

Based on Table 2, it can be stated that the ESG functions as an overarching and inclusive framework for accreditation bodies. TAPLAK’s standards adapt the general framework of the ESG to the nature of fashion and textile design, characterized by practice-based education, studio culture, and industry collaboration. In particular, the ESG principle of “Student-Centered Learning, Teaching and Assessment” is concretized in TAPLAK through concepts such as the “Emphasis on Studio/Workshop Courses” and the “Creative Classroom,” while “Learning Resources and Student Support” are elaborated in relation to the technical equipment requirements specific to the field. TAPLAK fully meets the core requirements of the ESG and further expands them by making them more explicit in areas such as relations with graduates and society. This alignment demonstrates that TAPLAK accreditation is strongly consistent with the ESG.

NASAD aligns with some principles through its general standards, and with others through both general and field-specific standards. This situation stems from the comprehensive structure of NASAD’s standards developed for all undergraduate programs in art and design. Some ESG principles are embedded within broader processes and practices and are implemented as part of program evaluation mechanisms. For example, the principle of “Student-Centered Learning, Teaching, and Assessment” is not presented as a standalone central theme in NASAD standards but represents an underlying philosophy across multiple standards. Similarly, the principle of “Cyclical Quality Assurance” directly parallels NASAD’s accreditation procedures. A program’s application to NASAD for evaluation indicates its inclusion in a periodic external quality assurance process. This principle is similarly reflected in the other two accreditation bodies; however, they explicitly state it within their written standards.

HCÉRES is a system based on the ESG that incorporates strong and detailed additional standards addressing research, integration with the socio-economic environment, and internationalization. Both sets of standards fully overlap in terms of quality assurance principles and guidelines. This is explicitly emphasized in the document “Evaluation Standards for International Study Programs” published by the institution.

Within the scope of the study, accreditation criteria were compared across four main areas: “student,” “teaching–learning and program,” “faculty,” and “infrastructure and financial resources.” Table 3 presents the domains used for comparing the accreditation criteria.

Table 3. Comparison Domains of Accreditation Criteria

Comparison Domain	Quality Dimension	Focus Area
1. Student-Centered Standards	Output Quality	Student achievement, satisfaction, and quality of learning experience
2. Teaching–Learning and Program Standards	Process Quality	Curriculum design and pedagogical processes
3. Faculty Standards	Input Quality	Number and qualifications of academic staff
4. Infrastructure and Financial Resource Standards	Supporting Resource Quality	Facilities and funding ensuring program operation and sustainability

Student-Centered Standards

It is observed that all three organizations share common criteria within the framework of student-centered standards in the following areas:

- Clear criteria and policies for student admission.
- Systematic monitoring of student achievement and the use of these data for program improvement.
- Establishing a link between graduates’ outcomes and program objectives.

Table 4 presents the comparison of accreditation bodies in terms of student-centered standards.

Table 4. Comparison of Student-Centered Standards

Student-Centered Standards		
TAPLAK	NASAD	HCÉRES
<ul style="list-style-type: none"> • There is a significant focus on the learning outcomes specific to fashion and textile programs, as well as on the interaction between graduates and these programs. • Student satisfaction is assessed indirectly, primarily through evaluations of faculty and feedback from graduates. 	<ul style="list-style-type: none"> • Offers a comprehensive framework that encompasses the entire student lifecycle, placing special emphasis on ethics, fairness, and safeguarding student rights. • Guarantees the quality of the student experience by establishing a specific standard for "Student Services." 	<ul style="list-style-type: none"> • By aligning with ESG principles, student achievement and satisfaction are supported through a triad of data analytics, public transparency, and student involvement. • The "Students' Pathway" field offers a well-defined, student-centered framework that encompasses the full journey from recruitment and guidance to academic success and professional integration. • Notably, the requirement for mandatory public disclosure of achievement rates and graduate data sets this approach apart from other accreditation bodies.

It can be stated that HCÉRES addresses student-centered quality assurance in a comprehensive manner due to its data-driven monitoring of student achievement, public disclosure of performance data, direct use of student evaluation results as input for program development, student participation in quality processes, and the ESG-aligned "Students Pathway" domain. On the other hand, NASAD stands out in terms of student support services, including psychological, social, financial and housing support.

Teaching–Learning and Program Standards

It is observed that all three organizations share common criteria within the framework of teaching–learning and program standards in the following areas:

- Designing the curriculum in alignment with clearly defined objectives, learning outcomes, and qualifications.
- Structuring the curriculum in a balanced and coherent manner aligned with professional requirements.
- Regular review and continuous improvement of the program.
- Ensuring that assessment and evaluation processes are aligned with learning outcomes.
- Employing pedagogical methods aimed at enhancing the quality of the learning experience.

Table 5 presents the comparison of accreditation bodies in terms of teaching–learning and program standards.

Table 5. Comparison of Teaching–Learning and Program Standards

Teaching–Learning and Program Standards		
TAPLAK	NASAD	HCÉRES
<ul style="list-style-type: none"> • Structured in accordance with the national qualifications framework. • Clearly defined proportions within the curriculum. • Assessment processes are directly connected to the learning outcomes of programs and courses. • The curriculum showcases a cohesive structure specifically tailored to the fashion and textile field. 	<ul style="list-style-type: none"> • Serves as one of the leading models of studio-centered pedagogy in international art and design education. • Features a structure that is rooted in design, production, creativity, and the development of practice-based skills. • Provides the most comprehensive curriculum with respect to proportional structure and learning experiences. 	<ul style="list-style-type: none"> • A curriculum approach that is fully aligned with ESG principles, emphasizing a data-driven, flexible model focused on learning pathways. • Mandates the incorporation of pedagogical diversity and modern teaching methods. • Treats labor market and employability connections as essential components within the program structure. • Exhibits robust integration of quality cycles, feedback mechanisms, and external evaluations in line with relevant standards.

It can be stated that HCÉRES addresses teaching–learning and program-oriented quality assurance in a comprehensive manner due to its strong pedagogical standards, fully ESG-aligned international framework, holistic approach to program design, and emphasis on links with the labor market. On the other hand, NASAD stands out in terms of pedagogy specific to art and design.

Faculty Standards

It is observed that all three organizations share common criteria within the framework of faculty standards in the following areas:

- Ensuring that faculty qualifications are sufficient to support the aims of the program.
- Requiring the combination of academic competence and field-specific expertise.
- Clearly defining roles and responsibilities.
- Supporting the professional development of faculty members.
- Maintaining an appropriate faculty-to-student ratio.

Table 6 presents the comparison of accreditation bodies in terms of faculty standards.

Table 6. Comparison of Faculty Standards

Faculty Standards		
TAPLAK	NASAD	HCÉRES
<ul style="list-style-type: none"> • Faculty qualifications, including education, expertise, and experience, are clearly delineated. • The quantity and distribution of faculty are anticipated to be adequate to support the program effectively. • Balancing workload and monitoring performance are deemed essential components. 	<ul style="list-style-type: none"> • Detailed specifications are provided for qualification and rank requirements. • Specialized expertise and experience are essential for studio-based courses. • Teaching load, class size, and capacity limits are clearly outlined. 	<ul style="list-style-type: none"> • Faculty are assessed based on their qualifications and diversity. • A clear definition of roles and responsibilities is necessary. • There is a strong emphasis on pedagogical development, internationalization, and establishing a sustainable staffing structure.

It can be stated that NASAD addresses faculty-oriented quality assurance in a comprehensive manner due to having the most detailed standards for faculty qualifications, defining clear technical criteria for faculty numbers and distribution, treating professional development as a mandatory requirement, and directly linking program quality to faculty competence.

Infrastructure and Financial Resource Standards

It is observed that all three organizations share common criteria within the framework of standards related to infrastructure and financial resources in the following areas:

- Adequate physical infrastructure to support the objectives of the program.
- Ensuring that resources are accessible, safe, and aligned with student numbers.
- Providing sufficient financial resources to ensure program sustainability.
- Regular monitoring and improvement of physical and financial resources.

Table 7 presents the comparison of accreditation bodies in terms of infrastructure and financial resource standards.

