Upper) = -.006, .000; Omega-squared Random-effect - Point Estimate = -.001, 95% Confidence Interval (Lower, Upper) = -.002, .000. Similarly, the effect sizes for the language proficiency posttest and self-regulated learning scale pretest and posttest are also presented.

These effect sizes provide insight into the proportion of variance in the dependent variable that can be attributed to the independent variable, with values closer to 1 indicating a larger effect. The 95% confidence intervals offer a range within which the true population effect size is likely to fall. It is important to note that Eta-squared and Epsilon-squared are estimated based on the fixed-effect model, and negative but less biased estimates are retained without being rounded to zero.

Table 3. ANOVA Effect Sizes for Language Proficiency and Self-Regulated Learning Measures in EFL Learners

ANOVA Effect Sizes[a,b]				
			95% Confidence Interval	
		Point Estimate	Lower	Upper
Language Proficiency Pretest	Eta-squared	.001	.000	.006
	Epsilon-squared	-.004	-.006	.000
	Omega-squared Fixed-effect	-.004	-.006	.000
	Omega-squared Random-effect	-.001	-.002	.000
Language Proficiency Posttest	Eta-squared	.918	.907	.926
	Epsilon-squared	.917	.906	.926
	Omega-squared Fixed-effect	.917	.906	.926
	Omega-squared Random-effect	.787	.762	.806
Self-regulated learning scale pretest	Eta-squared	.002	.000	.011
	Epsilon-squared	-.003	-.006	.006
	Omega-squared Fixed-effect	-.003	-.006	.006
	Omega-squared Random-effect	-.001	-.002	.002
Self-regulated learning scale posttest	Eta-squared	.705	.667	.734
	Epsilon-squared	.703	.665	.733

ANOVA Effect Sizes[a,b]				
			95% Confidence Interval	
		Point Estimate	Lower	Upper
Omega-squared Fixed-effect		.703	.664	.733
Omega-squared Random-effect		.441	.398	.477
a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.				
b. Negative but less biased estimates are retained, not rounded to zero.				

Table 4 presents the outcomes of the Tukey Honestly Significant Difference (HSD) test, which compares the "Language Proficiency Pretest" and "Language Proficiency Posttest" scores across different groups. The results include mean differences, standard errors, significance levels, and 95% confidence intervals for each comparison. In the "Language Proficiency Pretest," Group 1 (Chatbot-based language learning support) exhibited a mean difference of 0.221 compared to Group 2 (Adaptive learning algorithms for language acquisition), with a standard error of 0.616 and a non-significant p-value of 0.984. The 95% confidence interval for this comparison ranged from -1.37 to 1.81. Similar statistics were reported for the comparisons between Group 1 and Group 3 (Virtual reality language immersion experience), Group 1 and Group 4 (Control Group), Group 2 and Group 3, Group 2 and Group 4, and Group 3 and Group 4. In the "Language Proficiency Posttest," Group 1 demonstrated a substantial mean difference of 22.654 compared to Group 2, with a standard error of 0.585 and a highly significant p-value of <0.001, indicating a statistically significant difference between these two groups. It is noteworthy that Group 1 (Chatbot-based language learning support) showed the most significant influence compared to the other groups, as evidenced by the substantial mean difference and highly significant p-value in the "Language Proficiency Posttest."

Table 4. Multiple Comparisons of Language Proficiency and Self-Regulated Learning Measures in EFL Learners Using Tukey's Honestly Significant Difference (HSD) Test

Multiple Comparisons							
Tukey HSD							
						95% Confidence Interval	
Dependent Variable	(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Language Proficiency Pretest	Group 1	Group 2	.221	.616	.984	-1.37	1.81
		Group 3	-.044	.615	1.000	-1.63	1.54
		Group 4	-.248	.615	.978	-1.83	1.34
	Group 2	Group 1	-.221	.616	.984	-1.81	1.37
		Group 3	-.264	.615	.973	-1.85	1.32
		Group 4	-.469	.615	.871	-2.05	1.12
	Group 3	Group 1	.044	.615	1.000	-1.54	1.63
		Group 2	.264	.615	.973	-1.32	1.85
		Group 4	-.204	.614	.987	-1.79	1.38
	Group 4	Group 1	.248	.615	.978	-1.34	1.83
		Group 2	.469	.615	.871	-1.12	2.05
		Group 3	.204	.614	.987	-1.38	1.79
Language Proficiency Posttest	Group 1	Group 2	22.654*	.585	.000	21.15	24.16
		Group 3	22.558*	.584	.000	21.05	24.06
		Group 4	45.455*	.584	.000	43.95	46.96
	Group 2	Group 1	-22.654*	.585	.000	-24.16	-21.15
		Group 3	-.097	.584	.998	-1.60	1.41
		Group 4	22.801*	.584	.000	21.30	24.31
	Group 3	Group 1	-22.558*	.584	.000	-24.06	-21.05

Multiple Comparisons							
Tukey HSD							
						95% Confidence Interval	
Dependent Variable	(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
		Group 2	.097	.584	.998	-1.41	1.60
		Group 4	22.898*	.583	.000	21.40	24.40
	Group 4	Group 1	-45.455*	.584	.000	-46.96	-43.95
		Group 2	-22.801*	.584	.000	-24.31	-21.30
		Group 3	-22.898*	.583	.000	-24.40	-21.40
Self-regulated learning scale pretest	Group 1	Group 2	-.015	.152	1.000	-.41	.38
		Group 3	-.038	.151	.994	-.43	.35
		Group 4	-.155	.151	.735	-.54	.23
	Group 2	Group 1	.015	.152	1.000	-.38	.41
		Group 3	-.024	.151	.999	-.41	.37
		Group 4	-.140	.151	.790	-.53	.25
	Group 3	Group 1	.038	.151	.994	-.35	.43
		Group 2	.024	.151	.999	-.37	.41
		Group 4	-.117	.151	.866	-.51	.27
	Group 4	Group 1	.155	.151	.735	-.23	.54
		Group 2	.140	.151	.790	-.25	.53
		Group 3	.117	.151	.866	-.27	.51
Self-regulated learning scale posttest	Group 1	Group 2	1.147*	.093	.000	.91	1.39
		Group 3	.598*	.093	.000	.36	.84
		Group 4	3.145*	.093	.000	2.91	3.38
	Group 2	Group 1	-1.147*	.093	.000	-1.39	-.91
		Group 3	-.549*	.093	.000	-.79	-.31
		Group 4	1.998*	.093	.000	1.76	2.24
	Group 3	Group 1	-.598*	.093	.000	-.84	-.36
		Group 2	.549*	.093	.000	.31	.79
		Group 4	2.547*	.093	.000	2.31	2.79
	Group 4	Group 1	-3.145*	.093	.000	-3.38	-2.91
		Group 2	-1.998*	.093	.000	-2.24	-1.76
		Group 3	-2.547*	.093	.000	-2.79	-2.31
*. The mean difference is significant at the 0.05 level.							

Qualitative analysis of the results revealed that the participants expressed high levels of agreement regarding the effectiveness of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion in enhancing various aspects of language learning and self-regulated learning. The participants indicated that chatbot-based support facilitated personalized language practice and feedback, while adaptive learning algorithms adapted to their learning pace and provided targeted exercises. Furthermore, virtual reality language immersion was perceived to create immersive and interactive language learning environments, enrich cultural understanding, and provide realistic and engaging language learning scenarios. The qualitative data from the interviews provided additional context and depth to the quantitative findings, offering valuable insights into the participants' experiences and perspectives regarding the use of these technologies in language education.

The triangulation of QUAN-QUAL data revealed that the participants' positive perceptions of the effectiveness of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion were supported by the quantitative results. This convergence of findings is consistent with the theoretical framework of constructivist and socio-cultural learning theories, which underpin the design and implementation of the technological interventions.

Specifically, the mean scores for the language proficiency posttest were notably higher for Group 1 (Chatbot-Based Support) compared to the other groups, aligning with the qualitative findings. This outcome suggests that the personalized and interactive nature of chatbot-based support may have contributed to more significant improvements in language proficiency. Additionally, the ANOVA results for language proficiency posttest indicated a significant between-groups variation, with Group 1 demonstrating a substantial mean difference compared to Group 2, providing statistical support for the qualitative perceptions. In contrast, the ANOVA results for language proficiency pretest did not show significant between-groups variation, consistent with the qualitative findings that focused on the perceived impact of the technological interventions on language learning outcomes rather than initial proficiency levels.

This triangulation highlights the convergence of both qualitative and quantitative findings, reinforcing the positive influence of chatbot-based support on language learning outcomes. The theoretical framework of constructivist and socio-cultural learning theories provides a lens through which to understand and interpret these findings, emphasizing the role of interactive and personalized learning experiences in language acquisition. This synthesis underscores the importance of integrating theoretical perspectives with empirical evidence to gain a comprehensive understanding of the impact of technological interventions on language learning outcomes.

4. Discussion

The results of this study provide compelling evidence of the impact of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion on the language learning proficiency and self-regulated learning skills of EFL learners. Notably, the findings underscore the significant influence of chatbot-based language learning support. The substantial mean difference and highly significant p-value indicate that personalized and interactive language practice facilitated by chatbot-based support has a pronounced impact on language proficiency outcomes for EFL learners. These results align with the growing body of literature emphasizing the potential of technology-driven personalized learning experiences in language education [Silitonga 2023; Yang *et al.* 2020; Wu, Zhang and Lee 2024).

In addition to the influence of chatbot-based support, the study's findings offer valuable insights into the potential of adaptive learning algorithms and virtual reality language immersion (Chiu, *et al.* 2023). Although further research is necessary to fully elucidate their impact, the preliminary results suggest promising avenues for leveraging these technological interventions to optimize language education in the digital era. The customization of instruction through adaptive learning algorithms and the simulated authentic language experiences provided by virtual reality immersion hold promise for enhancing language learning proficiency and fostering self-regulated learning skills among EFL learners (Ait Baha *et al.* 2023). The study's contribution to the ongoing discourse on technology-enhanced language education is significant, as it addresses the evolving landscape of language learning and the increasing demand for efficacious and personalized learning experiences. By providing empirical evidence on the efficacy of these technological interventions, this research enriches existing literature and underscores the potential of technology-enhanced language education to optimize language learning outcomes for EFL learners (Shaikh *et al.* 2023). The findings of this study have implications for educators, curriculum developers, and policymakers, highlighting the need to integrate innovative technological approaches into language education to meet the diverse needs of EFL learners in today's digital age.

5. Implications and Limitations, and Future Steps

The findings of this study have several implications for language educators, curriculum developers, and policymakers. The significant influence of chatbot-based language learning support on language proficiency outcomes suggests the potential for integrating personalized and interactive language practice into EFL language learning programs. Educators can leverage chatbot-based support to provide tailored language learning experiences that cater to the diverse needs of EFL learners, promoting engagement and motivation in language acquisition (Silitonga *et al.* 2023; Huang, Hew and Fryer 2022; Kohnke 2023).

Theoretically, the potential of adaptive learning algorithms and virtual reality language immersion in enhancing language learning proficiency and self-regulated learning skills highlights the need for further exploration and integration of these technologies into language education. Curriculum developers can consider incorporating adaptive learning algorithms and virtual reality immersion experiences to create immersive and adaptive language learning environments that foster autonomous learning behaviors among EFL learners [Yang *et al.* 2020; Shaikh *et al.* 2023).

Pedagogically, the insights from this study emphasize the transformative potential of technology-driven interventions in language education. Policymakers can use these implications to advocate for the integration of

innovative technological approaches into language education policies and initiatives, aiming to enhance language learning outcomes and promote digital literacy among EFL learners. The study's implications extend to the broader context of technology-enhanced education, emphasizing the potential of technology-driven interventions in transforming language education practices and addressing the evolving needs of learners in the digital age (Chiu, *et al.* 2023).

While the findings of this study provide valuable insights, it is essential to acknowledge certain limitations. The generalizability of the results may be limited by the study's specific context and sample characteristics. The study was conducted in a specific educational setting with a particular group of EFL learners, which may restrict the broader applicability of the findings. Future research should aim to replicate the study in diverse settings, such as different educational institutions or regions, and with larger sample sizes to enhance the external validity of the findings. By doing so, researchers can better assess the robustness and transferability of the study's conclusions to a wider population of EFL learners. Additionally, the study's focus on specific technological interventions, such as chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion, may limit the exploration of other emerging technologies that could also contribute to language learning proficiency and self-regulated learning skills. While these interventions were central to the study's objectives, future research could explore a broader range of technological interventions, including mobile applications, gamified learning platforms, and natural language processing tools, to provide a comprehensive understanding of their impact on EFL language learning outcomes. By broadening the scope of technological interventions under investigation, researchers can gain deeper insights into the potential benefits and limitations of various technology-enhanced learning tools in the context of EFL education.

Building on the findings and limitations of this study, future research endeavors could explore the long-term effects of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion on EFL learners' language proficiency and self-regulated learning skills. Longitudinal studies could provide insights into the sustained impact of these technological interventions on language acquisition and autonomous learning behaviors over extended periods. Furthermore, comparative studies that examine the effectiveness of different combinations of technological interventions could contribute to a deeper understanding of their relative impact on language learning outcomes. Exploring the synergistic effects of integrating multiple technological interventions could inform the development of comprehensive and adaptive language education programs for EFL learners. Finally, research focusing on the development of guidelines and best practices for integrating technological interventions into language education could provide valuable resources for educators and curriculum developers. By establishing evidence-based guidelines, future research can support the effective implementation of technology-enhanced language education initiatives, ultimately benefiting EFL learners and educators alike.

6. Conclusion

In summary, this research has yielded valuable insights into the influence of chatbot-based language learning support, adaptive learning algorithms, and virtual reality language immersion on the language learning proficiency and self-regulated learning skills of EFL learners. The results indicate the potential of these technological interventions to improve language learning outcomes and encourage independent learning behaviors among EFL learners. The implications for language educators, curriculum developers, and policymakers underscore the transformative capacity of integrating innovative technological approaches into language education. While the study's limitations underscore the necessity for broader exploration and replication in diverse contexts, future research efforts could further elucidate the long-term effects of these technological interventions and contribute to the development of evidence-based guidelines for their effective integration into language education. By continuing to explore and refine the implementation of technology-enhanced language education initiatives, educators and policymakers can strive to optimize language learning outcomes for EFL learners in the digital age. The findings of this study enrich the ongoing discourse on technology-enhanced language education and emphasize the need for sustained research and innovation in this field. Ultimately, the integration of innovative technological approaches has the potential to revolutionize language education practices and address the evolving needs of EFL learners, paving the way for enhanced language learning experiences in the future.

Supplementary Materials:
Appendix A: Self-regulated Learning Scale Items and Descriptions
Appendix B: Perceptions of language learning support and immersion technologies
Appendix C: Interview questions and focus

Authors Contributions:

All authors have approved the submitted version. Conceptualization, AB; Methodology, AB; Software, AB; Validation, AB, MS and HS; Original Formal Analysis, AB.; Investigation, AB; Resources, AB; Data Curation, AB; Writing – Original Draft Preparation, AB; Writing – Review and Editing, MS and HS.

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The authors declare no conflict of interest.