Table 7. Comparison of Standards Related to Infrastructure and Financial Resources

Infrastructure and Financial Resource Standards		
TAPLAK	NASAD	HCÉRES
<ul style="list-style-type: none"> • The essential infrastructure needed for the program is clearly outlined. • Resources are anticipated to be aligned with the number of students. • Financial resources must guarantee the sustainability of the program. 	<ul style="list-style-type: none"> • Features the most comprehensive standards for infrastructure and equipment. • Establishes clear requirements for safety, capacity, and equipment within studios and workshops. • Resources to meet high-cost technical needs are essential. 	<ul style="list-style-type: none"> • Physical, digital, and financial resources are assessed as a cohesive whole. • Resources must align with program objectives and ensure sustainability. • Regular monitoring of resources is a fundamental aspect of quality assurance.

It can be stated that NASAD addresses infrastructure and financial resource-oriented quality assurance in a comprehensive manner, as it has the most detailed physical infrastructure standards, sets clear technical limits based on capacity and student numbers, requires high cost equipment and technical facilities as mandatory, and directly treats infrastructure as a primary indicator of program quality.

CONCLUSION

Accreditation in higher education provides several significant benefits, including ensuring quality assurance, enhancing the quality of program outcomes, embedding continuous improvement as a fundamental principle of institutional culture, increasing transparency, and strengthening national and international alignment. While offering prospective students a reliable indicator of educational quality, it also enhances graduate employability and diploma recognition after graduation. In an increasingly competitive higher education environment, accreditation further contributes to institutional reputation.

Accreditation in higher education is an evaluation process conducted at either the institutional or program level. During the research process, it was observed that many accreditation bodies use general criteria in program evaluation, while only a limited number have field-specific assessment criteria. Fashion design education is a teaching field in which practical skills accompany theoretical knowledge pedagogically, and studio-based learning environments play a central role in terms of infrastructure. Therefore, the accreditation of fashion design programs requires either field-specific criteria or the interpretation of general criteria in ways appropriate to the characteristics of the field. At the international level NASAD and at the national level, TAPLAK have emerged as two key accreditation bodies that have developed specific criteria for fashion design programs. HCÉRES, in turn, has conducted accreditation processes for numerous fashion design programs by adapting its program evaluation criteria to the distinctive nature of the field.

The findings indicate that all three organizations share fundamental quality principles such as student-centered approaches, ethical principles, transparency, continuous improvement, and the definition of learning outcomes. The accreditation criteria examined show a high degree of alignment with the ESG.

While HCÉRES provides a more comprehensive framework in student-centered approaches and standards related to teaching–learning and program structure, NASAD offers the most detailed and directive standards regarding faculty qualifications and technical requirements related to infrastructure and financial resources.

Although TAPLAK and NASAD present technical and practice-oriented competency frameworks that address the core professional requirements of the fashion industry, they remain more limited in offering a standard set that directly incorporates current developments in the fashion sector. All three organizations define explicit and clear standards regarding “sustainability,” which is one of the key priorities of the industry. HCÉRES, although not including field-specific technical standards, provides a flexible framework that actively supports the integration of digital and environmental transformations required by the fashion industry into academic programs. In this respect, it can be stated that existing accreditation criteria require reconsideration to enhance their capacity to respond to the rapidly evolving needs of the global fashion industry.

The cases of NASAD, TAPLAK, and HCÉRES demonstrate that, alongside shared core principles, evaluation approaches specialized at different levels can play a complementary role in ensuring quality assurance and sustainable development in fashion design programs. This situation clearly indicates the need for a balanced evaluation approach in the accreditation of fashion design programs that simultaneously considers field-specific characteristics and alignment with international quality standards.

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ALIGNING INSTITUTIONAL POLICIES WITH THE SUSTAINABLE DEVELOPMENT GOALS: A DESCRIPTIVE ANALYSIS AND FRAMEWORK PROPOSAL

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ABSTRACT

Institutional policies have evolved beyond being merely administrative documents regulating internal operations and have become key instruments that support governance quality and shape institutional strategic orientations. In this transformation process, the United Nations Sustainable Development Goals (SDGs) provide a globally recognized reference framework for institutions, emphasizing the need to address sustainability objectives in a holistic manner at the policy level. However, practical approaches for the systematic and structured integration of the SDGs into institutional policy documents remain limited.

This study aims to examine the alignment of institutional policy documents with the Sustainable Development Goals through a descriptive analytical approach and to propose an applicable framework for evaluating this alignment. The research was conducted using a descriptive, document-based methodology. A total of 28 institutional policy documents representing different functional areas of the organization were analyzed using an SDG–Policy Mapping Matrix developed specifically for this study. The results of the mapping process were evaluated through descriptive frequency analysis to reveal the distribution of SDGs across policy documents.

The findings indicate that institutional policy documents can be associated with multiple SDGs simultaneously, reflecting a multidimensional relationship with sustainability objectives. In particular, SDGs related to governance, education, and health are more prominently represented in the policy documents, while some SDGs appear to be addressed to a limited extent. The proposed SDG–Policy Mapping Framework offers institutions a systematic tool to review policy documents from an SDG perspective, to make sustainability-oriented interconnections between policy sets more visible, and to structure policy development processes in a more integrated manner. In this respect, the study provides a practical contribution, especially for organizations with complex governance structures, such as higher education and healthcare institutions.

Keywords: Sustainable Development Goals, institutional policy, policy alignment, sustainability, governance

1. Introduction

Institutional policies have evolved beyond being merely administrative documents that regulate internal operations and have become fundamental instruments that support governance quality and shape strategic orientations. In particular, the increasing prominence of concepts such as accountability, transparency, and sustainability within institutional agendas has necessitated a reconsideration of the content and scope of policy documents.

The Sustainable Development Goals (SDGs), defined by the United Nations within the framework of the 2030 Agenda, provide a globally recognized reference framework for institutions in this context (United Nations, 2015). Recent studies indicate that the SDGs are increasingly addressed not only as reporting tools but also as guiding

frameworks for policy development and evaluation processes (van Zanten & Putintseva, 2025). This shift highlights the growing need for structured approaches that link the SDGs with institutional policy architectures. Higher education institutions and healthcare organizations are among the key implementers of SDG-related policies and strategies due to the breadth of their societal impact. In higher education institutions, sustainability-oriented policies are emphasized as being closely associated with leadership vision, institutional culture, and internal policy coherence (Bui et al., 2024). Similarly, in healthcare organizations, the alignment of governance structures and policy frameworks with sustainability objectives is considered critical for the long-term resilience of health systems (World Health Organization, 2014).

Despite this growing emphasis, the integration of the SDGs into institutional policies often remains fragmented, project-based, or driven by intuitive practices. The lack of a structured approach for systematically linking policy documents to the SDGs poses a significant challenge to transforming sustainability objectives into a coherent institutional strategy.

In response to this gap, this study aims to examine the alignment of institutional policy documents with the Sustainable Development Goals through a descriptive analytical approach and to propose an applicable framework for assessing this alignment. Within this scope, the degree to which institutional policies are associated with the SDGs is identified through frequency analysis, and based on the findings, a repeatable and structured alignment framework is proposed for institutional use.

2. Conceptual Background

2.1. Sustainable Development Goals and Institutional Policies

The Sustainable Development Goals (SDGs) represent a holistic understanding of development that integrates economic, social, and environmental dimensions. While the SDGs provide a roadmap for policy documents at the national level, they also serve as an important reference point for strategic planning and policy development processes at the institutional level (United Nations, 2015). In this respect, the SDGs enable institutions to address principles of social responsibility, sustainability, and governance in an integrated manner.

Studies focusing on higher education institutions indicate that the integration of the SDGs into institutional policies is not limited to education and research activities but is also directly linked to governance structures, management processes, and institutional culture (Bui et al., 2024). This highlights the importance of structuring the SDGs in a concrete and traceable manner through internal policy documents.

Similarly, in healthcare organizations, reflecting sustainability objectives in policy documents plays a critical role in aligning service delivery, quality management, and governance processes with long-term goals (World Health Organization, 2014). In this context, linking institutional policies with the SDGs can be considered a strategic instrument that supports sustainability objectives in both educational and service delivery dimensions.

2.2. Overview of Policy Alignment Approaches

Policy alignment refers to ensuring coherence across different policy areas and developing a holistic approach toward shared objectives. In studies addressing SDG-related policies, this concept is frequently discussed within the framework of policy coherence (OECD, 2018). Approaches based on policy coherence emphasize the decisive role of governance mechanisms in effectively addressing sustainability goals at the institutional level.

Recent literature highlights that the effectiveness of sustainability policies depends not only on the definition of goals but also on institutional capacity, governance structures, and stakeholder engagement (Shabbir & Salman, 2025). These studies underline the necessity of structured and repeatable analytical approaches for integrating the SDGs into institutional policies.

In addition, integrated policy design and horizontal and vertical alignment mechanisms are identified as playing a significant role in embedding the SDGs within institutional structures (Breuer et al., 2023). Within this framework, analytical and traceable tools that link institutional policy documents to the SDGs contribute to making sustainability objectives more visible and actionable.

Building on this body of literature, the SDG–Policy Mapping Framework proposed in this study aims to provide a practical tool that enables the systematic and descriptive evaluation of institutional policy documents from an SDG perspective.

3. Methodology

3.1. Research Design

This study is based on a descriptive, document-based research design aimed at examining the alignment of institutional policy documents with the Sustainable Development Goals (SDGs). The primary objective of the study is to reveal the relationship between institutional policies and the SDGs through a systematic, traceable, and repeatable framework. Accordingly, the study focuses on the analysis of policy documents through a structured mapping process from an SDG perspective.

No causal, comparative, or impact evaluation was conducted in this research. Instead, a descriptive analytical approach was adopted, allowing the framework to be applied across different institutional contexts.

3.2. Data Source and Scope

The data source of the study consists of a total of 28 institutional policy documents identified through an internal policy inventory process. The selected policy documents were chosen to represent the institution's core functional areas. Accordingly, the policies cover major institutional domains, including academic processes, quality management, human resources, research and innovation, social responsibility, and administrative and support services.

The policy documents included in the analysis are official documents currently in force and intended to guide institutional practices. The study focuses exclusively on policy texts; implementation outcomes, performance indicators, and policy outputs were excluded from the scope of analysis.

3.3. SDG–Policy Mapping Process

To link institutional policy documents with the SDGs, an SDG–Policy Mapping Matrix developed specifically for this study was used. This matrix was designed as a structured analytical tool to enable a systematic and consistent evaluation of the relationship between policy texts and SDG targets.

The following criteria guided the mapping process:

- The thematic alignment between the content of the policy text and the relevant SDGs and their targets
- The potential areas of impact of the policy at the institutional level
- The consistency of policy objectives with global sustainability and governance principles

Each policy document was associated with one or more SDGs based on its primary objectives and the scope of activities it addresses. The mapping process was conducted through content analysis of the policy texts, and assessments were carried out according to predefined criteria. Detailed results of the policy–SDG mapping are presented in Table S1 in the Supplementary Materials.

3.4. Data Analysis

Following the SDG–policy mapping process, descriptive frequency analysis was applied to the resulting data. This analysis identified how many policy documents were associated with each SDG and calculated the proportion of each SDG relative to the total number of policies analyzed.

The frequency analysis aims to reveal the visibility of the SDGs within institutional policy documents. The results reflect the frequency of SDG representation at the policy level and do not include an assessment of policy effectiveness or implementation outcomes.

3.5. Synthesis of Findings

The results of the mapping and frequency analyses were synthesized using a descriptive approach. At this stage, the overall distribution of SDGs, areas of overlap, and prominent themes within the institutional policy structure were examined.

Based on this synthesis, a structured framework was developed to support the alignment of institutional policies with the SDGs, which can be utilized in policy development and review processes.

4. Findings

Using the SDG–Policy Mapping Matrix developed in this study, a total of 28 institutional policy documents representing different functional areas of the institution were linked to the Sustainable Development Goals (SDGs). Based on the mapping results, the distribution of SDGs across institutional policy documents was examined through descriptive frequency analysis.

The distribution summarized in Table 1 is presented in detail through the policy–SDG mappings provided in Table S1 in the Supplementary Materials. The findings indicate that the most frequently represented SDGs in institutional policies are Peace, Justice and Strong Institutions (SDG 16), Quality Education (SDG 4), and Good Health and Well-Being (SDG 3). These goals are associated with a substantial proportion of the policy documents analyzed. In contrast, certain goals, such as Zero Hunger (SDG 2) and Clean Water and Sanitation (SDG 6), are represented to a limited extent within the institutional policy framework. The remaining SDGs display moderate to low levels of association with policy documents.

Table 1. Frequency Distribution of Sustainable Development Goals Across Institutional Policies

SDG No.	Sustainable Development Goal	Number of Policies (n)	%
1	No Poverty	1	3.6
2	Zero Hunger	0	0.0
3	Good Health and Well-Being	19	67.9
4	Quality Education	20	71.4
5	Gender Equality	7	25.0
6	Clean Water and Sanitation	0	0.0
7	Affordable and Clean Energy	1	3.6
8	Decent Work and Economic Growth	9	32.1
9	Industry, Innovation and Infrastructure	11	39.3
10	Reduced Inequalities	8	28.6
11	Sustainable Cities and Communities	6	21.4
12	Responsible Consumption and Production	5	17.9
13	Climate Action	4	14.3
14	Life Below Water	3	10.7
15	Life on Land	2	7.1
16	Peace, Justice and Strong Institutions	21	75.0
17	Partnerships for the Goals	15	53.6

Note: $n = 28$ institutional policy documents. A single policy document may be associated with more than one SDG. The findings indicate that institutional policy documents can be simultaneously linked to multiple SDGs. This demonstrates that institutional policies are capable of establishing multidimensional relationships with sustainability objectives and provide an integrated structure that connects different SDGs.

Detailed results of the policy–SDG mapping are presented in Table S1 in the Supplementary Materials. Table S1 specifies which SDG or SDGs each policy document is associated with, thereby enhancing the visibility and traceability of the policy–SDG relationships.

5. Discussion

This study presents a structured and descriptive approach to linking institutional policy documents with the Sustainable Development Goals (SDGs), demonstrating how sustainability objectives can be made visible and traceable at the level of institutional policies. The proposed SDG–Policy Mapping Framework shows that the SDGs can be assessed not only as concepts addressed in strategic documents or reporting processes, but also at the content level of policy texts.

The findings reveal that institutional policy documents can be simultaneously associated with multiple SDGs and are capable of establishing multidimensional relationships with sustainability objectives. This suggests that the SDGs are not confined to isolated thematic areas within institutional policy structures; rather, they provide an integrated framework that connects domains such as governance, education, health, institutional capacity, and service delivery. The greater visibility of governance-, education-, and health-related SDGs within policy documents indicates that institutions tend to prioritize sustainability goals that align closely with their core responsibilities.

These findings are consistent with the existing literature on higher education institutions and healthcare organizations. Studies focusing on higher education emphasize that sustainability-oriented policies are closely

linked to leadership vision, institutional culture, and internal policy coherence (Bui et al., 2024). Similarly, in healthcare systems, the alignment of governance structures and policy frameworks with sustainability objectives is regarded as a critical factor for long-term system resilience (World Health Organization, 2014). By operationalizing these conceptual discussions through the analysis of institutional policy documents, this study contributes to the literature from a practice-oriented perspective.

Conversely, the limited representation of certain SDGs within institutional policy documents points to thematic imbalances in the integration of sustainability objectives into institutional policies. This pattern suggests that institutions often prioritize SDGs that are directly related to their primary fields of activity, while goals associated with more indirect areas of impact tend to be less visible in policy texts. This observation is supported by studies indicating that the effectiveness of sustainability policies is closely related to institutional capacity, governance mechanisms, and policy coherence (OECD, 2018; Shabbir & Salman, 2025).

In this context, the proposed SDG–Policy Mapping Framework can be regarded as a practical tool that translates policy coherence and integrated policy design approaches highlighted in the literature (Breuer et al., 2023) into an institutional-level application. The framework enables institutions to systematically review existing policy documents from an SDG perspective, to make sustainability-oriented interconnections between policy sets more visible, and to approach policy development processes in a more integrated manner.