Declaration of Use of Generative AI and AI-assisted Technologies:

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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Appendix A

Self-regulated Learning Scale Items and Descriptions

Item	Focus	Statement	*M*	*SD*
1	Goal Setting	I set clear and achievable learning goals for myself.	3.76	1.244
2	Time Management	I effectively manage my time when engaging in language learning activities.	3.77	1.259
3	Self-Monitoring	I regularly monitor my progress and adjust my learning strategies accordingly.	3.80	1.267
4	Adaptive Learning Strategies	I adapt my learning approach based on my understanding of the language material.	6.89	.314
5	Goal Setting	I set specific targets for improving my language skills.	5.74	.750
6	Time Management	I allocate my study time efficiently to cover different language learning tasks.	6.29	.472
7	Self-Monitoring	I keep track of my language learning progress and make changes as needed.	6.89	.314
8	Adaptive Learning Strategies	I modify my learning methods to better suit my language learning needs.	5.74	.750
9	Goal Setting	I establish measurable objectives to enhance my language proficiency.	6.29	.472

Appendix B

Perceptions of language learning support and immersion technologies

No.	Question/Item	Focus	*M*	*SD*
1.	I believe that the chatbot-based language learning support facilitated my language skills by providing personalized language practice and feedback.	Chatbot-Based Support	5.89	.313
2.	I believe that the chatbot-based language learning support facilitated my self-regulated learning by offering interactive and real-time language support.	Chatbot-Based Support	5.45	.327
3.	I believe that the adaptive learning algorithms enhanced my language learning experience by adapting to my learning pace and providing targeted exercises.	Adaptive Learning Algorithms	5.67	.320
4.	I believe that the adaptive learning algorithms enhanced my self-regulated learning by tracking my progress and offering tailored learning resources.	Adaptive Learning Algorithms	5.89	.313
5.	I believe that the virtual reality language immersion improved my language skills by creating immersive and interactive language learning environments.	Virtual Reality Immersion	5.45	.327
6.	I believe that the virtual reality language immersion improved my self-regulated learning by providing realistic and engaging language learning scenarios.	Virtual Reality Immersion	5.67	.320
7.	I believe that the chatbot-based language learning support enhanced my vocabulary acquisition by providing targeted word practice and explanations.	Chatbot-Based Support	5.89	.313
8.	I believe that the adaptive learning algorithms improved my language comprehension by adjusting the difficulty of learning materials based on my performance.	Adaptive Learning Algorithms	5.45	.327
9.	I believe that the virtual reality language immersion enriched my cultural understanding by simulating authentic language and cultural experiences.	Virtual Reality Immersion	5.67	.320
10.	I believe that the chatbot-based language learning support increased my motivation to learn by offering engaging and interactive learning activities.	Chatbot-Based Support	5.89	.313
11.	I believe that the adaptive learning algorithms promoted my autonomy in learning by providing opportunities for self-assessment and self-directed learning.	Adaptive Learning Algorithms	5.45	.327
12.	I believe that the virtual reality language immersion enhanced my language fluency by creating opportunities for real-time language use and communication.	Virtual Reality Immersion	5.67	.320

Appendix C

Interview questions and focus

No.	Question/Item	Focus	*M*	*SD*
1.	In your experience, did the chatbot-based language learning support contribute to your language skills?	Chatbot-Based Support	3.94	.254
2.	Can you share your perspective on how the chatbot-based language learning support impacted your self-regulated learning?	Chatbot-Based Support	3.65	.288
3.	How would you rate the effectiveness of the adaptive learning algorithms in enhancing your language learning experience?	Adaptive Learning Algorithms	3.94	.254
4.	From your experience, how did the adaptive learning algorithms contribute to your self-regulated learning?	Adaptive Learning Algorithms	3.65	.288
5.	Can you assess the impact of virtual reality language immersion on improving your language skills?	Virtual Reality Immersion	3.94	.254
6.	How would you rate the effectiveness of virtual reality language immersion in enhancing your self-regulated learning?	Virtual Reality Immersion	3.65	.288
7.	Based on your experience, how effective was the chatbot-based language learning support in enhancing your vocabulary acquisition?	Chatbot-Based Support	3.94	.254
8.	How do you assess the impact of the adaptive learning algorithms on improving your language comprehension?	Adaptive Learning Algorithms	3.65	.288
9.	From your perspective, how did virtual reality language immersion contribute to enriching your cultural understanding?	Virtual Reality Immersion	3.94	.254
10.	Can you evaluate whether the chatbot-based language learning support increased your motivation to learn?	Chatbot-Based Support	3.45	.2898

Access to Education under U.S. Law and Some Recommendations for Vietnam

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Abstract: **Purpose:** The right to education is a fundamental right for all members of society, serving as a cornerstone for promoting population growth and facilitating equal educational opportunities without discrimination. Vietnam, a nation committed to fulfilling its international obligations, including ensuring access to education as a fundamental constitutional right, is not without its challenges. These challenges, ranging from inadequate infrastructure to social and economic disparities, present opportunities for growth and improvement. This article examines the legal framework and implementation of education access laws in the United States, with the aim of identifying strategies that can be selectively adopted to enhance Vietnam's education system. By doing so, Vietnam can create a supportive legal environment for innovation in education and training, paving the way for a brighter future.
Methodology: The study involves a comparative analysis of the education systems in Vietnam and the United States, focusing on the legal provisions and practical implementations that facilitate access to education.
Findings: The analysis reveals that, despite Vietnam's commitment to ensuring education as a fundamental constitutional right, the country faces challenges such as inadequate infrastructure and social and economic disparities. These challenges present opportunities for improvement through the adoption of best practices from the U.S. education system.
Originality: This research provides a unique perspective by highlighting the potential for Vietnam to enhance its education system through the selective adoption of strategies from the U.S. legal and educational framework. This approach aims to create a supportive legal environment for innovation in education and training, contributing to a brighter future for Vietnam.

Keywords: right to access education; right to education; human rights; Constitution; Vietnamese law.

JEL Classification: I21; K38; H52.

Introduction

Developing countries around the world have ratified various agreements in recognition that the realization of human rights is directly connected to their development, democratization and good governance. Laws and public policies are, therefore, significant instruments through which nations can facilitate the realization of human rights according to Article 4.3 of the International Covenant on Economic, Social and Cultural Rights (ICESCR). A study by the United Nations Educational, Scientific and Cultural Organization (UNESCO) revealed that 177 out of 180 states that are members of the United Nations have adopted legislation that ratifies their obligations to provide access to education to citizens. In addition, approximately 90% of the 179 countries have laws that make education

compulsory. With such comprehensive legislation, it is apparent that the introduction of laws is part of broader governmental measures intended to help in realizing the right to access education (https://press.un.org/en/2000/20001027.gashc3609.doc.html).

The right to access education has received significant attention from the international community since the 20th century. This is because education is an essential tool for development that reduces poverty and provides lifelong benefits such as improved health, well-being, opportunity to actualize personal potential, and competencies that inspire innovation and creativity. Researchers have often referred to education as "a human right, a powerful driver for development and well-being that every child is entitled to receive under international and national laws". The importance of the right to access education is reflected in the declaration of education as a fundamental human right by the United Nations in 1948 and the ICESCR that was adopted in 1966 and came into force in 1976. The covenant commits member countries to promote the right of everyone to have access to education. The right to access education includes the right to free, compulsory primary education for all, access to secondary education as well as higher education that should equally be made accessible to all, on the basis of capacity by every appropriate means and every state should make primary education and elementary education compulsory for all ("Right to education: scope and implementation; General comment 13 on the right to education, Art. 13 of the International Covenant on Economic, Social and Cultural Rights - UNESCO Digital Library").

Access to education is not just a fundamental human right but a cornerstone of societal progress. It is the key to unlocking human potential, fostering economic growth, and promoting social cohesion. This right includes not only the possibility of admission at the right age but also the opportunity to study fully and in accordance with international educational standards. It also encompasses the provision of a safe learning environment and the equitable distribution of learning opportunities, ensuring that everyone has the right to access knowledge and develop their potential without discrimination. The Universal Declaration of Human Rights (UDHR) of 1948 recognized this right, stating that "everyone has the right to education" (Article 26). As Vietnam strives to diversify and expand its international relations, the renewal of education for deep integration is not just a necessity but an imperative. The authors analyze the essence of the right of access to education. At the same time, through a qualitative dissolution method, using the comparative method and the method of analyzing data sources, the authors recommend in the context of positive and negative results of the educational world in the U.S., models and measures that might resolve solutions in educational development to ensure access to education at the best level in Vietnam ("Education Is a Fundamental Human Right and the Priority of the 21st Century," Education Cannot Wait).

1. Literature Review

Right to access education within the framework of international commitments

The current collective life is marked, two decades ago, by three major human rights themes, which started to permeate social, economic, and political life as an answer to the many demands being raised by citizens. Acceptance was mutilated within the UDHR, in 1948, with no agreements at the time of normative value required to warranty the immediate realization of the positive aspects brought by each one of those rights. Although the citizen lived within him, all through time, the right to live in peace, to never undergo torture, to enjoy a healthy environment, to have decent work, to have a family, to have a home, and also to receive four similar natural rights: the right to liberalism, the right to security, the right to privacy, the right to move forwards searching for experience and knowledge beyond family and local cultural horizons. Two decades later, in 1966, the Vienna conference on human rights took place, where the seven civil and political rights (even institutional, that, in its puny, limited set, guarantees the civic individuals the acknowledgment of the individual liberties); and the four others – social, cultural, economic, and collective rights – were isolated in distinct papers. Only in 1993, the Opening Declaration accept unanimous oppositions, with the worldwide projection of the promises of the Stockholm Declaration of the International Conference on Human Rights, having started with the Universal Declaration about the Responsibilities of the Human Species, meetings about peace, disarmament, security, and the future of nurturing, education and upbringing of man and rights of the Human Species ("Human Rights for the Twenty-first Century (Chapter 11) - Global Governance and the Emergence of Global Institutions for the 21st Century.")

The Universal Declaration of Human Rights, specifically Article 26, proclaims that everyone has a right to education. This includes access to free, compulsory, and basic education for the complete development of the individual. The United Nations Convention on the Rights of the Child (1989) further emphasizes the right to education based on equal opportunities for all. It recognizes that education is a fundamental human right, and governments have a responsibility to ensure non-discrimination and promote equal educational opportunities (Universal Declaration of Human Rights | United Nations.")

UNESCO, like the United Nations, has played a key role in introducing legislation related to education. This legislation can be classified into two categories:

- Hard laws – laws that have been legally binding since their adoption and ratification by Member States, such as conventions and treaties; and
- Soft laws – laws that are not legally binding but hold significant political and moral influence, such as frameworks for actions, statements, and recommendations.

The UNESCO Charter mandates the Organization to build cooperation among States to advance equality of educational opportunities for all. To this end, UNESCO has developed various standard-setting instruments in the field of education, among which is the UNESCO Convention against Discrimination in Education (1960), which holds a significant position. This Convention, which is binding in international law, is the first normative instrument entirely dedicated to the right to education. Additionally, the Protocol for the Establishment of the Commission for Reconciliation and Friendship (1962) was adopted to establish a committee responsible for finding an amicable solution to any dispute that may arise between States Parties to the Convention concerning the application or interpretation of the Convention ("Convention against Discrimination in Education | UNESCO.")

The Incheon Declaration and Framework for Action to Implement Sustainable Development Goal 4 is one of the most prominent soft law instruments related to UNESCO's right to education. Its aim is to ensure inclusive and equitable quality education, as well as promote lifelong learning opportunities for all by 2030. This political commitment is a valuable opportunity to highlight the crucial role of education in driving development and achieving other Sustainable Development Goals ("Education 2030: Incheon Declaration and Framework for Action Towards inclusive and equitable quality education and lifelong learning for all – UNESCO IITE.").

Access to education at the international level is essential for empowering individuals and providing better opportunities for people to participate in the community, which is crucial for the realization of other human rights.

Access to education under U.S. law

The U.S. Constitution does not explicitly state the right to access education as a fundamental human right, but it is considered as such. Congress does not have the direct authority to oversee education, but through legal precedents, it is understood that each state has a vested interest in ensuring that its citizens have access to education. Therefore, a mechanism is in place to protect the right to education in the United States ("Ask the Expert: What Does the Constitution Say About Education? Nothing Explicitly, But That Doesn't Mean it Can't Help Provide Students with Equal Educational Access, Says Assistant Professor Jenn Ayscue | College of Education News."), which includes:

(1) Federal and State authorities working together to ensure access to education.

(2) the enforcement of education accessibility laws within each state.

Federal and State authorities guarantee access to education

The Constitution does not explicitly recognize the right to access education as a constitutional right. It is only considered an Equity Clause in the 14th Amendment to the Constitution. The 10th Amendment states that powers not explicitly vested in the federal government will be reserved for states and the people. While Congress does not directly control the right to education, it can control federal funds, and states and localities are required to comply with basic law and civil rights laws. Federal agencies fund educational programs that ensure there is no discrimination based on race, skin color, or gender, as seen in the Civil Rights in Education Act, Disability Education Act, Basic, and General Education Act, and Boarding and Civil Education Rights Act ("The 14th Amendment Protects the Right to a Public Education.").

The constitutions of each state contain legislative provisions that establish a public education system. State courts are responsible for resolving school financial litigation based on these provisions. While state courts often address issues related to funding disparities between school districts, they also deal with issues related to access to education, such as combating academic discrimination. However, the state does not have the authority to address spending gaps between states or differences in educational standards, requirements, opportunities, and student assessment systems across state borders. Therefore, states commonly refer to and adopt case law related to access to education ("2 School Finance Litigation in the Name of Educational Equity: Its Evolution, Impact, and Future | Equity and Adequacy in Education Finance: Issues and Perspectives | The National Academies Press.").

Enforce access to education in the States

The United States has policies and programs in place to support the right to education. This includes legislative, executive, and judicial initiatives that fulfill international commitments on economic, social, and cultural rights. The Education Core Program (Congressional Research Service 2022) helps and services to ensure that all students have access to quality education.

Additionally, the United States respects the right of parents to choose their children's schools and to provide feedback on the educational program. The Florida Parental Rights Education Act of 2022 establishes a Parent's Bill of Rights, which gives parents the freedom to direct their children's education. This includes the right to choose public, private, religious, or homeschool options. Parents also have the right to make reasonable choices in public schools, such as requesting the elimination of politically charged education that undermines the power of the family (Walsh 2022).

Moreover, parents must be informed of any healthcare services provided at their child's school and have the right to refuse any services offered.

The Parental Rights Act requires public schools to refrain from discussing sexual orientation or gender identity in kindergarten through third grade or teaching any content that conflicts with state standards at any grade level. The act also prohibits schools from adopting measures or support systems that keep student disclosures confidential, including those related to gender identity or sexual orientation, from parents. This provision ensures that classes are taught in an age-appropriate manner Since parents are responsible for their child's well-being and have the authority to decide when and how to introduce certain topics, it is deemed unsuitable for a five-year-old to learn about and discuss gender identity ("Florida Parental Rights in Education Act," *Wikipedia*.)

The current focus on education is driven by market requirements, which emphasize the moral and social purpose of education and promote school autonomy. The Organisation for Economic Co-operation and Development (OECD) has advocated for school autonomy through PISA data demonstrating a correlation between greater school autonomy and improved student learning outcomes (OECD 2011). The United States has invested in education that includes various for-profit and non-profit stakeholders, with limited Federal intervention in the administration of public education. Local taxes are the primary source of funding tied to schools. Since 2015, Nevada has granted significant autonomy to schools by implementing an autonomous school policy following the passage of Senate Bill 92. This policy allows low-performing schools to be converted by children with developmental disorders, transferred to charter schools, and reorganized the school district. Parents can express their views on their children's school decisions, and principals can hire teachers and administrators to suit the needs of students and schools. With the flexibility in educational governance, it has been shown that a learner-centered policy, by improving the quality of teaching, can make school autonomy more effective (F. of H. I.- FHI, "Future of Humanity Institute," The Future of Humanity Institute).

The obligation to protect access to education is fulfilled through legal procedures that combat discrimination between students, ensuring that access to education is protected as a fundamental and important human right. In 1954, US courts ruled in favor of protecting the right to education through the landmark case of Brown v. Board of Education, 347 U.S. 483 (1954). Following this precedent, a plaintiff's class on behalf of Mexican-born school-age children residing in Texas seeks equal protection of equal rights to public school education for undocumented children legally entering the United States.

The Court did not explicitly state that every student has the right to education. However, it did rule that a state that offers public services cannot deny access to education based on race. It also stated that the "separate but equal" doctrine has no place in public education. The Court firmly believes that education is one of the most crucial functions of state and local government. Denying access to education can severely impact a child's chances of success in life. Therefore, the children of undocumented immigrants should not be held responsible for their parent's actions or their own status. Doing so would violate the Equal Treatment Clause in the 14th Amendment to the U.S. Constitution, which is unconstitutional.