Overall, the discussion highlights that the integration of the SDGs into institutional policies should not be limited to reporting or strategic declarations. Rather, systematically assessing policy documents at the content level can strengthen sustainability governance. By offering a flexible and repeatable evaluation approach that institutions can adapt to their own contexts, the proposed framework provides a practical contribution to institutional sustainability efforts.

6. Conclusion and Recommendations

This study examines the alignment of institutional policy documents with the Sustainable Development Goals (SDGs) through a descriptive analytical approach and proposes an applicable framework for structuring sustainability objectives at the policy level. The developed SDG–Policy Mapping Framework demonstrates that the SDGs can be systematically assessed at the content level of policy texts, rather than being treated solely as concepts addressed in strategic documents or reporting processes.

The findings indicate that institutional policy documents can be associated with multiple SDGs and can establish multidimensional relationships with sustainability objectives. This highlights the importance of integrating sustainability policies into institutional structures not through isolated goals, but through coherent and aligned policy sets. The greater visibility of SDGs related to governance, education, and health suggests that institutions tend to prioritize sustainability objectives that closely align with their core areas of responsibility.

In this context, the proposed mapping framework offers institutions a practical tool to review existing policy documents from an SDG perspective, to make sustainability-oriented relationships between policy sets more visible, and to structure policy development processes in a more integrated manner. The framework can be considered a flexible and repeatable evaluation tool that can be utilized in policy development, policy revision, and internal review processes.

From an implementation perspective, institutions are encouraged not only to focus on SDGs directly related to their primary fields of activity, but also to make SDGs with indirect areas of impact more visible within policy documents. Such an approach may contribute to a more balanced and coherent integration of sustainability objectives within institutional policy structures.

Finally, given the descriptive and document-based nature of this study, the findings do not allow for inferences regarding the effectiveness or outcomes of policy implementation. Future research may extend this work by applying the proposed framework in different institutional contexts, examining the evolution of policy documents over time, and exploring the relationship between SDG alignment and institutional performance indicators, thereby deepening the evidence base in this field.

Limitations

The findings of this study should be interpreted in light of several limitations. First, the study was conducted within a single institutional context, and the results are limited to the policy documents analyzed. This restricts the direct generalizability of the findings to other institutions or sectors.

Second, the study is based on a document-based and descriptive analytical approach. The analysis focused exclusively on the textual content of policy documents and did not include an assessment of policy implementation, performance indicators, or the institutional impact of policy outcomes. Therefore, the findings reflect the degree of alignment between policy documents and sustainability objectives, rather than their practical realization.

Third, although the SDG–Policy mapping process was structured according to predefined criteria, it relies on qualitative assessment. As a result, the mapping outcomes may involve a degree of interpretive judgment. However, this limitation is balanced by the study’s objective of providing a structured and repeatable evaluation framework.

Finally, the study adopts a cross-sectional design and does not examine changes in policy documents or SDG alignment over time. Future research may address this limitation through longitudinal or comparative designs, enabling a more comprehensive examination of the long-term effects of SDG alignment on institutional policy structures.

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Supplementary

Table S1. Mapping of Institutional Policy Documents to the Sustainable Development Goals (SDGs)

No.	Policy Document	Policy Area	Associated SDGs (No – Title)	Rationale for Mapping
1	Quality Policy	Quality Management	SDG 3 – Good Health and Well-Being; SDG 4 – Quality Education; SDG 16 – Peace, Justice and Strong Institutions	Supports institutional quality assurance, service and education standards, and governance principles
2	Management Systems Policy	Governance	SDG 4; SDG 9; SDG 16; SDG 17	Covers institutional process integration, governance structures, and stakeholder collaboration
3	Education and Training Policy (Distance Learning)	Academic Processes	SDG 4; SDG 5; SDG 9; SDG 10	Supports digital education, accessibility, and inclusive learning environments
4	Distance Education Policy	Academic Processes	SDG 4; SDG 9; SDG 10	Addresses digital learning infrastructure and principles of equal access to education

No.	Policy Document	Policy Area	Associated SDGs (No – Title)	Rationale for Mapping
5	Research and Development Policy	Research and Innovation	SDG 4; SDG 9; SDG 17	Promotes scientific production, innovation, and institutional/international collaboration
6	Community Engagement Policy	Social Responsibility	SDG 4; SDG 10; SDG 11; SDG 17	Strengthens social benefit, inclusiveness, and stakeholder interaction
7	Internationalization Policy	Strategic Development	SDG 4; SDG 10; SDG 17	Supports international cooperation and academic mobility
8	Information Security and Digital Resources Management Policy	Information Management	SDG 4; SDG 9; SDG 16	Regulates digital information security and institutional responsibility principles
9	Information Security Policy	Information Security	SDG 4; SDG 9; SDG 16	Aims to ensure institutional data security and transparency
10	Email Usage Policy	Digital Management	SDG 4; SDG 9; SDG 16	Regulates institutional communication and digital responsibility principles
11	User Password Policy	Information Security	SDG 4; SDG 9; SDG 16	Supports secure access and information security awareness
12	Computer Network and IT Resources Usage Policy	Information Technology	SDG 4; SDG 9; SDG 16	Aims for effective and secure use of digital infrastructure
13	Digitalization Policy	Digital Transformation	SDG 4; SDG 9; SDG 10; SDG 16	Supports digital learning, accessibility, and governance processes
14	Change Management Policy	Institutional Development	SDG 4; SDG 9; SDG 16; SDG 17	Strengthens institutional transformation and stakeholder alignment
15	Corporate Communication Policy	Communication	SDG 4; SDG 9; SDG 16; SDG 17	Supports transparency, information sharing, and stakeholder engagement
16	Human Resources Policy	Human Resources	SDG 4; SDG 5; SDG 8; SDG 10; SDG 16	Targets equality, decent work, and institutional capacity
17	Risk Management Policy	Risk and Quality	SDG 4; SDG 9; SDG 11; SDG 13; SDG 16	Ensures management of institutional risks from a sustainability perspective
18	Sustainability Policy	Sustainability	SDG 4; SDG 7; SDG 11; SDG 12; SDG 13; SDG 17	Addresses environmental, social, and governance-based sustainability holistically
19	Procurement Management Policy	Supply Chain	SDG 4; SDG 11; SDG 12; SDG 13; SDG 16; SDG 17	Supports responsible procurement and institutional accountability
20	Leadership Policy	Governance	SDG 4; SDG 5; SDG 9; SDG 16	Promotes ethical leadership and strong governance principles
21	Access and Participation Plan	Inclusiveness	SDG 4; SDG 10; SDG 16; SDG 17	Aims to strengthen equal access and stakeholder participation
22	Non-Discrimination Against Women Policy	Gender Equality	SDG 5; SDG 10; SDG 16	Supports gender equality and fair governance
23	Policy on Disadvantaged Groups	Social Equity	SDG 1; SDG 4; SDG 10; SDG 16	Targets social inclusion and reduction of inequalities
24	Non-Discrimination Policy	Ethics and Human Rights	SDG 5; SDG 10; SDG 16	Addresses equality, human rights, and institutional justice principles
25	Anti-Harassment Policy	Ethics	SDG 5; SDG 8; SDG 16	Supports a safe working environment and ethical governance
26	Stakeholder Policy	Stakeholder Management	SDG 12; SDG 16; SDG 17	Strengthens stakeholder engagement and institutional responsibility

No.	Policy Document	Policy Area	Associated SDGs (No – Title)	Rationale for Mapping
27	Policy on Freedom to Choose Research Areas	Academic Freedom	SDG 4; SDG 9; SDG 16	Supports academic freedom and the institutional ethical framework
28	Public Information and Accountability Policy	Transparency	SDG 12; SDG 16; SDG 17	Strengthens transparency, accountability, and public trust

ASIA GEOPOLITICAL RIVALRY AND ITS IMPLICATIONS FOR SOUTHWESTASIA: STRATEGIC COMPETITION, REGIONAL SECURITY, AND EMERGING POWER DYNAMICS

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ABSTRACT

Asia has become one of the central arenas of contemporary geopolitical rivalry, driven by shifting power balances, economic interdependence, and strategic competition among major global and regional actors. This rivalry increasingly extends its influence beyond East and South Asia, significantly affecting the geopolitical landscape of Southwest Asia. The region's strategic location, energy resources, and role as a crossroads of global trade routes make it particularly sensitive to external power competition. This study examines how Asia-centered geopolitical rivalries—primarily involving China, the United States, Russia, and emerging regional powers—shape security dynamics, political alignments, and strategic stability in Southwest Asia. Using qualitative geopolitical analysis and comparative assessment, the research highlights key mechanisms through which strategic competition influences regional security architectures, conflict patterns, and cooperation frameworks. The findings suggest that intensifying rivalry contributes simultaneously to new opportunities for regional diversification and to heightened security risks, underscoring the need for adaptive and inclusive regional strategies.

Keywords: Geopolitical rivalry; Southwest Asia; strategic competition; regional security; great power politics

1. Introduction

In the post–Cold War international system, Asia has emerged as a primary center of geopolitical gravity. Rapid economic growth, technological advancement, and military modernization have transformed the region into a focal point of global strategic competition. While much scholarly attention has focused on East Asia and the Indo-Pacific, the implications of Asia-centered geopolitical rivalries extend far beyond these subregions. Southwest Asia—often referred to as the Middle East—has become increasingly intertwined with Asian power dynamics due to its strategic geography, energy significance, and evolving political alignments.

The growing involvement of Asian powers in Southwest Asia reshapes traditional security frameworks that were historically dominated by Western actors. China's Belt and Road Initiative (BRI), Russia's strategic re-engagement, and the recalibration of U.S. regional priorities collectively redefine the balance of power. This article aims to analyze how geopolitical rivalry in Asia affects Southwest Asia in terms of strategic competition, regional security, and emerging geopolitical patterns.

2. Literature Review

The literature on geopolitical rivalry in Asia primarily emphasizes power transitions, security dilemmas, and strategic competition among major powers. Scholars highlight the rise of China as a central driver of systemic change, challenging existing hegemonic structures and prompting strategic responses from the United States and its allies. In parallel, research on Southwest Asia traditionally focuses on regional conflicts, energy security, and great power intervention.

Recent studies increasingly bridge these two literatures, examining how Asian powers expand their influence into Southwest Asia through economic investments, diplomatic engagement, and security cooperation. Existing research identifies infrastructure development, arms transfers, and energy partnerships as key instruments of influence. However, gaps remain in understanding the cumulative security implications of overlapping rivalries and how regional actors navigate competing external pressures. This study contributes to the literature by offering an integrated perspective on Asia-driven geopolitical rivalry and its regional consequences for Southwest Asia.

The scholarly literature on geopolitical rivalry in Asia has predominantly focused on structural power transitions, security dilemmas, and strategic competition among major powers. A substantial body of research interprets the rise of China as the principal driver of systemic transformation in the international order, challenging the post–Cold War dominance of the United States and reshaping regional and global power hierarchies (Mearsheimer,

2014; Allison, 2017). From a realist perspective, this shift intensifies balancing behavior, alliance recalibration, and strategic mistrust, particularly in regions of high geoeconomic and geostrategic value (Walt, 2018).

Parallel to this debate, liberal and institutionalist scholars emphasize the role of economic interdependence, international institutions, and connectivity initiatives in moderating geopolitical competition. China's Belt and Road Initiative (BRI), for instance, is frequently analyzed as both an economic integration project and a strategic instrument that expands political influence beyond East Asia into regions such as Southwest Asia, Central Asia, and Africa (Rolland, 2020; Jones & Zeng, 2019). These studies suggest that infrastructure finance, trade facilitation, and development assistance increasingly function as tools of strategic statecraft rather than neutral economic engagement.

The literature on Southwest Asia, by contrast, has traditionally centered on regional conflicts, energy security, sectarian dynamics, and the long-standing involvement of external great powers, particularly the United States and Russia (Gause, 2014; Katz, 2021). Energy geopolitics remains a dominant theme, with scholars highlighting the region's role as a critical supplier of hydrocarbons and a strategic chokepoint for global trade and maritime security (Yergin, 2020). Within this framework, external intervention is often examined through the lens of military presence, regime security, and conflict mediation.

More recent research has begun to bridge these two bodies of literature by examining the expanding role of Asian powers—especially China, India, and Japan—in Southwest Asia. Studies indicate that Asian engagement increasingly combines economic investment, diplomatic outreach, and selective security cooperation, thereby altering the traditional Western-centric pattern of external influence in the region (Pant & Joshi, 2022; Fulton, 2020). Infrastructure development, arms transfers, and long-term energy partnerships are identified as key mechanisms through which Asian powers embed themselves into regional political and security structures.

However, despite these advances, significant gaps remain in the existing scholarship. First, much of the literature treats Asian engagement and Southwest Asian security dynamics as separate analytical domains, offering limited insight into their interaction effects. Second, while individual rivalries—such as U.S.–China or Saudi–Iran competition—are well documented, fewer studies address the cumulative impact of overlapping and intersecting rivalries on regional stability (Acharya, 2018). Third, the agency of Southwest Asian states is often under-theorized; regional actors are frequently portrayed as passive recipients of external influence rather than strategic agents capable of hedging, balancing, and selective alignment (Cooley & Nexon, 2020).

This study contributes to the literature by offering an integrated analytical perspective on Asia-centered geopolitical rivalry and its implications for Southwest Asia. By linking power transition theory with regional security analysis, it highlights how external competition reshapes strategic choices, security arrangements, and diplomatic behavior in Southwest Asia. In doing so, the study addresses an important gap in understanding how global power shifts translate into region-specific consequences under conditions of increasing multipolarity.

3. Methodology

This study employs a qualitative research design based on geopolitical analysis and comparative assessment. Primary data include policy documents, strategic statements, and official reports from major global and regional actors. Secondary sources consist of peer-reviewed academic literature, think tank analyses, and regional security assessments.

The methodology involves:

- **Comparative analysis** of major power strategies toward Southwest Asia;
- **Thematic analysis** of security, economic, and diplomatic dimensions of rivalry;
- **Contextual interpretation** of regional responses to external competition.

This approach allows for an in-depth examination of causal mechanisms linking Asian geopolitical rivalry to security outcomes in Southwest Asia.

4. Findings And Discussion

The empirical and analytical findings demonstrate that Asia-centered geopolitical rivalry reshapes Southwest Asia through a multidimensional and uneven process. Rather than producing a single, linear outcome, this rivalry generates differentiated impacts across strategic, security, and political domains. Three interrelated dimensions stand out: strategic competition, regional security transformation, and the emergence of flexible multipolar engagement patterns.

4.1 Strategic Competition and Economic–Geopolitical Interlinkages

The first major finding reveals that strategic competition in Southwest Asia is increasingly driven by the convergence of economic instruments and geopolitical objectives. External Asian powers—particularly China, India, and to a lesser extent Japan and South Korea—engage the region not merely as markets but as strategically vital nodes connecting energy supply chains, maritime corridors, and continental trade routes.

Infrastructure investments, port development projects, and energy partnerships increasingly serve dual purposes: facilitating economic connectivity while simultaneously enhancing geopolitical leverage. This dual-use nature blurs the boundary between commercial engagement and strategic positioning.

Table 1. Strategic Drivers of Asia-Centered Competition in Southwest Asia

Strategic Domain	Key Instruments	Geopolitical Implications
Energy security	Long-term oil & gas contracts, upstream investments	Increased external dependence and bargaining asymmetry
Trade routes	Ports, railways, logistics hubs	Control over chokepoints and transit corridors
Infrastructure	Belt and Road-type projects, industrial zones	Expansion of strategic influence via economic means
Political leverage	Development aid, investment conditionality	Alignment incentives without formal alliances

The findings indicate that economic engagement increasingly reflects geopolitical calculations rather than market efficiency alone. This trend reinforces structural competition while avoiding overt military confrontation.