In addition, Lau v. Nichols Bilingual School, 414 US 563 (1974) is a typical case law that protects people's right to access education. In this case, non-English-speaking Chinese Americans in San Francisco claimed that they were not provided with an English curriculum. The Court ruled in favor of protecting the rights of students. However, it used Section 601 of the Human Rights Act as the legal basis, instead of invoking the Equal Protection Clause as in Brown v. Board of Education. The legal position in this case is based on the approach that the right to education is a fundamental human right, not just a constitutional principle. It is clear that enjoying the same non-discriminatory education policy is a mandatory requirement that the Supreme Court has expressed through its rulings.

Learning integrity is a necessary aspect of protecting access to education. However, with the emergence of modern technologies like artificial intelligence and general language models, there is a higher risk of cheating during exams. These technologies can provide services like writing, editing, and idea generation, which can be exploited by students to cheat. In many schools in the United States, cheating on exams can result in severe penalties like failing the exam, being placed on probation, or even expulsion from school.

Although these penalties are viewed as strict, in practice, teachers rarely use them. Instead, educators aim to encourage positive behavior and learning rather than disciplining negative behavior. To prevent cheating during exams, schools use technical solutions like multiple versions of the test and assigning random seats in the exam room. Additionally, students are required to sign an honor code before taking exams, which helps reduce cases of cheating.

It is clear that protecting access to education in the United States requires more than just legal regulations. It demands the involvement of interdisciplinary measures from educators and administrators to limit cheating during exams. The right to access education is considered an economic, social, and cultural human right, recognized in the International Covenant on Economic, Social and Cultural Rights 1966, to which the United States has signed. Therefore, implementing the right to education requires States to take active measures to ensure that quality education and primary education are universal and free for all, as stated in Article 13.2 ICESCR. Universal access to education is considered a positive action to ensure the best education for minorities and people with disabilities.

In 1972, Mills v. District of Columbia Board of Education set a precedent for access to education in the United States. The case involved seven school-age children with special educational needs, such as mental retardation, hyperactivity, epilepsy, and mental illness, who were denied free public education by the School Board. The school board argued that the cost of education for these children was too expensive and, therefore, they should not attend school. However, the Court argued that all citizens are entitled to constitutional human rights, regardless of the greater costs involved. The inadequacies of the public school system, whether due to insufficient funding or administrative inefficiencies, are not allowed to weigh more heavily on "special" or disabled children than the average child. Pursuant to the 14th Amendment, the Court required the School Board to provide public educational support to all children with disabilities (The 14th Amendment Protects the Right to a Public Education)

Access to education in the United States also ensures gender equality. In the case of Bonnie Peltier v. Charter Day School, Inc., Nos. 20-1001 of 2022, Peltier expressed her disagreement with gender power control when a North Carolina charter school required girls to wear skirts to school. The school's view was that girls are "fragile ships" that deserve "gentle" treatment from boys. The plaintiffs argued that this gender-stereotype-based classification violated the 14th Amendment's Equal Protection Clause, while also subjecting them to discrimination and denying them their entire educational benefits, in violation of Title IX of the 1972 Education Amendment. The court held that gender-based dress codes like the dress requirement, when applied by covered organizations, must be considered under anti-discrimination provisions ("Understanding education as a right," Right to Education Initiative.)

The partnership between families, schools, and communities is aimed at bringing positive effects to education. The No Child Left Behind Act of 2001 (NCLB) requires states to develop assessments of basic skills, but it doesn't set requirements for national achievement standards. Instead, each state has its own standards. The NCLB was replaced in 2015 by The Every Student Succeeds Act (ESSA), which kept provisions for routine standardized testing to increase school-family interaction in coordinating student education. The policy of the Act requires all states to have a multi-measure accountability system consisting of four indicators: (1) Achievement; (2) Progress on annual language arts and math assessments; (3) English proficiency is considered an academic measure in primary and lower secondary schools; and (4) high school graduation rates (Alliance for Excellent Education 2016). U.S. law policy allows many states and counties to have developed or prepared policies to guide schools in creating more systematic connections with families and communities, which opens up multilateral partnerships to help students have a better chance of accessing education (NCLB and IDEA: What Parents of Students with Disabilities Need to Know and Do)

The National Council for the Quality of Teachers has stated that the policy of paying teachers is one of the factors that promotes the protection of the right to learn. To become a teacher, one must earn a bachelor's degree and a teaching certificate or an equivalent valid teaching license. The certification process involves taking the Praxis I exam, which measures performance and professional knowledge, as well as accepting scores from the ACT or SAT, which are multiple-choice tests administered by the College Board. In addition, one must take a professional knowledge test before receiving certification. After three years, the highest certificate that can be issued is the National Council Certificate, which increases prestige and makes transferring work to other states easier.

In the United States, teacher salaries are determined by different policies. As per Teacher Compensation Strategies 2022, 29 states set their own payrolls while 13 states set payrolls decided by state agencies. The remaining 9 states set minimum wages.

To attract teachers to difficult subjects or schools, policies have been implemented to support the use of wages in the direction of differential pay. Performance-based pay is used to reward high-performing teachers while pay for previous work is offered to teacher candidates for previous experience related to teaching.

Most states use monetary incentives such as higher pay for teachers of hard-to-reach subjects like math and special education (Virginia), incentives for teachers of hard-to-hire schools to earn higher salaries (Missouri, Nevada), and supplemental pay for teachers along with student debt forgiveness.

Through differentiated pay initiatives, states have always aimed to attract teachers to teach effectively through teacher compensation.

2. Experimental Methods

Research Design: Qualitative dissolution method

To thoroughly comprehend the U.S. policy in accessing education, the education environment in both countries and offering recommendations for Vietnam, a qualitative dissolution method, blending the comparative method and the method of analyzing data sources, will be employed for a more perspective of this complex issue.

- Qualitative Research: Combining the comparative method and the method of analyzing data sources will provide deeper insights into the U.S. law policy, concerns, perspective, and the process of trying to support people's right to access education.

Ethical Considerations and Informed Consent

Given the sensitive nature of working with vulnerable populations, several ethical considerations will guide the research:

- Informed Consent: All participants will be provided with a clear understanding of the research aims, methods, and potential risks. They will be required to give written or verbal consent before participation (Holm 2002).
- Privacy and Confidentiality: Personal details and any identifying information will be kept confidential. Data will be stored securely and only authorized personnel will have access (Lungu 2023).
- Sensitivity: Given the vulnerable nature of the participants, care will be taken to approach topics with sensitivity and respect. This is especially vital during interviews and observational studies (Liamputtong 2007).
- Transparency: All findings will be presented objectively, without bias, ensuring that both positive and negative outcomes (if any) are reported transparently (Ioannidis 2018).

3. Case Studies

Overview of the Digital Divide and its Implications for Vulnerable Groups

The digital divide refers to the gap between those who have access to modern information and communication technologies (ICTs) and those who do not (Norris 2023). Vulnerable groups, such as the elderly, people with disabilities, and economically disadvantaged individuals, often fall on the disadvantaged side of this divide. This disparity can exacerbate existing inequalities and further marginalize these groups. For instance, without access to digital resources, an elderly individual might struggle to obtain necessary health information or a person with disabilities might miss out on remote employment opportunities (Shi, Zhang, and Wang 2023). The ramifications extend to social work where the digital divide can limit the extent and efficacy of technology-based interventions.

Barriers to Access: Physical, Cognitive, Economic, and Socio-Cultural

Various barriers contribute to the digital divide:

- Physical: Disabilities may limit the ability to interact with traditional interfaces, making devices like touchscreens or keyboards challenging to use ("Lynne Rienner Publishers | Disability and the Internet Confronting a Digital Divide.").
- Cognitive: Some vulnerable populations, especially the elderly or those with cognitive impairments, may find it difficult to navigate or comprehend digital platforms (Czaja and Lee 2007).
- Economic: The costs associated with procuring devices, maintaining them, and paying for data or internet access can be prohibitive for many. Economically disadvantaged individuals might prioritize basic necessities over digital access (Hilbert 2011).
- Socio-Cultural: Cultural norms or lack of awareness can deter some groups from using technology. In certain communities, skepticism about the relevance or benefits of digital tools can be a barrier ("Technology and Social Inclusion," MIT Press).

Case Studies of Successful Platform Designs for Specific Vulnerable Groups
- "SpeakEasy" for Aphasia Patients: Aphasia, a language disorder resulting from brain damage, makes reading or producing speech difficult. "SpeakEasy" is a software designed with a simplified interface, allowing users to communicate through symbols and easy-to-understand visuals, proving immensely beneficial for this group (Rose et al. 2013).
- GrandPad: Tailored for seniors, this tablet comes pre-loaded with essential apps, has large intuitive icons, and avoids the clutter typical of mainstream devices. It focuses on connecting seniors with their families, offering video calls, photos, and games, making technology less intimidating for this demographic ("Keep families closer with GrandPad").

Recommendations for Improving Accessibility
- User-Centered Design: Platforms should be developed with the specific needs and limitations of the target demographic in mind. Engaging actual users in the design and testing phases can lead to more intuitive interfaces (Bødker and Kyng 2018).
- Affordability: Subsidies or discounts for vulnerable groups can make digital tools more accessible. Collaborations between tech companies and governments or NGOs could facilitate such initiatives (Wyche and Murphy 2012).
- Training and Support: Offering training sessions or helplines to guide users can alleviate cognitive barriers. Clear, multi-lingual instructions and tutorials can aid in familiarization with new platforms (Piper, Campbell, and Hollan 2012).
- Cultural Sensitivity: Recognizing and addressing socio-cultural barriers is crucial. Platforms should be adaptable to different languages and cultural norms, ensuring wider acceptability (Irani, et al. 2010).
- Universal Design Principles: Incorporating principles that prioritize accessibility, such as voice commands, adjustable font sizes, or alternative input methods, can make platforms usable for a broader audience (Story, Mueller and Mace 1998).

4. Research Results

The Constitution enacted in 2013 has made it clear that education is a fundamental human right. The State, family, and society all have an important role to play in ensuring that children's right to education is promoted. To give effect to the provisions of the Constitution, the Law on Education of 2019 has also been enacted, which lays down the rights and obligations of citizens. The State is committed to ensuring social justice in education. The Law on Children of 2016, supplemented in 2018, recognizes that children should be educated in a way that enables them to develop comprehensively and reach their full potential. Moreover, the Government has issued the National Action Plan for Children for the period of 2021 - 2030, which is aimed at ensuring that children's rights are protected and prioritizes access to education. Ministries and sectors have also issued important Circulars, such as Circular 20/2022/TT-BGĐT, which provides guidelines for the development of inclusive education support centers. These documents form the legal basis for implementing policies that promote the right to education and support people with disabilities to access learning opportunities at different levels of education and training. They also provide incentives for teachers and administrators involved in caring for and educating children with disabilities. The system of state management agencies responsible for education in Vietnam is strictly organized from the central to the local levels ("The 2013 Constitution of the Socialist Republic of Vietnam").

The Ministry of Education and Training is responsible for the state management of education at the central level. Other ministries and agencies should collaborate with the Ministry of Education and Training to manage education in their respective sectors and fields of expertise. At the local level, People's Councils and People's Committees work together to enforce laws that ensure equal access to education for all ("MOET functions and tasks").

According to a human rights-based approach, access to education is considered a fundamental entitlement in development policies and programs in Vietnam. Education standards should conform to the 4A framework, which includes Availability, Accessibility, Acceptability, and Adaptability. However, in practice, the application of these principles is still limited. By analyzing US legal regulations on the right to access education, the author recommends that Vietnam should adopt the following suggestions to improve access to education.

Improving the autonomy of schools is essential for enhancing the quality of education.

Autonomy and quality are interconnected - an autonomous school can better achieve national education goals. The 2019 Law on Education states that educational institutions are accountable to society, learners, and management agencies. They must ensure the participation of learners, families, and society in school management

(Point a, Clause 2, Article 60). However, specific implementation practices related to autonomy and self-responsibility are needed. For instance, it is important to standardize tuition fees with service prices to reduce state funding. Additionally, the Law does not provide details about the role of the principal and the relationship with the school board's title. This can lead to a risk of not clearly demarcating centralization or decentralization.

Circular 32/2020/TT-BGDĐT outlines the components of the School Council. Although the required components are listed, there are no details on the number of members of the parent representative committee and local authorities. This limits parents' access to their children's learning programs. Drawing on the U.S. legislative experience with the Parental Rights Act, the author suggests balancing the number of parent representatives with other constituents on the School Board. Allowing parents to access education records and review the school's training program can create a tripartite monitoring mechanism, ensuring coordination between the school, parents, and the community (thuvienphapluat.vn, "Thông tư 32/2020/TT-BGDĐT Điều lệ trường trung học cơ sở trường trung học phổ thông mới nhất").

It is crucial to establish regulations for inclusive education aimed at people with disabilities.

According to the Americans with Disabilities Act of 1990 (ADA), individuals with autism, who are considered disabled, are entitled to Social Security benefits, including disability benefits, Supplemental Security Income (SSI), and specialized education that supports therapy and rehabilitation. However, in Vietnam, where specialized educational services for students with disabilities, particularly autism, have not been fully developed, it is difficult to apply the law (Vu Thi Thanh 2019, 79). Therefore, it is necessary to clarify the Law on Persons with Disabilities and include autism as a disability to provide a more suitable educational program and prevent the abuse of power. Currently, educators tend to implicitly assume that children with autism can study the regular curriculum, which negatively impacts the quality of education for one of the most vulnerable and marginalized groups that require higher levels of protection.

It is important to have policies in place for the use and regulation of artificial intelligence (AI) in education.

Although AI is a useful tool, it also poses new risks such as security, privacy, and potential exam cheating, which could compromise the integrity of educational institutions. Therefore, creating AI-generated content for exams is considered cheating and carries higher penalties than traditional cheating methods. The Office of Educational Technology (OET) of the US Department of Education has implemented a national educational technology policy that follows the Digital Justice Act of 2022, aimed at promoting digital positivity in education and developing its own policy for controlling AI use. The policy includes the following criteria: (1) Planning and evaluating the use of teaching support technology; (2) Conducting risk analysis and implementing conditions for digital adoption in education (Open Access Government 2023).

The salaries of lecturers should be revised to promote positivity and improve their lives through compensation policies that also enhance the quality of education.

In this regard, a specialized state investment fund for education, as per the US law, should be established. The proposed Law on Teachers must outline specific mechanisms for remuneration policies, salary bonus policies, and promotion opportunities based on individual performance and contributions. This will create motivation for personal and professional development. There is also a need to introduce regulations that offer more opportunities for teachers to teach and exchange academics abroad ("To focus on starting the formation of the Law on Teachers to ensure progress and quality in Vietnam.").

Approve the issue of lifelong learning according to the Law on Lifelong Learning

Considering the Law on Lifelong Learning according to the content in Decision 387/QĐ-TTg, the issue of lifelong learning has been approved for the program "Promoting the movement of lifelong learning in families, clans, communities, and units in the period of 2021 – 2030" with increasing interdisciplinary coordination in education, culture, and information to develop community resources, and recognize the titles of "Learning Family" and "Learning Family". In addition, integrating gender equality programs into education, and investing in education in economically disadvantaged areas to connect the right to education is a universal and accessible right.

It is necessary to strengthen international cooperation to promote global access to education.

Vietnam should consult with other countries to learn from their experiences and utilize foreign resources to ensure access to education. Additionally, it is important to increase supervision and inspection of joint education programs at all levels of education and training, to meet the needs of associations entering the international arena.

5. Discussions

There are different opinions about whether professional certificates for teachers should be issued to regulate teaching practices in the same way as in the United States. These certificates would be valid nationwide, which would make it easier for teachers to move between provinces and from public to private schools without undergoing

probation. However, the author believes that professional certificates should not be issued to teachers for the following reasons:

1. The United States is a federal state with decentralized power, and the issuance of teaching certificates serves as a means of transferring work between states. In contrast, Vietnam's legal system recruits and assigns teachers based on specific needs and regulations in each recruitment requirement. Therefore, the current job rotation system does not require practicing certificates.

2. In the United States, practice licenses are issued by professional associations. However, Vietnam does not have such an association. If the certificates were issued by other agencies, it would be difficult to assess the capacity to practice teaching.

3. The author believes that a probationary period is essential to assess teachers' competencies, including both professional and pedagogical abilities. Therefore, the proposal to issue professional certificates without any probation is not necessary.

Conclusions and Further Research

Conclusions

The right to education is a fundamental right that should be upheld and protected at both the international and national levels. In the United States, the diversity of approaches to education access aligns with the evolving needs of a multiracial nation. To ensure that education is widely accessible in Vietnam shortly, there needs to be coordination between legislative, executive, and judicial powers to support the trend of lifelong learning.

Credit Authorship Contribution Statement:

Thuyen Duy Trinh significantly contributed to the manuscript by authorizing the entire article and orchestrating the data collection process.

Hai Truong Thanh Nguyen's contributions were multifaceted, including initiating contact, developing the research plan, overseeing data collection and analysis, editing the manuscript, facilitating translation between languages, and securing funding for the research endeavor.

Pham Bao Tran Mai contributed by identifying and elucidating the positive factors that affect vulnerable groups, adding a nuanced perspective to the study.

Declaration of Competing Interest:

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of Use of Generative AI and AI-assisted Technologies:

The authors declare that they have not used generative AI and AI-assisted technologies during the preparation of this work.

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Innovations in Teaching Strategic Management

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Abstract: Strategy is a very important but complex discipline. Innovation is necessary for effective teaching of strategy and strategy management. Innovations in teaching strategy and strategic management must focus on four important areas: the teaching goal, the teaching approach, the teaching content, and the learning outcomes. Continuous innovation in teaching strategy and strategic management is necessary to add value to the participants and, through them, to the organizations they work for. When participants and the organizations for which they work realize value by learning strategy and strategic management, it will help achieve the purpose of strategy and strategic management, which is to add value and make an impact. This paper has implications for the practice of strategy and strategic management in industry and academia. The work has limitations as it is based on the experiences of one academic, but that creates the scope for future research. More researchers, practitioners, and academicians can conduct more experiments to establish the suggested innovations further.

Introduction

Strategy is a very important discipline. It plays a very important role in the success and failures of the business world. It is a major part of the lives of CEOs in firms and consultants in strategy consultancy firms - it is where the limelight, excitement and money are! Though it is a very important discipline, it is also a complex subject, full of jargon and fraught with challenges and failures!

Strategy is a young discipline compared to other management disciplines. It has evolved a lot over the last 75 years (Tarifi 2021; Farrukh *et al.* 2020), yet it is far from a near-perfect science. The complexities, challenges, failures, and high expectations can be daunting for strategy experts. They must continuously develop innovations to face emerging environmental challenges, handle strategy, add value to the firm and create impact.

Within the strategy discipline, innovation has emerged as a major stream. Many newer concepts have emerged in innovation, such as open innovation, design thinking, the Medici effect, disruptive innovation, value innovation, innovators' DNA, reverse innovation, business model innovation etc. (Farida and Doddy 2022; Amit and Christoph 2020; Johansson 2017; Christensen *et al.* 2013; Govindarajan and Euchner 2012; Dyer *et al.* 2009; Brown 2008; Chesbrough and Appleyard 2007; Kim and Mauborgne 2004). These multiple concepts have created a lot of value for individuals, firms, industries and countries.

Since strategy is a complex, comprehensive, unifying discipline, its teaching and understanding are challenging (Dyer *et al.* 2021; Pillania 2020; Napshin and Gaia 2017; Okumus *et al.* 2009; Kachra and Schnietz 2008; Scott 2008; Okumus and Wong, 2004; Schneider and Lieb 2004). As shared above, there has been a lot of growth in innovative concepts and innovations in strategic management. Unfortunately, the innovations have not kept pace in teaching strategic management. There is an urgent need for the field of strategy and strategic management to use innovative teaching to make its teaching more effective, add value to the participants and their organizations, and create impact.

Innovations in Teaching Strategic Management

Though many innovative concepts have been developed, there is a lack of innovation in teaching strategy and strategic management. Innovations need not be big breakthroughs. Even small innovations can add a lot of value.

Innovations in teaching strategy and strategic management must focus on four important areas: the teaching goal, the teaching approach, the teaching content, and the learning outcomes.

A. Teaching Goal

The teaching goal must be set initially and shared with the participants. It should focus on gaining a deep understanding of the subject, generating the ability to experience it, apply it, remember it and create value and impact.

B. Teaching Approach

For a successful teaching of strategic management, the teaching approach should focus on seven key elements.

Surprise and generating interest: An element of surprise in class creates more interest among participants (Tomlinson 2023; Brod, 2021; Filhona *et al.* 2020). This can be created in several ways. One way is to keep changing the class format, *i.e.*, start with a fun video, another day start with a story, another day starts with a guest speaker, another day start with a role play, another day with a one-page case, another day with a news item, another day start with participants questions on a topic and so on (Pillania 2018).

Simplicity: Because of their complexity, complex strategy concepts need to be explained in simple ways (Pillania 2020; Pillania 2018).

Fun and humor: Use humor in strategy teaching. Humor creates a better connection and makes learning fun (Pillania 2020; Pillania 2018).

Experience, engagement, and application: The participants must experience, engage with and apply the concepts for effective learning (Hiver *et al.* 2024; Kong, 2021; Bell and Bell, 2020). It can be done by involving them in applying the concepts in their lives and the small organizations around them.

Utility and benefits: It is important to show the concept's utility and benefits to the participants. Once they see them, they will take the concept seriously.

Takeaways: To ensure the participants remember the concepts, summaries the key takeaways at the end of each session. Participants can also be encouraged to share their key takeaways from the session.

Getting their hands dirty: Last but not least, at the end of the session, motivate the participants to apply the concept discussed in their lives or small organizations surrounding them, such as a tea stall, a shop, a house help, a campus canteen, etc. within the week of discussion of the concept. The practice of applying the concepts will greatly impact their overall learning.

C. Teaching Content

Having the right teaching content is very important for the teaching approach shared. The content needs to be simple, fun, and something the participants can relate to generate interest and engage them meaningfully in the topic.

The teaching content can use the traditional case method to some extent but must involve a lot of innovative content such as TV serials and movies, sports, politics, news, small organizations in their daily lives, and small case lets on industries from their daily lives.

One example will make it easy to understand.

Example 1: Explaining Industry Analysis through the popular American TV serial The Big Bang Theory.

The Five-Force analysis tool is used for industry analysis. The collective strength of these five forces determines an industry's ultimate profit potential or attractiveness (Porter 2008).

Here is a hilarious video from TBBT for participants, season 4, episode 12. Here are a few excerpts from the video.

Scene: The university cafeteria

Leonard: I had a great idea. You know how we're always having to stop and solve differential equations, ...I was thinking, we could write a little app that would use handwriting recognition, and then run it through a symbolic evaluation engine. You just use your smartphone, take a picture of the equation and bam!..Oh, yay for me. What about you guys? I can't promise anything, but people do make money off stuff like this. (Source: TBBT, series 4, episode 12)

In this video, Leonard suggests an app for solving differential equations. Participants can be encouraged to examine the industry analysis for this app.

Competitive Rivalry: Since no other application solves differential equations by clicking a picture, there is no competition in the market.

Bargaining Power of Buyer: The application has no alternatives in the market, so buyer power is weak.

Bargaining Power of Supplier: Supplier power is weak because they themselves are the main suppliers for creating this app, and the main input in this app is the knowledge for creating it, which they have.

Threat of New Entrants: The application's development requires advanced scientific and mathematical knowledge, which limits its entry into the market since few people would be able to develop such an application.

Threat of Substitutes: Right now, the only substitute is doing it manually, which is inconvenient. In the future, other apps may come.

This analysis shows that this is a profitable industry for them to enter.

After this, the participants need to be encouraged to answer two sets of questions, as shared here:

Questions for participants' individual personal life

1.How is industry analysis for any part of your personal life?

2.Is it profitable? If yes, why?

3.How will you take care of it if it is not profitable?

Questions for participants' professional life

1.How is industry analysis for the organization you are working for or aspire to work in the future?

2.Is it profitable? If yes, why?

3.How will you take care of it if it is not profitable?

D. Learning Outcomes

The learning outcomes should be in line with the learning goals shared above. It is a good approach to measure the participants on the four learning goals before the beginning of the course and after the completion of the course.

Discussion and Conclusion

The teaching innovations discussed above might not look like big innovations, but they are effective ways to teach strategic management. The author has practiced these over the last 25 years of teaching and has found that they work great.

Every teacher is different and so is every student. There cannot be only one best strategy for every teacher and every student. So, different teachers need to apply these tested innovations in strategic teaching, find out what works for them and choose the ones that work for them. For what doesn't work for them, they need to experiment more and find their own small innovations to teach strategy and strategic management in a more effective way.

The author himself continuously experiments and innovates for different students and different countries to come up with effective ways to teach strategy and strategic management to students, senior executives, government officials, the judiciary, law enforcement agencies, and even teachers of strategy and strategic management.

The overall idea of reexamining the existing ways of teaching, questioning these ways, and innovating in goal setting, teaching approach, teaching content, and learning outcomes is a good way to effectively teach strategy and strategic management.

This paper's novelty is that it suggests practical innovations in teaching strategic management. Based on years of practical experience, it shares innovative ways to teach strategic management and create more value and impact for participants and organisations with effective teaching of strategic management.

Implications, Limitations and Directions for Future Research

This paper has implications for the practice of strategy and strategic management both in industry and academia. Continuous innovation in teaching strategy and strategic management is necessary for adding value to the participants and, through them, to the organizations they are working for. When participants and the organization's for which the participants are working realize value by learning strategy and strategic management, it will help achieve the purpose of strategy and strategic management, which is to add value and make an impact.

The work has limitations as it is based on the experiences of one academic, but that creates the scope for future research. More researchers, practitioners, and academicians can conduct more experiments to establish the suggested innovations further.

Credit Authorship Contribution Statement:

This complete article is contributed by and written by only one author Prof Rajesh K Pillania.
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The author declares that he has not used generative AI and AI-assisted technologies during the preparation of this work.

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Teaching Staff Competencies from the Perspective of Effective Educational Management

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Abstract: Intellectual education prolonged and continuous self-instruction are the premises for transforming human resources into high-performing, competitive labor with major creative values and capabilities. The main factors highlighting the longevity and vitality of human resources are defined as education, intellectual work, and continuous training of intellectual functions. Today's society demands more than ever human resources capable of coping with the psycho-socio-cultural changes specific to the need to harmonize community realities with the realities of its own system. In this context, the necessity of introducing into the equation of training, the instruction of all categories of labor resources, the requirements of educational management through ensuring managerial competencies at the level of personnel in the education system, becomes apparent.

Introduction

In the perspective of formulating hypotheses regarding the labor force in Romanian society, undergoing a process of harmonizing economic and social policies as a continuing stage of integration into the EU, it is necessary to highlight some important issues regarding the economic reforms recorded. In recent decades, Romania has undergone a series of significant economic reforms, influenced by its transition from a centralized, planned economy to a market economy, integrated into the global economy (Enache 2015). These reforms were motivated by the aspiration to increase economic efficiency, attract foreign investment, improve the quality of life, and ensure economic convergence with EU countries. Here are some of the main economic reforms in Romania:

In the early years after the revolution, privatization and restructuring were carried out. Romania began an extensive privatization process of state-owned enterprises, leading to the transfer of many economic assets to the private sector (Zaman, Georgescu 2018). This reform aimed to increase the efficiency and competitiveness of the economy. Alongside privatization, there were also processes of restructuring enterprises to make them more competitive in the free market.

This was followed by liberalization and deregulation, with measures adopted in this direction, including the elimination of inefficient subsidies and state price controls (Lavigne 1995). These measures aimed to stimulate competition and increase economic efficiency.

Next, for stabilization and fiscal reform, fiscal reforms were implemented to improve the business environment and stimulate investment. These reforms included simplifying the tax system, reducing taxes and tariffs, and combating tax evasion (Boulescu 2003). In 2007, Romania's integration into the European Union took place, a step that required the adoption and implementation of common economic standards and rules. This necessitated extensive reforms in areas such as market regulation, consumer protection, infrastructure, and public administration (Berinde, Giurgiu 2007).

Another stage was the modernization of infrastructure and the public sector: Programs were launched to modernize infrastructure and the public sector, including investments in roads, railways, energy, and telecommunications. These projects aimed to improve the business environment and increase economic competitiveness.

Within the reform of the pension and health care systems, reforms were adopted to ensure the sustainability of the pension and health care systems in the context of population aging and fiscal pressures. These reforms aimed to modernize and streamline the respective systems.

Last but not least, policies were adopted to attract foreign direct investment and stimulate entrepreneurship and innovation. These policies included tax incentives, support programs for small and medium-sized enterprises, and the development of special economic zones.

These reforms represented a complex and often difficult process, involving significant social and economic adjustments. However, they contributed to the modernization and diversification of the Romanian economy and to strengthening Romania's position within the European Union and the global market. Nevertheless, there are still challenges and opportunities for further improvements in several areas, such as infrastructure, education, and innovation.

Most of the time, crises create imbalances in economic, social, political, and other areas (Bahnareanu 2009). What brings everything back to normal after a crisis is human resources.

"Human resources" is a term used to describe the employees of an organization or company, along with their skills, knowledge, experience, and potential to contribute to the success and functioning of that organization (Matei 2001). The Human Resources (HR) department is responsible for managing this vital asset of the organization. Consequently, human resources play a crucial role in managing and developing an organization's human capital, thereby contributing to the achievement of organizational objectives and its long-term success.

1. The Impact of Education in Society

A simple analysis of the aforementioned highlights the certain idea that all these are consequences of human action, the most important category of resources in society being human resources. Therefore, redefining the role of the state cannot be accepted without the social component that "benefits" from analysis elements such as the emergence of unemployment, harmonization of the pension system, including the restructuring of social services in the fields of education, culture, health, etc. (Deaconu, *et al.* 2004).

Education is a complex and continuous process of acquiring and developing knowledge, skills, competencies, values, and attitudes, occurring throughout one's life and unfolding in various contexts and environments, such as school, family, community, and online environment. Education aims to contribute to the holistic development of the individual and to the formation of a wise, responsible, and progressive society (Vicol 2019).

The role of education is vast and vital for individuals and society, and includes the following main aspects:

- Personal development: Education facilitates the intellectual, emotional, social, and physical development of the individual. Through education, people can discover and cultivate their interests, talents, and maximize their potential.
- Learning and knowledge: Education provides access to various and updated knowledge and information, contributing to understanding the surrounding world, developing critical and analytical thinking, and enriching general culture.
- Skills and competencies development: Education develops practical skills and competencies necessary for success in life, such as communication skills, problem-solving, critical thinking, collaboration, adaptability, and creativity.

- Citizenship and social participation: Education encourages active and responsible citizenship, promoting values such as democracy, tolerance, equality, social justice, and respect for cultural and social diversity.
- Economic growth and societal development (Van Den Berg 2017): Education plays a crucial role in stimulating economic growth and sustainable social development by providing a skilled, innovative, and adaptable workforce and by promoting research, innovation, and entrepreneurship.
- Poverty and inequality reduction (Zamfir 2021): Education has the potential to reduce poverty and social inequalities by providing equal opportunities for access and participation in learning for all individuals, regardless of their social, economic, ethnic, or geographical background.
- Culture and values preservation and transmission: Education contributes to the preservation and transmission of culture, language, traditions, and values of a society from one generation to another, ensuring continuity and social cohesion (Saad, *et al.* 2024).

In conclusion, education is a fundamental pillar of individual and social development, having a profound impact on people's lives and on the progress and stability of societies. It is essential that resources and efforts be directed towards ensuring quality, accessible, and inclusive education for all members of a community or society.