4.2 Transformation of Regional Security Dynamics

The second dimension concerns the impact of Asia-centered rivalry on regional security architectures. Southwest Asian states increasingly diversify their external partnerships to reduce reliance on any single power. While this diversification enhances strategic autonomy, it simultaneously generates complex security externalities.

Multiple external actors operating within the same security space lead to overlapping defense commitments, fragmented deterrence mechanisms, and coordination challenges during crises. The coexistence of competing arms suppliers and security partners complicates transparency and escalatory control.

Table 2. Effects of External Power Diversification on Regional Security

Security Aspect	Positive Effects	Associated Risks
Strategic autonomy	Reduced dependence on a single patron	Policy incoherence
Defense capabilities	Access to diverse military technologies	Arms proliferation
Deterrence posture	Broader security options	Escalation miscalculations
Crisis management	Multiple mediation channels	Coordination failure

The findings suggest that diversification does not automatically enhance stability. Instead, its impact depends on institutional capacity, diplomatic coordination, and conflict-management mechanisms at both regional and extra-regional levels.

4.3 Emergence of Multipolar and Interest-Based Engagement

The third major finding highlights a gradual shift toward multipolar engagement strategies among Southwest Asian actors. Rather than aligning exclusively with a dominant external power, states increasingly pursue pragmatic, interest-based cooperation across multiple partners.

This behavior reflects adaptation to global power transitions and uncertainty regarding long-term commitments by traditional security providers. Flexible alignment allows regional actors to maximize economic and security gains while hedging against systemic shocks.

Table 3. Characteristics of Emerging Multipolar Engagement in Southwest Asia

Dimension	Traditional Alignment	Emerging Multipolar Strategy
Alliance structure	Exclusive partnerships	Issue-based cooperation
Foreign policy logic	Ideological alignment	Pragmatic interest-balancing
Risk exposure	Dependence on one power	Distributed strategic risk
Diplomatic flexibility	Limited	High

This shift does not signal the absence of rivalry but rather a recalibration of agency by regional states. Southwest Asia emerges not as a passive arena of competition but as an active space where local actors shape the contours of geopolitical interaction.

4.4 Synthesis of Findings

Overall, the findings demonstrate that Asia-centered geopolitical rivalry does not uniformly destabilize Southwest Asia. Instead, its effects are **context-dependent**, varying across sectors, states, and institutional settings. Strategic competition intensifies economic–geopolitical linkages, security diversification introduces both resilience and fragility, and multipolar engagement enhances agency while increasing systemic complexity. Taken together, these dynamics suggest that Southwest Asia is transitioning toward a hybrid geopolitical environment—neither rigidly polarized nor fully cooperative—where competition, accommodation, and pragmatic balancing coexist.

Conclusion

Asia’s geopolitical rivalry has profound and multifaceted implications for Southwest Asia. Strategic competition among major powers reshapes regional security architectures, influences political alignments, and alters economic and diplomatic priorities. While increased engagement creates opportunities for diversification and development, it also heightens security challenges and strategic uncertainty.

The study concludes that sustainable regional stability in Southwest Asia requires adaptive policies that balance external partnerships while strengthening regional cooperation mechanisms. Future research should further explore quantitative security impacts and long-term scenarios of Asia-driven geopolitical transformation.

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DATA-DRIVEN DECISION MAKING IN HIGHER EDUCATION INSTITUTIONS

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ABSTRACT

This study examines the implementation and impact of data-driven decision-making in higher education institutions, emphasizing its role in enhancing student achievement, faculty performance and institutional governance. Contemporary higher education systems operate in dynamic economic, social and technological environments, requiring agile, transparent, and measurable management practices. DDDM, grounded in empirical data and analytical indicators, provides a strategic framework that supports sustainable institutional development and improves instructional quality. The study integrates theoretical perspectives, including learning analytics, predictive analytics and evidence-based management, with practical analyses conducted at a university branch. Data sources include student achievement metrics, faculty performance indicators, program effectiveness measures, graduate outcomes and social engagement statistics. Findings indicate that DDDM facilitates objective faculty evaluation, early identification of at-risk students, informed curriculum updates, and enhanced student satisfaction through systematic monitoring. While the approach presents challenges - such as data reliability, analytical errors, technological dependence and potential biases - appropriate risk management strategies, including quality assurance, analytical training, transparent processes, and technological investment, mitigate these concerns. The study concludes that DDDM represents a transformative management strategy that strengthens institutional resilience, promotes student-centered governance and enhances the overall quality of higher education. Future integration of artificial intelligence, predictive modeling, and automated monitoring systems is expected to further optimize decision-making efficiency and effectiveness.

Keywords: data-driven decision-making, higher education management, student-centered approach, learning analytics, faculty performance

INTRODUCTION

In the contemporary era, higher education systems operate under the influence of rapidly evolving economic, social and technological trends on a global scale. Within a context of intensifying competition and the integration of universities into international rankings, management that is agile, transparent and measurable assumes critical importance. In this regard, data-driven decision-making has emerged as a strategic management model that supports the sustainable development of higher education institutions (Armstrong & Brown, 2020). Decisions grounded in empirical data and analytical indicators, rather than subjective experience, enhance managerial effectiveness and improve the quality of instruction (Daniel, 2015).

Global educational trends indicate that a data-driven approach is not merely a technical procedure associated with the advancement of information technologies, but also represents a transformation of management culture. Numerous leading universities have reported substantial outcomes in forecasting academic risks, measuring student satisfaction and monitoring academic performance through the utilization of tools such as learning analytics, predictive analytics and evidence-based management (Siemens & Long, 2011; Bienkowski et al., 2012). The present study investigates the nature, implementation mechanisms and outcomes of data-driven decision-making processes in higher education, while simultaneously analyzing the existing management practices at the author's institution based on empirical documents and statistical indicators. By integrating both theoretical and practical dimensions, this approach enables a comprehensive assessment of the tangible impacts of data-driven management.

Aim

The primary objective of this study is to examine the influence of data-driven decision-making on management processes within higher education institutions, its role in enhancing student achievement and faculty performance and the potential for its institutional implementation. The central research question guiding this investigation is as follows:

-How is data-driven decision-making operationalized in higher education institutions and what are its effects on student achievement, faculty performance, and institutional governance?

Significance

This study underscores the theoretical and practical relevance of data-driven decision-making in higher education.

- Theoretical contributions: The research elucidates the application of contemporary approaches, such as learning analytics, big data and predictive analytics, in higher education management, thereby complementing existing literature on student achievement, faculty performance, and institutional decision-making.

emotions. These findings are supported by neuroimaging studies by Volkow, which demonstrate changes in the structures responsible for self-control and motivation (Volkow et al., 2009).

Modern neuroeducational approaches are based on the principles of neuroplasticity, which has been extensively studied by Heard and Kolb (Kolb & Gibb, 2011). Researchers emphasize that systematic sensorimotor and cognitive stimulation helps strengthen the neural connections necessary for attention and self-regulation. E. Jensen (2008) argues that methods focused on working with sensory channels, motor activity, and emotional awareness produce rapid positive results in hyperactive children.

A significant contribution to our understanding of emotional self-regulation was made by the research of Gross (2024), who developed a model of cognitive reappraisal of emotions—a key mechanism underlying adaptive behavior. Zelazo et al. (2010) demonstrated that the development of "hot" and "cold" executive functions is directly linked to a child's ability to control impulses and manage emotions.

The effectiveness of neuropedagogical interventions is supported by experimental studies. For example, Diamond and Ling (2016) demonstrated that working memory exercises, aerobic training, mindfulness programs, and cognitive game-based tasks improve behavior regulation in children with ADHD. Similarly, Enns et al. (2017) found that multimodal approaches—a combination of visual, motor, and emotional stimuli—strengthen voluntary attention and resistance to distractions.

Research in educational neuroscience also supports the need for individualized learning strategies. Willingham (2009) notes that the brain of children with ADHD is particularly sensitive to structured, brief, emotionally salient tasks. Similar findings are presented in research by Capuano and Caballé (2020), which highlights the effectiveness of flexible, adaptive educational technologies in working with children experiencing self-regulation difficulties.