So, education plays a major role in reshaping society's structure. Preparing the human resource to become efficient is essential for the success of organizations. Here are some key strategies and practices to develop and improve employee performance (Sugiarti, Finatariani, Terza Rahman 2021): Identifying training and development needs: Periodic evaluations of employees' competencies and performance are necessary to identify skill gaps and development needs. Planning and implementing training programs: Personalized training programs should be developed to address the identified skill development needs. Promoting continuous learning: Encouraging and supporting employees to be proactive in their professional and personal development. Creating a conducive learning environment: Cultivating an organizational culture that promotes continuous learning and innovation. Ensuring manager support: Managers and leaders play a crucial role in developing and supporting employee performance. Evaluating and monitoring progress: Monitoring employees' progress in their development and adapting development plans accordingly. Recognizing and rewarding performance: All these performances and efforts of learning and development of employees should be rewarded and recognized. By adopting these practices and strategies, organizations can create an environment where employees can develop and achieve maximum performance, thereby contributing to organizational success and growth.

2. The Educational Management

Educational management is a part of management that deals with planning, organizing, coordinating, and evaluating activities within the education system, aiming at ensuring efficient leadership and continuous improvement of the educational process. This branch of management focuses on managing human, financial, and material resources in educational institutions, as well as on developing educational policies and implementing them in practice. Among the main aspects of educational management are (Hımmetoglu, Aydug, Bayrak 2020):

- Strategic planning: Defining institutional objectives and establishing strategies to achieve them.
- Institutional organization: Structuring the educational institution into efficient departments, programs, and work teams.
- Human resource management: Recruiting, selecting, training, and evaluating teaching and non-teaching staff to ensure a qualified and motivated workforce.
- Financial resource management: Allocating and efficiently using funds to support educational activities and institutional infrastructure.
- Curriculum development: Designing and implementing school programs that respond to students' needs and societal requirements.
- Performance evaluation and improvement: Continuously monitoring and evaluating the educational process to identify strengths and areas needing improvement.
- Communication and collaboration: Promoting effective communication among members of the educational community, as well as collaborating with parents, local authorities, and other partner organizations.

Educational management is essential for ensuring the quality of education and improving the performance of educational institutions in the context of continuous social, technological, and economic changes. Effective management contributes to creating an environment conducive to students acquiring knowledge, skills, and competencies relevant to their lives and society as a whole. Competency-based educational management is an approach that emphasizes the development and evaluation of competencies relevant to educational and life

success in general. This type of management focuses on identifying, understanding, and cultivating key competencies that students should acquire to become active and competent citizens in contemporary society.

Here are some key elements of competency-based educational management (Holubnycha, *et al.* 2022):

1.Identification of relevant competencies: It is essential to establish which competencies are crucial for students' success in school and in life after graduation. This may include academic competencies as well as social, emotional, and life skills.

2.Integration of competencies into the curriculum: Competencies need to be integrated into school programs and conveyed through appropriate teaching and assessment methods. The curriculum should be flexible and responsive to individual student needs so that they can develop all relevant competencies.

3.Assessment of competencies: Competency-based educational management involves assessing students' competencies in a holistic and authentic manner. This may involve using various assessment methods such as portfolios, projects, and ongoing assessments to evaluate progress and performance in different competency areas.

4.Teacher training: Teachers need to be prepared and supported to implement a competency-based approach in the classroom. This may include training in active teaching methodologies, diversity management, and relevant and equitable assessment of students' competencies.

5.Community and stakeholder involvement: Competency-based educational management involves collaboration with parents, the local community, and other stakeholders to ensure that the educational process meets their needs and requirements.

By adopting a competency-based approach in educational management, schools can contribute to preparing students for a constantly changing world, where skills and competencies are as important as academic knowledge. This approach can help students become more confident and capable of taking active roles in society and reaching their full potential.

After the Revolution of 1989, higher education in Romania underwent significant transformations, influenced by the political, economic, and social changes in the country. Among these changes, Vasilache, Temesi, Dima (2012) indicate that decentralization and university autonomy were important steps in the reform. In the post-revolution period, efforts were made to grant universities greater autonomy in resource management, academic planning, and administrative decision-making. This led to increased responsibility and flexibility within higher education institutions. As part of this change, greater academic freedom was granted, efforts were made to protect academic freedom and university independence, allowing researchers and professors to conduct research and provide education without fear of political persecution or influence.

Subsequently, a curricular reform took place. Although the curriculum remains very dense to this day, there was a greater emphasis on updating and modernizing study programs to make them more relevant to the labor market's requirements and to encourage the development of skills necessary for professional success in a rapidly changing society.

Upon integration into the European space, Romania sought to align itself with European standards and practices in higher education, including adopting the system of university studies in cycles (Bachelor's, Master's, Doctorate) and promoting student and academic staff mobility through programs such as Erasmus+.

Due to changes in the admissions system and the emergence of new faculties and specialties, there was a significant increase in access to higher education in Romania in the post-revolution period. The number of higher education institutions increased, and private universities became an important part of the academic landscape. With technological advances, there was an increase in the use of digital technologies in the teaching-learning process, including the introduction of online platforms, distance learning courses, and digital resources.

These changes were an integral part of the transition process of higher education in Romania towards a more flexible system, more oriented towards the needs of the labor market, and more integrated into the European and global context. However, challenges such as funding, the quality of education, and adaptation to the requirements of an ever-changing world persist, requiring continuous efforts to address them.

In the context of the changes in higher education in Romania after the Revolution, educational management can be defined as the process of planning, organizing, coordinating, and evaluating activities in higher education institutions, aiming to ensure efficient educational processes and continuous institutional performance improvement.

3. Educational Management in Higher Education

Educational management in higher education involves (Deem, Brehony 2005) effective strategic planning, namely, defining the long-term objectives of the higher education institution and developing strategies to achieve them. This may include, for example, the development of academic programs, institutional development plans, and educational

policies. Another important aspect of educational management is institutional organization, which involves structuring the higher education institution into departments, faculties, and other administrative units, as well as managing human, financial, and material resources efficiently and effectively.

Human resource management is a crucial objective. Recruiting, selecting, training, and evaluating academic and non-academic staff to ensure a qualified and motivated team of professionals who contribute to fulfilling the mission of the higher education institution are essential criteria for any faculty aspiring to be among the top institutions.

Furthermore, financial resource management is also a performance criterion. Allocating and efficiently using funds to support teaching, research, and development activities, as well as ensuring the overall functioning of the higher education institution, are essential.

Periodic curriculum review and development are also crucial. Academic programs need to be designed and updated to meet the needs and requirements of students and society, as well as to reflect changes in fields of study and the job market. For assessing and improving performance, continuous monitoring and evaluation of institutional performance and the educational process are necessary to identify strengths and areas needing improvement, as well as to make informed decisions for continuous improvement.

In conclusion, educational management in higher education is a complex and multidimensional process that involves managing all institutional aspects to ensure quality education and support the academic and professional success of students and academic staff.

The educational project represents a detailed and structured planning of activities and objectives to be carried out within an educational institution to fulfill its educational mission and vision. It can be seen as a strategic guide that sets the direction and priorities for the institution's medium- and long-term development (Parsons, Drew 1996).

The educational project is an essential tool for the leadership and management of educational institutions towards continuous improvement and the achievement of educational objectives. It is important for it to be flexible and adaptable to changes in the educational environment and the evolving needs of students and society.

Educational projects are developed by educational managers. Educational managers are essential professionals in the leadership and administration of educational institutions, including schools, high schools, and universities. Their responsibilities include strategic leadership, efficient resource management, pedagogical supervision, community partnership development, ensuring educational quality, compliance with legal regulations, effective communication, and continuous professional development. They are key to ensuring quality education and achieving the educational objectives of educational institutions (De Kydd, Crawford, Riches 1997).

Educational managers can hold various titles and roles depending on the level of the institution and its specific organizational structure. They play a vital role in ensuring the efficient functioning and continuous improvement of the educational system.

In the educational environment, the success of managerial endeavors is conditioned by teachers possessing the following categories of competencies: For educational management endeavors to be successful, teachers must possess diverse categories of competencies that enable them to fulfill their roles and responsibilities efficiently and effectively. Educational management requires teachers with a diverse range of essential competencies. These include pedagogical competencies, appropriate assessment and feedback for students, communication and interpersonal skills, classroom management, and the use of modern educational technologies. Additionally, teachers should be able to manage diversity in the classroom, collaborate with colleagues, and prioritize their continuous professional development. These competencies are fundamental to ensuring an efficient and effective educational environment in which students can thrive and learn appropriately.

These competencies are essential for teachers in successfully managing the educational process and contributing to the achievement of institutional objectives and student success. Continuous development of these competencies is crucial for adapting to changes in the educational field and improving teaching and learning practices.

The quality of higher education represents the extent to which educational activities, resources, and outcomes meet the standards and expectations established to ensure an efficient and valuable educational experience for students. Quality education is essential for the comprehensive development of students and their preparation for success in life. Accessibility and equity are fundamental, ensuring that all students, regardless of their social, ethnic, or economic background, have equal opportunities to benefit from resources and reach their full potential. A well-structured and relevant curriculum promotes both academic knowledge and the development of real-life skills. Qualified and well-prepared teachers create a stimulating and inclusive learning environment, while the use of a variety of teaching and assessment methods maintains student engagement and ensures proper

understanding of content. Access to adequate resources and appropriate infrastructure is crucial, and support for socio-emotional development and collaboration with the community can significantly contribute to improving the quality of the education process.

Ensuring quality in the education process requires continuous and collaborative efforts from all stakeholders involved in education - teachers, school leadership, parents, community, and policymakers. It is a dynamic process that needs to respond to the changing needs and challenges of students and society. Faced with underfunding, ensuring quality in higher education can be a challenge, and limited resources can negatively affect the educational experience of students and teachers. However, there are steps that institutions and decision-makers can take to improve quality under these conditions. Prioritizing resources, promoting partnerships and alternative funding, efficiency in administration, innovation in teaching methods, supporting the professional development of teaching staff, community involvement, and constant quality monitoring are essential approaches to ensuring quality higher education, even in the context of financial constraints (Tam 2001). Ultimately, underfunding can be a significant challenge in ensuring quality higher education, but with efficient resource management and strong commitment from all stakeholders involved, it is possible to improve the quality of the educational experience for students and teaching staff.

Conclusions

In conclusion, quality in higher education is essential for preparing students for their future and for contributing to society's development. It is important for educational institutions to provide a relevant, accessible, and high-quality educational experience, regardless of the level of available funding. Underfunding can be a challenge in achieving this goal, but there are ways in which institutions can maximize their resources and optimize their practices to ensure the quality of higher education.

Prioritizing resources, promoting partnerships and alternative funding, efficiency in administration and management, innovation in teaching and learning methods, supporting the professional development of teaching staff, involving the community and graduates, as well as monitoring and constantly evaluating quality are all essential elements in addressing underfunding in higher education.

By taking these measures and through the commitment of all stakeholders - educational institutions, decision-makers, teaching staff, students, and the community - it is possible to improve the quality of higher education and to provide better learning and development opportunities for all involved. It is important for these efforts to be continuous and adapted to the changing educational environment and the evolving needs of society.

Credit Authorship Contribution Statement:

Negulescu Mihail Cristian contributed with the idea of research, and with the beginning part, the Introduction. Also, the chapter *Educational Management in Higher Education* is his contribution**.** The conclusion part is also, the contribution of Negulescu Mihail Cristian

Barbu Cristina Mihaela is the corresponding author. Barbu Cristina Mihaela contributed with the short presentation of the research. She did the documentation about the current state of the research. The part of the article writing, editing part is her contribution.

Mihalcea Delia-Iuliana writing andandandted with her management experience to a renowned school in the city. The chapter *The Educational Management* is her contribution.

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Statistics in Social Sciences

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Abstract: This work is the result of some research and documentation of the theoretical problems of statistics and its applications in the study of phenomena and processes in nature and society. Statistics has applications in the most diverse fields, such as: medicine, natural sciences, economics, politics, human behavior sciences, etc. Practically, in any field of human existence we witness operations of gathering, systematizing and interpreting information. That is why its role is very important. Therefore, this paper reviews some statistical methods that are used in social sciences. The focus is mainly on the applied aspect of the techniques and the author give insights about techniques that can be used to answer problems in the abovementioned areas of research.
The article focuses on detailed explanations in the presentation of the consequences of the application of statistical procedures in the social sciences.

Introduction

Today we are dealing with statistics viewed as a resource, with statistics of sciences and fields of activity, in the sense that it has become omnipresent in every phase of our lives. Whether we like it or not, whether we are aware of it or not, we are dealing with statistical data, with the need for quantitative knowledge whenever the results of an experiment vary in an unforeseen or "random" manner ". A. Wald's prediction that "one day statistics will become as necessary for man as writing and reading" has become a reality.

Contemporary civilization cannot be imagined without numerical data because quantitative expression has become a necessity in all fields of knowledge. The practical needs related to the expression and transformation of social life determined the emergence and evolution of statistics.

Unlike the ancients who were satisfied with incomplete and occasional records and censuses made for administrative, military and financial purposes, nowadays we want permanent information in all fields.

Social science is one of the branches of science, devoted to the study of societies and the relationships among individuals within those societies. The term was formerly used to refer to the field of sociology, the original "science of society", established in the 18th century. In addition to sociology, it now encompasses a wide array of academic disciplines, including anthropology, archaeology, economics, human geography, linguistics, management science, communication science, psychology and political science (*"Social science: History, Disciplines, Future Development, and Facts". Britannica. April 27, 2023*)

Statistics play a crucial role in the social sciences for several reasons. Firstly, they allow researchers to make sense of large amounts of data and draw meaningful conclusions. Whether it's analyzing survey responses, economic trends, or demographic data, statistics help researchers identify patterns and relationships within complex social phenomena.

Secondly, statistics provide a way to test hypotheses and theories in the social sciences. By applying statistical methods, researchers can determine the likelihood that their findings are due to chance or if they reflect real relationships in the data. This helps ensure the validity and reliability of research findings.

Moreover, statistics allow for generalization. By collecting data from a sample of a population and using statistical techniques, researchers can make inferences about the entire population. This is particularly important in fields like sociology, where it's often impractical or impossible to study every individual in a population.

Additionally, statistics help policymakers and practitioners in the social sciences make informed decisions. Whether it's designing social programs, crafting public policy, or evaluating the effectiveness of interventions, statistics provide valuable insights into social issues and help guide decision-making processes.

Also, it is known that the majority of those who want to understand the human psyche do not show a special sympathy for numbers, formulas and calculation algorithms. However, today, statistics play an important role in psychology. Therefore, Statistics is also indispensable in psychology, contributing to the validation of theories, the improvement of clinical practices and the advancement of scientific knowledge. By using statistical methods, psychologists can ensure that their conclusions are based on solid evidence and can trust the results obtained from their research.

This is also valid in the use of statistics in law.

The scientific approach that we must use whenever we carry out a serious and valid study in the social sciences is a strictly staged process, which refers to (Dowdy et al. 2004):

1. Problem formulation;
2. Formulation of hypotheses;
3. Research design;
4. Carrying out observations;
5. Data interpretation;
6. Formulation of conclusions.

The success of the research can be appreciated by the correctness of the conclusions and by deepening the knowledge of the data recorded based on the indicators resulting from the statistical processing. If the assessments made on the basis of the research are inconsistent, the obvious nature of the studied group means that important errors have occurred.

In general, in the real world and in the economy in particular, no sequence of events is repeatable at the same level of manifestation, therefore probabilistic models are much more suitable for modelling phenomena in nature and society.

Deterministic models imply the possibility of making error-free predictions about the future states of a system, based only on the knowledge of previous states, which does not constitute a relevant scheme of the mechanism of human knowledge. Therefore, any conclusion and decision made following the application of the statistical method is a probabilistic and not certain decision.

Overall, statistics serve as a powerful tool for understanding, analysing, and addressing complex social phenomena, making them indispensable in the social sciences.

1. Literature Review

The multitude of fields in which statistics are applied allowed M.G. Kendall (1953) to say that "Statistics, in the broadest sense, is the matrix of any experimental science".

Statistics studies pressing problems from across the social sciences: economics, policy, and quantitative finance; the census, official statistics, and demography; political science and election integrity and security; sociology, social network analysis, and computational social science; and education and psychometrics. Thus, Petros Maravelakis (2019) reviews some of the statistical methods used in the field of social sciences, and Hesse and Ofosu (2017) presents many applications of statistics in engineering and social sciences.

The fact that statistics represent the scientific foundation of disciplines such as psychology, sociology, anthropology, econometrics and many others has been emphasized by Opariuc-Dan since 2009.

A literature review on the use of statistics in economics highlights the crucial role that statistical methods play in economic research and policy analysis. Methods such as regression analysis, time series analysis, and panel data analysis are widely used to understand relationships between economic variables and to forecast future trends (Samila, S., and Sorenson, O. 2011)

The application of statistics in psychology is a critical aspect of research, enabling psychologists to analyze data, validate hypotheses, and draw meaningful conclusions. Olsson-Collentine et al. (2019) explores the multifaceted use of statistics in psychology, highlighting its importance in various research methodologies and the development of psychological theories. Descriptive statistics allow psychologists to summarize data related to human performance, happiness, and other metrics (Nitsch, J. R., and Hackfort, 2016).

Quantitative methods in various subfields, from psychology to economics, are under demand for constant development and refinement in *Statistics in the Social Sciences: Current Methodological Developments* (2010), volume focused on fostering collaboration among mathematical statisticians and social science researchers.

Recent articles on the use of statistics in the social sciences have highlighted several important trends and methodologies.

Multilevel Modelling and Categorical Data is one key area of focus is multilevel modelling, which is used to analyze data involving nested structures, such as students within schools. This approach helps in understanding the effects of both individual and group-level variables. Categorical data analysis, including logistic regression and log-linear models, is also vital. These methods are crucial for dealing with variables that fall into discrete categories, such as survey responses categorized by demographic groups. For example, Jessica M E Herzing et al. (2024) demonstrates how an alternative parametrization of the random components in multilevel models, so-called separate coding, delivers valuable insights into differential interviewer effects for specific groups of sample members.

Time series analysis is another significant method, particularly in fields like economics and marketing. Techniques such as autoregressive models (AR), moving average models (MA), and their combinations (ARMA and ARIMA) are commonly used to analyze data collected over time. These models help in understanding patterns and making forecasts based on historical data. With the growing availability of multi-wave surveys, social scientists are turning to latent trend models to examine changes in social and political attitudes. Kołczyńska and Bürkner (2024) propose a framework for estimating trends in public opinion consisting of three components: the measurement model that links the observed survey responses to the latent attitude, the latent trend model that estimates a trajectory based on aggregated individual latent scores, and representativeness adjustments.

The increasing availability of large datasets has led to the adoption of data mining and machine learning techniques in social sciences. These methods, derived from statistics and artificial intelligence, are used to uncover patterns and make predictive analyses. This is especially important in handling large-scale social phenomena and deriving insights from complex data sets. For exemple, numerous researchers have developed different algorithms for automated occupation coding. Schierholz and Schonlau (2021) demonstrate the best results are obtained by merging the list of job titles with coded answers from previous surveys before using this combined training data for statistical learning.

Recent advancements also emphasize the importance of causal inference in understanding relationships between variables. Techniques like nonparametric estimation and dynamic graphics for statistics are being utilized to improve the robustness of statistical tests and the interpretation of high-dimensional data. This is crucial for making accurate inferences in complex social systems.

The integration of various data sources, including administrative, commercial, and digital trace data, is becoming more prevalent. This integration allows for more comprehensive analyses and the ability to address new research questions that were previously infeasible due to data limitations.

These advancements underscore the dynamic nature of statistical applications in social sciences, highlighting the continuous evolution of methodologies to address complex and large-scale data challenges.

2. Statistics in Sociology

Sociology deals with studying various social phenomena such as inequality, social mobility, and cultural norms. Statistics provide a way to quantify and measure these phenomena, allowing sociologists to describe and analyze them systematically.

Sociologists often formulate hypotheses about social relationships, behaviour, or the effects of certain variables. Statistics allow them to test these hypotheses rigorously using empirical data, determining whether their hypotheses are supported or refuted.

Sociologists use statistical analysis to identify patterns and trends in social data. This could include trends in marriage rates, crime rates, educational attainment, or income distribution. By understanding these patterns, sociologists can gain insights into societal changes and dynamics.

Also, sociologists frequently engage in comparative studies to understand how societies differ or are similar. Statistics enable them to compare social indicators across different groups, regions, or time periods, providing valuable insights into social structures and processes.

Sociology often deals with studying large populations. Statistics provide methods for sampling from these populations in a way that ensures representativeness and generalizability of findings. This allows sociologists to draw conclusions about entire populations based on data from a subset.

Statistics play a crucial role in evaluating social policies and programs. Sociologists use statistical methods to assess the impact of policies on various social outcomes, such as poverty rates, crime rates, or educational attainment. This information helps policymakers make informed decisions about policy design and implementation. In some cases, sociologists use statistical techniques for predictive modelling, forecasting future social trends or outcomes based on historical data and current trends.

In summary, statistics are indispensable in sociology for studying, analysing, and understanding the complexities of social life, as well as informing policy decisions and interventions aimed at addressing social issues.

2.1 Study Case. The study of Income Inequality in a Society

One example of the use of statistics in sociology is in the study of income inequality within a society.

Let's say a sociologist wants to investigate the level of income inequality in a particular country. Here's how statistics would be used in this study:

- **Data Collection**: The sociologist would collect data on income from a representative sample of individuals or households within the country. This could involve surveying a random sample of the population or using data from government sources such as tax records or household surveys.
- **Descriptive Statistics**: Descriptive statistics would be used to summarize the distribution of income in the sample. Measures such as the mean (average) income, median (middle) income, and measures of dispersion like the Gini coefficient could be calculated to describe the level of inequality.
- **Comparative Analysis**: Statistics allow sociologists to compare income levels and inequality across different demographic groups, such as gender, race, age, education level, or geographic region. This comparative analysis can reveal disparities in income distribution and highlight patterns of inequality within society.
- **Trend Analysis**: Sociologists can use statistical techniques to analyze changes in income inequality over time. By comparing data from different time periods, they can identify trends, such as whether inequality is increasing or decreasing, and understand the factors driving these changes.
- **Multivariate Analysis**: To understand the factors contributing to income inequality, sociologists may conduct multivariate analysis using regression techniques. This involves examining the relationship between income and various demographic, social, and economic variables, such as education, occupation, marital status, or industry sector.
- **Spatial Analysis**: Statistics can also be used to analyze spatial patterns of income inequality within a country. Geographic information systems (GIS) and spatial statistical techniques allow sociologists to map income distribution and identify areas with high levels of inequality or poverty concentration.
- **Policy Evaluation**: Sociologists may use statistics to evaluate the effectiveness of policies aimed at reducing income inequality, such as minimum wage laws, social welfare programs, or progressive taxation. Statistical methods help assess the impact of these policies on income distribution and social outcomes.
- **Reporting Findings**: The results of the study, including statistical analyses, charts, and tables, would be reported in a research paper or report. This allows other researchers, policymakers, and the public to understand the extent of income inequality and its implications for society.
- The share in poverty in any country depends on two factors: the average level of income and the level of inequality.

The EU statistics on income and living conditions (EU-SILC) indicators provide insights on the economic wellbeing and other living conditions on EU residents based on data collected during a specific year, denoted as N. This data encompasses both the characteristics of households for that year (N) and the income from the preceding year, N-1. The income for year N-1 is an estimate for income of year N within EU-SILC. To take into account differences in household size and composition and thus enable comparisons of income levels, the concept of equivalised disposable income is used. It is based on the total net (also referred to as disposable) household income divided by the number of 'equivalent adults', using a standard (equivalence) scale.

For example, the indicators on poverty and income inequality are based on EU statistics on income and living conditions (EU-SILC). The AROP rate is part of the at risk of poverty or social exclusion rate defined in the framework of the EU 2030 target on poverty and social exclusion.

Providing timelier social statistics – especially indicators on income poverty and inequality – is a priority for the Commission and the European Statistical System. In order to better monitor the effectiveness of social policies at EU level, Flash Estimates (FE) offer early indicative results for income year N, until EU-SILC data become available.

These estimates, that are part of the experimental statistics produced by Eurostat, have a release date appreciably earlier than the survey data.

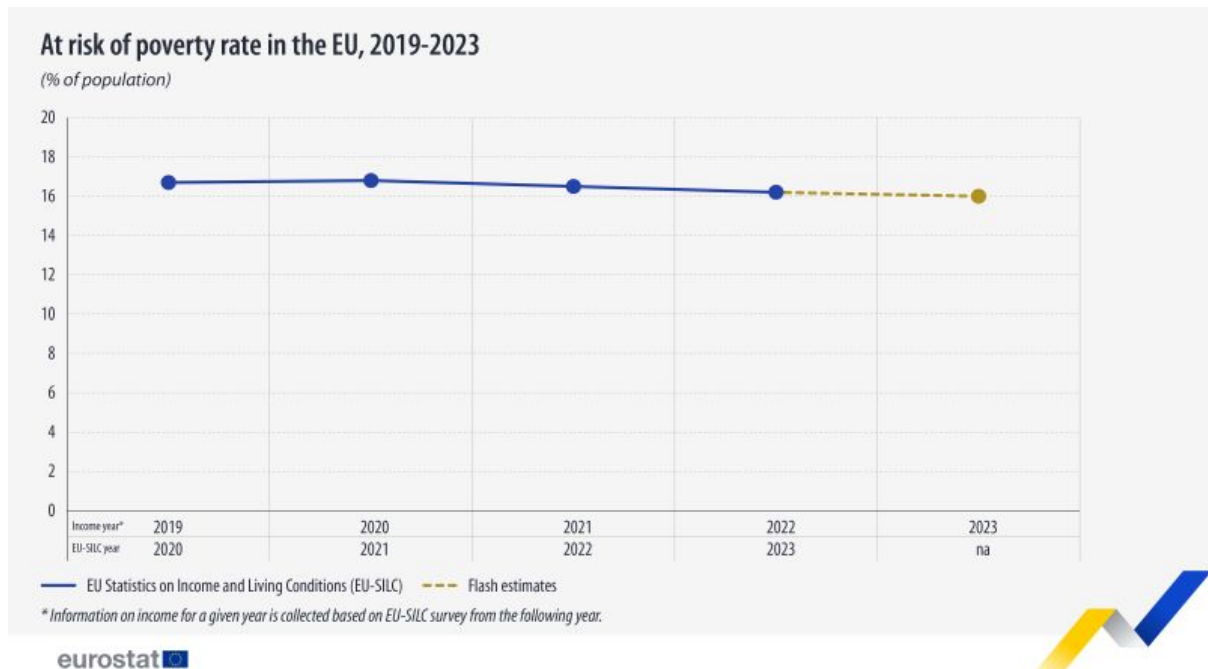Figure 1. At risk of poverty rate in the EU, 2019-2023

Figure 1 shows the at-risk-of-poverty (AROP) rate in EU-SILC 2023 (2022 income), complemented by the flash estimates on the AROP rate based on 2023 income (nowcasting EU-SILC 2024). According to the 2023 EU-SILC results, Latvia, Estonia (both 22.5 %) and Romania (21.1 %) had the highest at-risk-of-poverty rates. On the other side, Ireland, Denmark, and Czechia reported the lowest shares (12.0 %, 11.8 % and 9.8 %, respectively). Flash estimates are represented by arrows indicating the estimated direction and magnitude of change. According to the flash estimates, AROP is expected to remain stable in most countries (17), decrease in 6 (Germany, Estonia, Spain, the Netherlands, Portugal and Finland), and increase in 4 (Greece, France, Luxembourg, and Austria). It should be noted that these indicators are based on nominal values of disposable income and therefore do not incorporate changes in the cost of living and purchasing power (Eurostat).

In order to better monitor the effectiveness of social policies at EU level, flash estimates (FE) have been developed. These estimates are calculated based on nowcasting and modelling techniques and have a release date appreciably earlier than the survey data: i.e., FE of income year 2023 published in June 2024 complementing EU-SILC 2023 data that refers to income year 2022.

In summary, statistics are indispensable in sociology for studying, analysing, and understanding the complexities of social life, as well as informing policy decisions and interventions aimed at addressing social issues.

3. Statistics in Psychology

The systematic use of statistics in psychology dates back to the early 1950s. At the time, when computers were still in the electromechanical age, the biggest problem was computational effort. For this reason, learning statistics then meant above all learning formulas and procedures that would simplify the computational effort as much as possible. The appearance of computers and statistical processing programs made it possible to move to the face where the emphasis is on understanding statistical reasons.

Even when engaged in an activity with a strongly individual orientation, such as psychotherapy, the psychologist cannot dispense with statistics. It is necessary for its evaluation of a new therapeutic method, compared with other differences, or for the identification of certain conditions that can influence the effectiveness of therapy sessions (time of day, gender similarity between the patient and the therapist, etc.). Also, integration into the professional scientific environment forces the psychologist to use statistical methods in the elaboration of his own studies or in the understanding of studies from specialized literature.

Psychologists use statistical methods to design studies and analyze data. Whether conducting experiments, observational studies, or surveys, statistical techniques help psychologists make sense of the data they collect and draw valid conclusions about behavior and mental processes.

Psychology often deals with abstract concepts such as personality traits, intelligence, or mental health. Statistics provide a way to quantify and measure these constructs, allowing psychologists to assess and compare them across individuals or groups. Like in sociology, psychologists formulate hypotheses about behavior, cognition, or the effects of interventions. Statistics allow them to test these hypotheses rigorously, determining whether their predictions are supported by empirical evidence. Individuals vary in their behaviors, thoughts, and emotions. Statistics help psychologists understand the extent of this variability and identify factors that contribute to differences between individuals or groups.

Psychologists need to ensure that their measures are reliable and valid. Statistics provide methods for assessing the consistency and accuracy of measurements, helping researchers determine whether their instruments are measuring what they intend to measure.

Also, psychologists often study relationships between variables. Statistics enable them to examine correlations between different factors and assess the strength and direction of these relationships. While correlation does not imply causation, statistical methods can help researchers infer causality in certain situations.

Psychology relies heavily on empirical research findings. Meta-analysis, a statistical technique that combines results from multiple studies, allows psychologists to synthesize evidence from a body of research and draw more robust conclusions about a particular phenomenon. In clinical psychology, statistics are used in the assessment and diagnosis of mental disorders. Psychologists employ statistical methods to interpret psychological tests, evaluate symptoms, and determine appropriate interventions for clients.

Moreover, psychologists working in applied settings, such as therapy or organizational psychology, use statistics to evaluate the effectiveness of interventions and programs. By analysing outcome data, psychologists can assess whether their interventions are achieving the desired outcomes and make adjustments as needed.

Data is needed to conduct studies. There is a primary registry of clinical trial (ISRCTN at https://www.isrctn.com) registry recognised by World Health organization (WHO) and International Committee Medical Journal Editors (ICMJE) that accepts all clinical research studies (whether proposed, ongoing or completed), providing content validation and curation and the unique identification number necessary for publication.

3.1   Study Case. The Cognitive-Behavioural Therapy (CBT) for Treating Depression

Cognitive behavioural therapy (CBT) is one of the most evidence-based psychological interventions for the treatment of several psychiatric disorders such as depression, anxiety disorders, somatoform disorder, and substance use disorder. The uses are recently extended to psychotic disorders, behavioural medicine, marital discord, stressful life situations, and many other clinical conditions (Gautam *et al.*, 2020).

Let's say a group of researchers wants to investigate whether CBT is effective in reducing symptoms of depression compared to a control group that receives no treatment. Here's how statistics would be used in this study:

- **Study Design**: The researchers would design a study where participants with depression are randomly assigned to either the CBT group or the control group. This is important to ensure that any differences observed between the two groups are due to the treatment and no other factors.
- **Data Collection**: Before and after the intervention, participants would complete a depression symptom questionnaire, such as the Beck Depression Inventory (BDI). These questionnaires provide numerical data on the severity of depressive symptoms.
- **Descriptive Statistics**: Descriptive statistics would be used to summarize the characteristics of the participants in each group (e.g., mean age, gender distribution) and the initial levels of depression symptoms.
- **Inferential Statistics**: The main analysis would involve inferential statistics to determine if there is a significant difference in depression scores between the two groups after the intervention. This could be done using a statistical test such as the t-test or analysis of variance (ANOVA), depending on the study design and assumptions.
- **Effect Size**: In addition to testing for statistical significance, researchers would calculate the effect size to quantify the magnitude of the difference between the groups. This helps to determine the practical significance of the intervention.
- **Control for Confounding Variables**: Statistics may also be used to control for potential confounding variables that could influence the results, such as initial severity of depression, demographic factors, or

medication use. This could be done through techniques like analysis of covariance (ANCOVA) or propensity score matching.