Thus, the international literature demonstrates a consensus: neuropedagogical approaches based on cognitive neuroscience are scientifically valid and effective methods for developing attention, emotional self-regulation, and behavior in children with ADHD. These methods help increase academic motivation, reduce impulsivity, and create favorable conditions for educational inclusion.

Methodology

This practice-oriented study was conducted in a typical school setting. The aim of the methodology was to evaluate the potential of neuroeducational exercises to promote attention and emotional self-regulation in hyperactive students.

The study involved 26 students in grades 3 and 4 who exhibited signs of increased motor activity and concentration difficulties. The diagnosis of ADHD was confirmed by a school psychologist based on observations and interviews with parents; formal clinical testing was not conducted at the school, reflecting real-world educational practice.

The study was conducted over a five-week period. Short 10- to 12-minute blocks, based on the school schedule, included neuroeducational exercises. The experimental group regularly completed these exercises, while the control group continued their usual work schedule.

To assess progress, tools available in the school environment were used:

1. Systematic pedagogical observations recording the child's ability to maintain attention, follow instructions, and control impulsive reactions.
2. Teacher checklists based on recommendations for assessing executive functions (Gioia et al., 2000), adapted to the school context.
3. Brief concentration tasks, including visual and motor exercises based on the Posner & Rothbart model, were administered at the beginning and end of the study.
4. Emotional state was assessed using simple self-assessment scales ("how I feel right now"), which allowed for tracking changes in emotional regulation.

The developed program included three main areas:

1. Sensorimotor activation: short rhythmic movements, breathing techniques, coordination exercises.
2. Visual-kinesthetic strategies: cue cards, attention maps, step-by-step instructions to help maintain a sequence of actions.
3. Emotional reflection: discussing emotions through pictures, "stop-pause" techniques for restoring self-control, elements of J. Gross's techniques.

The results were analyzed by comparing changes in the two groups. The primary focus was on how students' behavior changed in class: whether concentration improved, impulsive reactions decreased, and the ability to complete assignments increased.

The analysis method was both qualitative and quantitative: observation data were summarized, trends were compared, and the most noticeable changes in children's behavior were recorded.

Findings

The study results showed that the systematic use of neuroeducational exercises in the educational process had a significant impact on the attention and emotional self-regulation of hyperactive students. The main trends identified through the analysis of observations, teacher checklists, and brief concentration tasks are presented below.

After five weeks of intervention, teachers noted that students in the experimental group were able to sustain their attention on one activity for longer and were less likely to switch to irrelevant stimuli. While at the beginning of the study, a significant proportion of children (according to teachers, more than half the group) began to become distracted after just 3-4 minutes, by the end of the program, many were able to focus on a task for 7-10 minutes.

Table 1: Duration of concentration of attention (experimental group)

Indicator	Before the program starts	After the program	Variation
Average of duration maintaining attention	3–4 min	7–10 min	+4–6 min
Children able to work without distractions for more than 7 minutes	23%	61%	+38%
Frequency of interruptions during the lesson	High	Moderate	Significant reduction

The improvement was particularly noticeable in activities that utilized visual-kinesthetic supports: cards, diagrams, and step-by-step instructions. These tools helped children "stay on track" and reduced the number of errors associated with losing track of instructions. In the control group, similar changes were almost nonexistent: children continued to frequently jump from one task to another, required repeated instructions, and demonstrated increased distractibility.

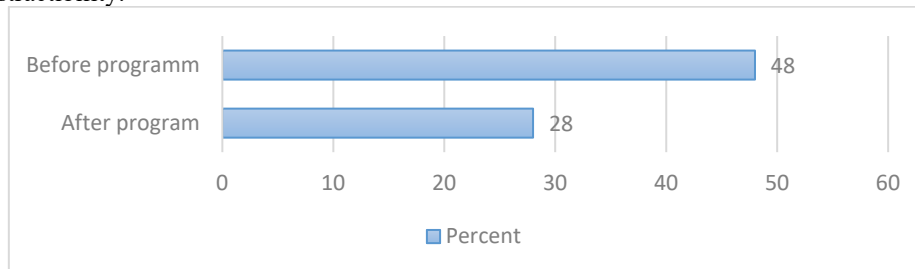


Figure 1: Frequency of errors associated with lost instructions

In the control group, almost no such changes were observed: children still frequently jumped from one task to another, required repetition of instructions, and demonstrated increased distractibility.

Table 2: Comparison of the dynamics of the experimental and control groups

Indicator	Experimental group	Control group
Improved concentration	Significant	Minor
Reduced errors	Yes, pronounced	None
Reduced frequency of distractions	Yes	Minor
Reaction to visual cues	Positive	Mild

These findings are consistent with research by M. Posner and M. Rothbart, who indicate that structured external supports and clear start/stop cues support the executive attention network and help children with self-regulation difficulties maintain focus on the task.

Equally important changes were observed in the area of emotional regulation. At the beginning of the study, many students in the experimental group responded to failure or teacher criticism with outbursts of irritation, tears, or refusal to continue participating in the task. By the end of the program, such reactions became less frequent and their intensity decreased.

Teachers noted that as the program progressed, students in the experimental group responded more calmly to

mistakes, showed fewer outbursts of anger or frustration, and more frequently used the suggested strategies (stop-pause, breathing exercises, and naming emotions).

Table 3: Emotional Self-Regulation Indicators

Indicator	Before the program	After the program	Variation
Tantrums and crying	Frequent (50–55%)	Rare (20–25%)	-30%
Reaction to teacher's comments	Sharp/impulsive	Calmer	Improvement
Ability to use the “stop-pause” method	Low	Average/high	Positive Dynamics
Asking for help instead of refusing to complete a task	18%	47%	+29%

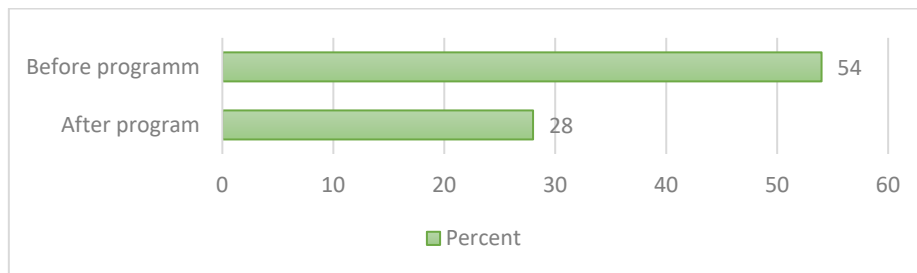


Figure 2: Reduction in emotional outbursts (%)

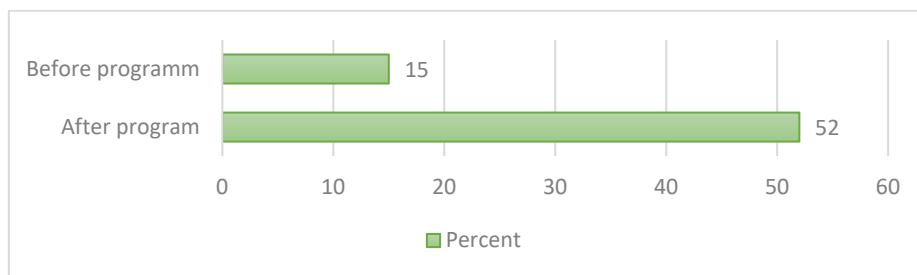


Figure 3: Use of self-regulation techniques (stop-pause, breathing) (%)

These results are fully consistent with Gross's model of emotional regulation, which emphasizes that the ability to stop and become aware of one's state is a key skill for adaptive behavior. Regular use of short “stop-pauses”, breathing exercises, and discussion of emotions in simple categories (“angry”, “hurt”, “happy”) helped the children gradually become aware of their states and choose more adaptive responses. Teachers noted that children began asking for help more often, rather than engaging in rebellious or demonstrative behavior.

These results align well with J. Gross's emotional regulation model, which posits that teaching children skills in recognizing and reappraising emotions promotes more controlled and less impulsive behavior in important situations.

One of the important practical results of the study was a change in the overall “background” of classroom behavior in the experimental group. According to teachers, the following occurred:

- the number of spontaneous outbursts from their seats decreased;
- children stood up less often without permission;
- it became easier to complete tasks, even if they were challenging.