- **Interpretation of Results**: Based on the statistical analysis, the researchers would interpret the findings. If the CBT group shows a significant decrease in depression symptoms compared to the control group, they would conclude that CBT is effective in reducing depressive symptoms.
- **Reporting Findings**: The results of the study, including statistical analyses, effect sizes, and any relevant graphs or tables, would be reported in a research paper or article for publication in a peer-reviewed journal.

Next, we will give the example of a research carried out by academic staff from the University of Bristol, together with colleagues from the universities of Exeter, Oxford, Glasgow and University College London (Nicola *et al.*, 2016). This study found when CBT was given, in addition to usual care that included antidepressants, it was effective in reducing depressive symptoms and improving quality of life over the long term – on average 46 months – for patients whose depression had not responded to medication. These benefits were found on average, 40 months after the end of therapy.

Figure 2. CoBalT trial profile extended to include long-term follow-up
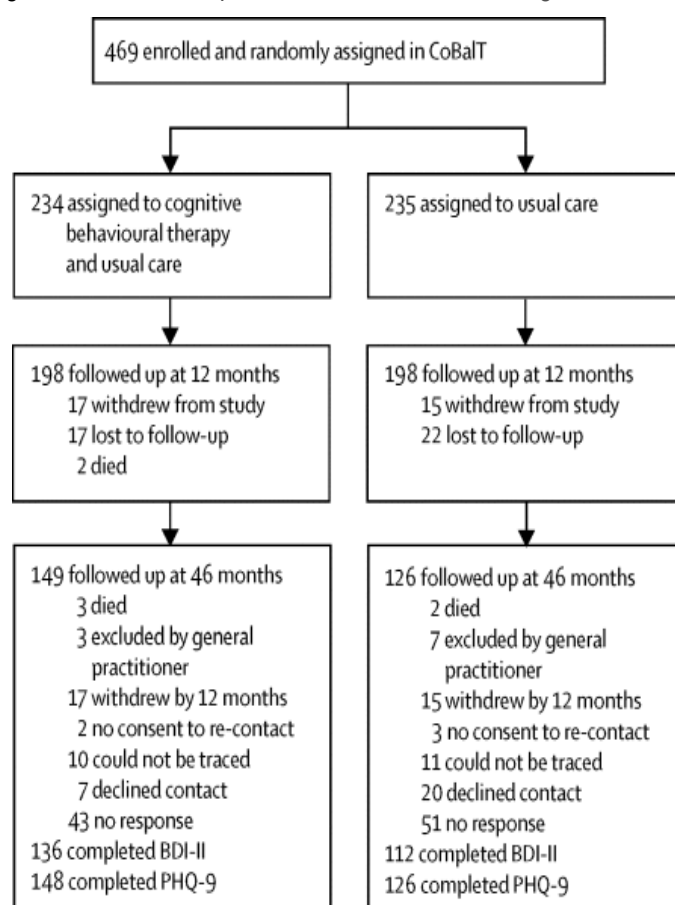
Source: Nicola et al., 2016, https://www.thelancet.com/journals/lanpsy/article/PIIS2215-0366(15)00495-2/fulltext

Statistical analyses were done with Stata version 13.1. According to this study, more than 50% of primary care patients with depression do not respond to antidepressants. The findings provide robust evidence for the effectiveness of CBT given as an adjunct to usual care that includes medication in reducing depressive symptoms and improving quality of life over the long term. Also, the effects observed were substantial and represented good value for money. As most of the CoBalT participants had severe and chronic depression, with physical or psychological comorbidity, or both, these results should offer hope for this population of difficult-to-treat patients. Clinicians need to discuss referral for CBT with all those for whom antidepressants are not effective.

The phenomena of intense closeness and increasingly accentuated collaboration between the contemporary psychologist and the modern statistician are turning each of them more and more into interdisciplinary team researchers, enriching each one's specific language, the medical one with the statistical one or vice versa, contributing to the structuring of increasingly efficient research methodologies.

4. Statistics in Political Sciences

Statistics play a crucial role in political science, offering tools to analyse, interpret, and understand political phenomena.

Political scientists often use statistics to analyze election results, voter behavior, and turnout rates. They employ techniques like regression analysis to understand how factors such as demographics, economic indicators, and campaign strategies influence electoral outcomes. Surveys and opinion polls are common tools in political science for gauging public opinion on various issues, candidates, and policies. Statistical methods help in sampling, data collection, and analysis of survey data, allowing political scientists to draw accurate conclusions about public sentiment.

Also, comparative politics involves studying political systems, institutions, and behaviors across different countries. Statistics enable political scientists to compare political indicators such as government stability, corruption levels, or policy outcomes across nations, using techniques like cross-national regression analysis.

Statistical methods are used to evaluate the effectiveness of public policies and programs. Political scientists employ techniques such as difference-in-differences analysis or randomized controlled trials to assess the impact of policies on outcomes such as poverty rates, crime rates, or economic growth. Moreover, statistics help political scientists study individual and collective behavior in politics. This includes analyzing factors that influence voting behavior, political participation, party affiliation, and political mobilization.

Political scientists often use mathematical models and game theory to understand strategic interactions among political actors. Statistics are employed to estimate parameters in these models and test their predictions against empirical data.

In the study of political networks, statistics are used to analyze the structure and dynamics of relationships among individuals, organizations, or governments. Network analysis techniques like centrality measures or community detection help identify key actors and patterns of influence.

Political scientists often analyze data over time to understand trends and patterns in political phenomena. Longitudinal statistical techniques allow researchers to track changes in variables such as public opinion, policy outcomes, or political attitudes over multiple time points.

Political scientists use statistical models to forecast election outcomes, predict policy impacts, or anticipate political events. These models integrate historical data, current trends, and relevant predictors to make informed predictions about future developments.

4.1 Study Case. Analysis of Voter Behaviour

This example illustrates how statistical analysis can help political scientists understand voter behaviour, identify key factors influencing voter turnout, and suggest evidence-based policies to improve democratic participation.

Understanding voter behavior in the context of the European elections of 2024 involves analysing various factors that influence how individuals and groups decide to vote. This includes demographic, economic, social, and political influences. Here are several key aspects to consider:

1. Demographic Factors
- Age: Younger and older voters often have different priorities and political leanings.
- Gender: Voting patterns can differ between men and women, influenced by issues such as gender equality, social policies, and economic opportunities.
- Education: Higher levels of education often correlate with different political preferences and voter turnout rates.
- Urban vs. Rural: Voters in urban areas may prioritize different issues compared to those in rural areas, such as public transportation versus agricultural policies.

2. Economic Factors
- Employment Status: Unemployment or job security concerns can significantly influence voting behavior, often swaying voters towards parties that promise economic stability and job creation.
- Income Levels: Economic disparities can lead to differing priorities, with wealthier voters potentially focusing on tax policies, while lower-income voters may prioritize social welfare programs.
- Economic Outlook: General perceptions of the economy, including inflation, cost of living, and economic growth, impact voter sentiment.

3. Social Factors
- Migration and Integration: Attitudes towards immigration and the integration of migrants can be a significant factor, particularly in regions experiencing high levels of immigration.

- Social Justice Issues: Topics such as LGBTQ+ rights, gender equality, and minority rights can influence voter behavior, especially among younger and more socially progressive voters.
- Environmental Concerns: Climate change and environmental policies are increasingly important, particularly for younger voters and those in regions affected by environmental issues.

4. Political Factors

- Party Loyalty: Historical loyalty to specific parties can influence voting behavior, though this is often less rigid in modern European elections.
- Populism and Extremism: The rise of populist and extremist parties can shift traditional voting patterns, appealing to voters disillusioned with mainstream parties.
- Political Campaigns: The effectiveness of political campaigns, including the use of social media, advertisements, and public debates, can sway undecided voters.
- European Integration: Attitudes towards the European Union and further integration can significantly influence voter behavior, with some voters supporting parties that advocate for more integration and others favoring Eurosceptic parties.

5. Cultural Factors

- National Identity: Issues of national identity and sovereignty can play a crucial role, especially in regions with strong nationalist movements.
- Historical Context: Historical events and long-standing regional issues can shape voter behavior and party preferences.

6. Media Influence

- Traditional Media: Newspapers, television, and radio can shape public opinion and influence voter behavior through their coverage of the election and political issues.
- Social Media: Platforms like Facebook, Twitter, and Instagram are increasingly important for reaching younger voters and shaping political discourse.

7. Voter Turnout

- Motivation to Vote: Factors that motivate voters to turn out, such as perceived stakes of the election, satisfaction with democratic processes, and the impact of grassroots mobilization efforts.
- Barriers to Voting: Practical issues such as voter registration processes, accessibility of polling stations, and availability of early or postal voting options.
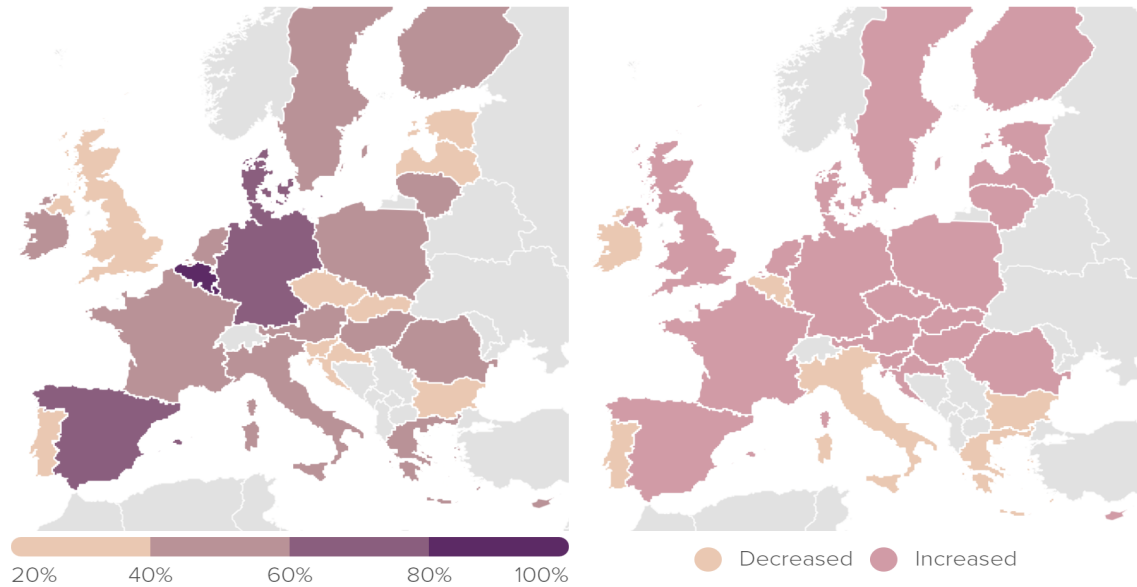
Figure 3. Turnout in the European election compared with the average turnout in national parliamentary and presidential elections in EU9* and EU28** countries
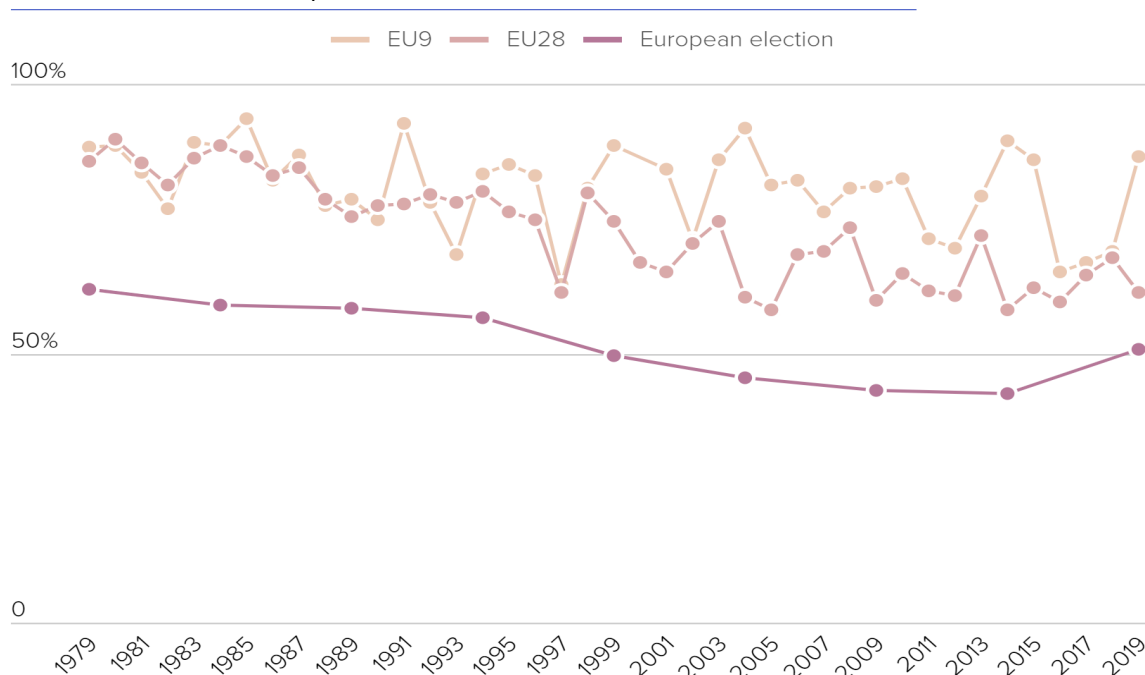
*Belgium, Luxembourg, the Netherlands, Italy, Germany, the U.K., Ireland, France, Denmark. **EU27 countries plus the U.K.
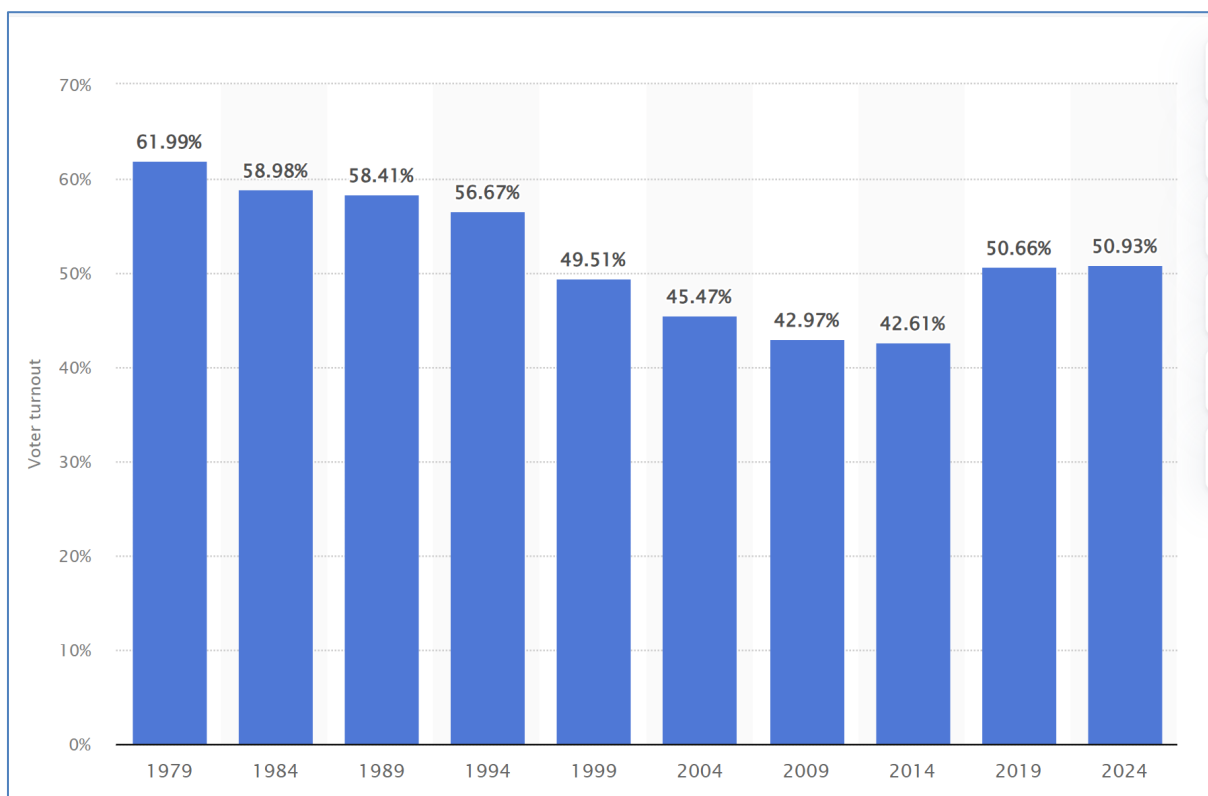
Figure 4. Turnout in the 2019 European election by country and change compared with 2014

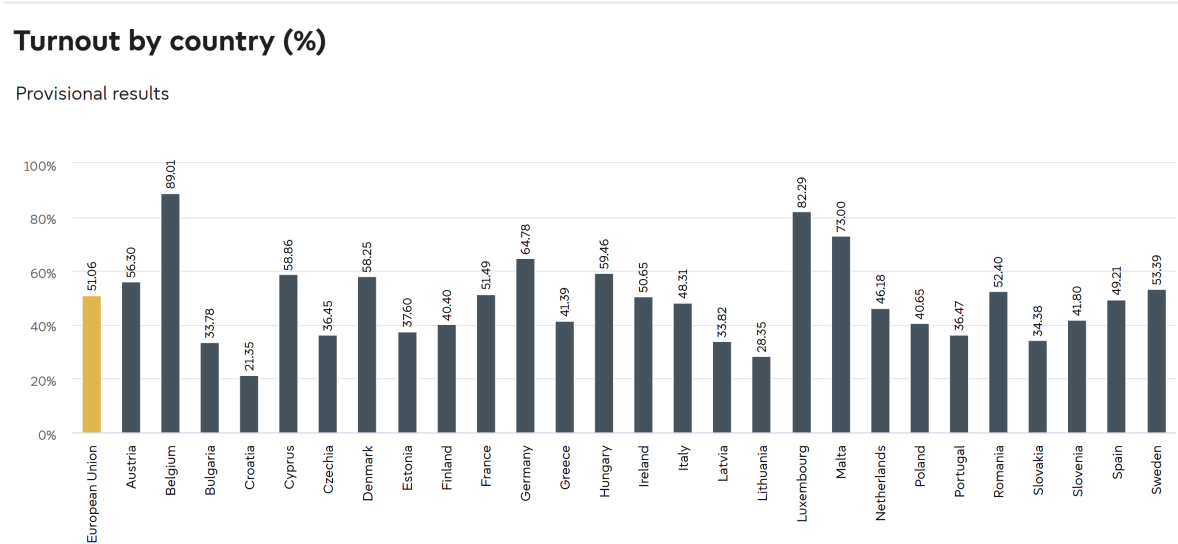Turnout in the 2019 European election by country and change compared with 2014.

For the 2024 elections, the only accessible data are those in Figure 5 and Figure 6.

Figure 5. Voter turnout in the European Parliament Elections in the European Union (EU) from 1979 to 2024

Source: Statista 2024

Figure 6. Turnout by country, 2024

Turnout by country (%)

Provisional results

Source: Statista 2024

To analyze voter behavior for the European elections of 2024, several methodologies can be employed:

- Surveys and Polls: Conducting pre-election and exit polls to gauge voter intentions and understand the issues that matter most to them.
- Statistical Analysis: Using regression models and other statistical tools to identify correlations and causations in voter behavior.
- Case Studies: Examining specific regions or demographic groups to gain deeper insights into localized voting patterns.
- Comparative Analysis: Comparing voter behavior across different European countries to identify common trends and unique factors.

Understanding voter behavior in the 2024 European elections requires a comprehensive approach that considers a wide range of demographic, economic, social, and political factors. By analyzing these influences, researchers and political analysts can gain valuable insights into the motivations and preferences of European voters, helping to predict election outcomes and inform future political strategies.

This example illustrates how statistical analysis can help political scientists understand voter behaviour, identify key factors influencing voter turnout, and suggest evidence-based policies to improve democratic participation.

5. Statistics in Economics

Statistics play a crucial role in economics by providing tools and methodologies to analyze data, test theories, and make informed decisions.

Economists use statistical methods to collect and analyze data. This involves designing surveys, experiments, and other data collection methods to gather relevant information. Once data is collected, statistical techniques are used to analyze it, identify trends, and make sense of complex datasets.

Statistical models are essential for understanding economic phenomena and making forecasts. Econometric models, which combine economic theory with statistical methods, allow economists to estimate relationships between different economic variables. These models are used to predict future economic conditions, such as inflation rates, unemployment levels, and GDP growth. In economics, hypotheses about how different factors influence economic outcomes can be tested using statistical methods. By applying techniques such as regression analysis, economists can determine whether there is a statistically significant relationship between variables and test the validity of economic theories.

Also, statistics are used to evaluate the impact of economic policies. By analyzing data before and after the implementation of a policy, economists can assess its effectiveness and make recommendations for future policy decisions. This involves using control groups and statistical techniques to isolate the effects of the policy from other factors.

Many key economic indicators, such as inflation, unemployment, and GDP, are derived from statistical analysis. These indicators are vital for understanding the state of the economy and for making comparisons over time or between different countries.

In financial economics, statistics are used to assess and manage risk. This involves analyzing historical data to estimate the likelihood of various outcomes and to develop strategies for mitigating potential risks. Techniques such as value at risk (VaR) and stress testing are commonly used in this context.

Statistics are used to analyze market trends and behaviors. This includes studying consumer behavior, market competition, and price dynamics. Statistical tools help economists understand how markets operate and how various factors influence supply and demand.

Experimental economics uses controlled experiments to study economic behavior. Statistics are crucial in designing experiments, analyzing the results, and drawing conclusions about economic theories and human behavior.

Common Statistical Techniques in Economics are:

- Descriptive Statistics: Summarizing data using measures such as mean, median, mode, and standard deviation.
- Inferential Statistics: Making predictions or inferences about a population based on a sample of data.
- Regression Analysis: Examining the relationship between a dependent variable and one or more independent variables.
- Time Series Analysis: Analyzing data points collected or recorded at specific time intervals to identify trends, cycles, and seasonal variations.
- Panel Data Analysis: Using data that tracks the same subjects over multiple time periods to analyze dynamic changes and causality.

Statistics provide the foundation for empirical research in economics, enabling economists to test theories, evaluate policies, and make predictions. The integration of statistical methods into economic analysis ensures that conclusions drawn are based on robust, quantifiable evidence. This, in turn, helps in formulating sound economic policies and making informed decisions that can positively impact economies.

Knowledge of daily events such as the evolution of prices and wages, the exchange rate, inflation, etc. is not possible without quantitative expression.

5.1. Study Case. Relationships between Economic Variables

The analysis of the interdependence between phenomena, in general, and between economic ones, in particular, is a particularly difficult problem. Defining the causal connection between two events A and B in the economy should not be done abstractly, but considering the concrete conditions in which these events occur. Thus, the analysis of the causal connection begins with a qualitative approach, considering the foundations of economic theory and the experience gained in studying a phenomenon, and only after that quantitative methods specific to statistical research will be used. The series of data obtained following the observation process will be processed through appropriate statistical methods.

The market economy required that the statistical survey be an important element in the study of the social and economic phenomenon and in the elaboration of statistical information.

The Internet has enabled changes in communication between people in terms of how to do business, including in marketing research. The business environment embraced online research, which led to the realization of qualitative and quantitative research, due to the advantages related to speed, the reduction of material costs, etc. The limitations are also considerable, deriving for example from the low, uneven penetration of the Internet in certain geographic areas, poorly developed in terms of infrastructure.

The relationship between advertising and sales volume is often explored through correlation analysis to understand how changes in advertising expenditure impact sales. Correlation analysis measures the strength and direction of the linear relationship between two variables. Here's a step-by-step example of how such an analysis might be conducted:

Step 1: Collect Data

Gather data on advertising expenditure and sales volume over a specific period. For this example, let's assume we have monthly data for one year.

Table 1. Advertising expenditure and Sales volume

Month	Advertising Expenditure (in $1000s)	Sales Volume (in units)
January	10	200
February	15	220
March	14	210
April	20	250
May	18	210
June	25	300
July	22	280
August	30	320
September	28	310
October	35	350
November	33	340
December	40	400

Step 2: Plot the Data
Create a scatter plot to visualize the relationship between advertising expenditure and sales volume. This helps to see if there is a visible pattern or trend.

Figure 7. A scatter chart to compare the two sets of values. The trendline
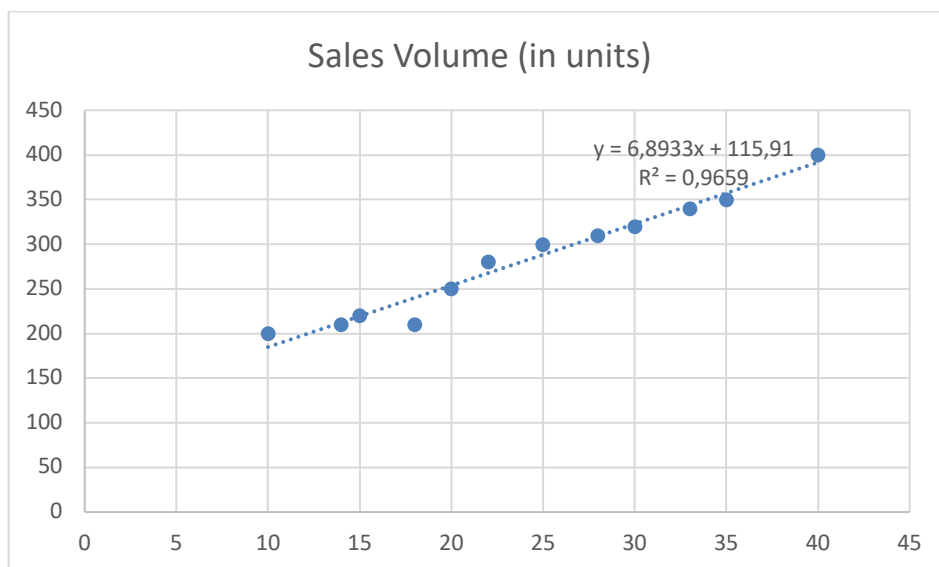
Step 3: Calculate the Correlation Coefficient
The correlation coefficient values satisfy the inequality $-1 \leq r_{xy} \leq 1$ and their interpretation is as follows:

- if $0 \leq r_{xy} \leq 0,2$ there is no connection between variables x and y or this connection is very weak; if $0,2 \leq r_{xy} \leq 0,5$ the link is weak; if $0,5 \leq r_{xy} \leq 0,75$ the connection is of medium intensity; if $0,75 \leq r_{xy} < 1$ there is a deterministic or functional link. The type of connection between the two variables is determined by the

sign of *r*, if *r* is positive the connection is direct, for $r < 0$ the connection is indirect. When $r = 0$ the variables are independent or uncorrelated.

$$r_{xy} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{\left[n\sum x_i^2 - \left(\sum x_i\right)^2\right]\left[n\sum y_i^2 - \left(\sum y_i\right)^2\right]}}$$

where:
- n is the number of data points
- x is the advertising expenditure
- y is the sales volume

Example Interpretation

The calculated correlation coefficient is r=0.96.

A correlation coefficient of 0.96 indicates a very strong positive linear relationship between advertising expenditure and sales volume. This means that as advertising expenditure increases, sales volume tends to increase significantly as well.

This example demonstrates how to perform a correlation analysis between advertising and sales volume. A strong positive correlation suggests that increasing advertising expenditure is associated with higher sales volume, which can help businesses make informed decisions about their advertising strategies.

Conclusions

Today, statistics are a powerful tool for learning about the world around us. Most disciplines borrow from statistics its models and procedures, otherwise indispensable for fulfilling their role. It should be mentioned, however, the great danger to which these disciplines can be subjected in case of improper use of statistical methods and procedures. Analysis and knowledge of socio-economic phenomena and processes can only be achieved as a result of rigorous and methodical observation, during which they can be measured. Within the operation of modelling phenomena and processes, a process of symbolizing and abstracting them takes place in order to analyse them quantitatively.

Based on what has been presented, the role and importance of knowing the methods and procedures made available by statistics in the knowledge process can be emphasized once again. The contribution of statistics is not unimportant even in fields such as: medicine, biology, physics, chemistry, legal sciences, etc. There are frequent cases in which studies undertaken in these fields draw conclusions that are based on a lot of data resulting from statistical observations, directly involving models of statistical inference.

Therefore, the systemic vision of researching economic and social phenomena requires interdisciplinarity within which statistical analysis occupies an important place.

Declaration of Competing Interest

The author is Editor in Chief and was not involved in the editorial review or the decision to publish this article.

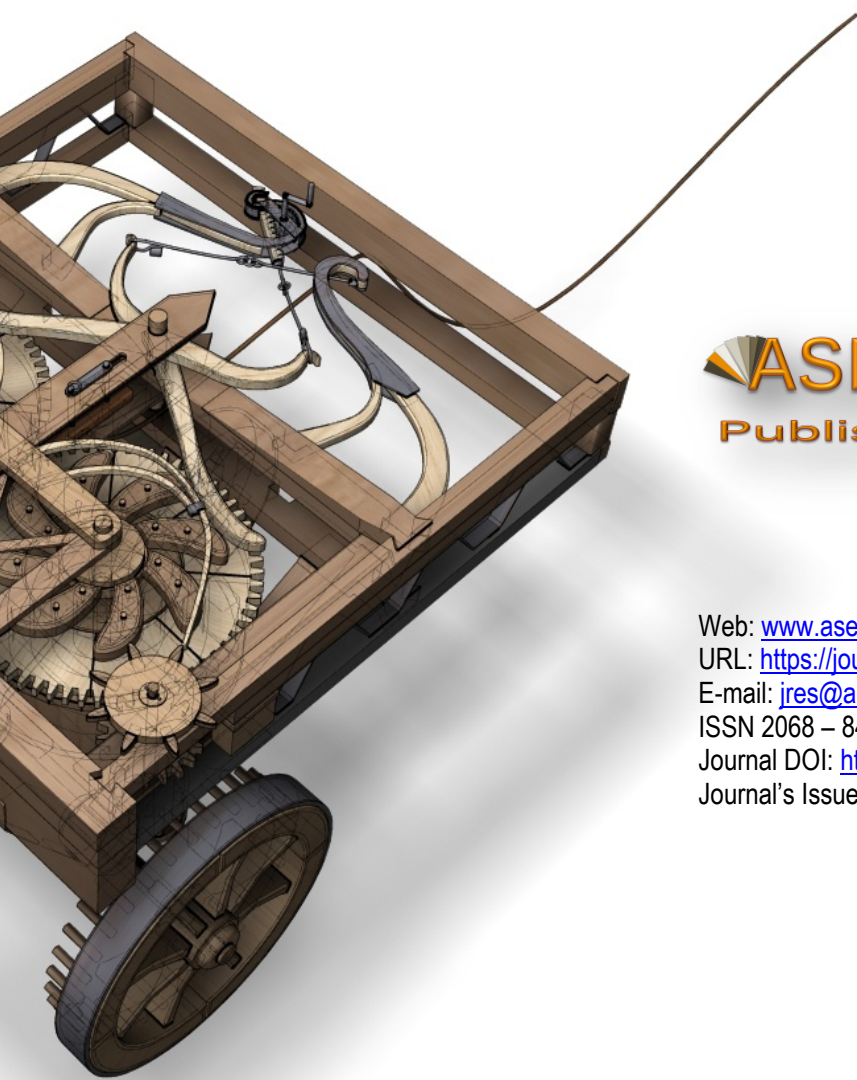## Declaration of Use of Generative AI and AI-Assisted Technologies

The author declares that he has not used generative AI and AI-assisted technologies during the preparation of this work.

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