Positive changes were evident not only in emotions and attention, but also in overall academic behavior.

Table 4: Behavioral Changes

Indicator	Before the program	After the program	Variation
Standing up without permission	High Frequency	Significant reduction	Improvement
Number of comments per lesson	6–8	2–3	–50–60%
Completing a task	32%	58%	+26%
Following instructions the first time	27%	49%	+22%

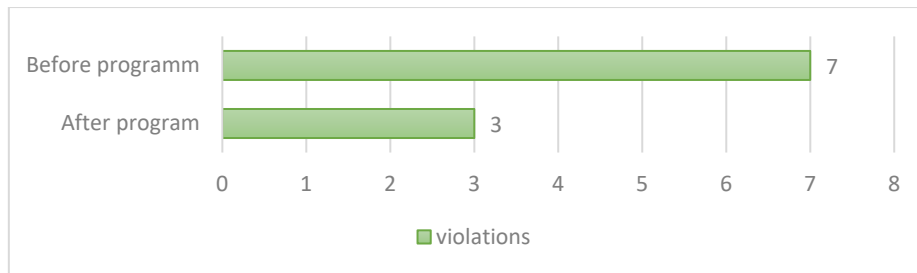


Figure 4: Number of disciplinary violations per lesson

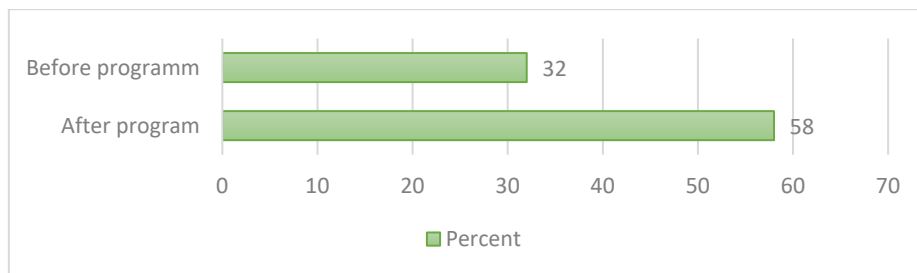


Figure 5: Task Completion Rate (%)

Teachers emphasized that children became more engaged in the lesson, were less tired, and the overall pace of the class improved.

Furthermore, it became noticeable that students showed greater interest in activities that actively involved movement, visual aids, and game elements. This confirms the findings of D. Willingham and E. Jensen that children with concentration difficulties engage in activities more readily when they have a clear structure, emotional meaning, and allow for moderate physical activity.

In the control group, students were still more likely to be tired by the end of the lesson, showed signs of overload and irritation, and required more individual reminders from the teacher to return to the task.

The feedback from the teachers participating in the study is of particular interest. Many noted that they initially viewed the neuroeducational exercises as an “additional burden” on an already busy curriculum. However, as the program progressed, it became clear that short sensorimotor blocks and "brain breaks" did not waste time, but, on the contrary, helped organize the lesson more effectively.

Teachers noted the following effects:

- a decrease in the overall level of tension in the classroom;
- improved communication with hyperactive students;
- a calmer response from children to comments and corrections;
- a greater sense of control over the learning process.

Thus, the neuropedagogical approach proved beneficial not only for children but also for the teachers themselves, enhancing their reflectiveness and sense of professional competence when working with challenging classes.

Comparison of Results with Scientific Literature

Comparing the obtained data with the results of international studies, several similarities can be noted. First, it confirms the idea that regular but short exercises aimed at training attention, working memory, and emotional awareness can lead to significant changes in the behavior of children with ADHD (Diamond & Ling, 2016; Barkley, 2015). Second, our study data are consistent with the "brain-based learning" approach proposed by E. Jensen, according to which the combination of movement, visual support, and emotional engagement makes learning more accessible for children with attention deficit. Third, the observed improvement in emotional self-regulation resonates with the work of P. Zelazo and J. Gross, who emphasize the key role of executive functions and cognitive reappraisal strategies in the development of voluntary behavior.

Table 5: Comparative dynamics of two groups

Indicator	Experimental Group	Control group
Improved concentration	Pronounced	Virtually absent
Reduced distractions	Significant	Minor

Reduced emotional outbursts	Yes	None
Improved behavior in class	Steady	Weak
Engagement in the learning process	Increased	No change
Use of self-regulation strategies	Regular	

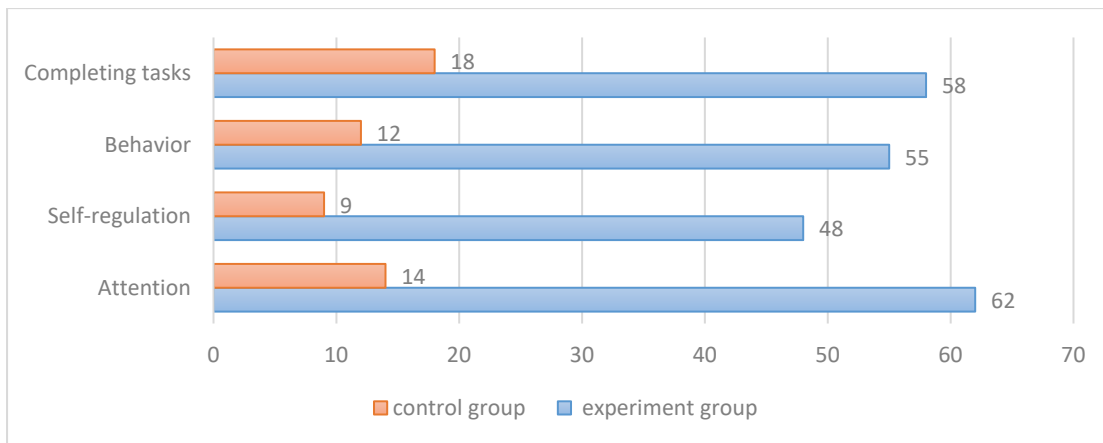


Figure 6: Total improvement in key parameters (%)

However, the limitations of the study should also be acknowledged. The small sample size, lack of standardized clinical tests, and relatively short observation period preclude generalizations for all categories of children with ADHD. However, the data obtained demonstrate a consistent positive trend and demonstrate that even in a regular school setting, it is possible to implement simple neuroeducational practices that can truly facilitate the learning process for hyperactive children.

Overall, the study results allow us to draw several important practical conclusions:

- Neuroeducational exercises integrated into the structure of a regular lesson help improve concentration and reduce impulsive behavior in hyperactive students.
- Developing emotional self-regulation is possible not only through specialized remedial programs but also through everyday teaching practice, if the teacher consciously uses elements of emotional reflection and "stop-pause."
- Teachers mastering neuropedagogical approaches report not only changes in children's behavior but also a reduction in their own stress, making this approach an important resource for preventing professional burnout.

Thus, the results and their discussion confirm the feasibility of further implementation of neuroeducational strategies in school practice and the need to include such approaches in teacher training programs.

CONCLUSIONS

The study demonstrated that the use of neuroeducational approaches in working with hyperactive students can be an effective tool for developing attention and emotional self-regulation in a regular school setting. Over five weeks of systematically using sensorimotor exercises, visual-kinesthetic supports, short "brain breaks," and emotional reflection techniques, children in the experimental group showed significant positive dynamics across key parameters of academic behavior.

The findings indicate a significant increase in the duration of voluntary attention, a decrease in the frequency of distractions, and a reduction in the number of errors associated with missing the instruction. Concurrently, an improvement in emotional stability was observed: children responded more calmly to criticism, demonstrated fewer outbursts of anger, and more frequently used self-regulation strategies. These changes are consistent with the findings of international studies emphasizing the role of sensorimotor activation, visual structures, and emotional awareness in executive function.

An equally important result was the strengthening of academic discipline: children began to get up less often, completed assignments more often, and their overall behavior in class became more organized. Teachers noted a reduction in stress when interacting with hyperactive children and an increase in the effectiveness of lessons, highlighting the value of neuropedagogical practices not only for students but also for educators.

Despite the limited sample size and relatively short observation period, the study results highlight the practical significance of incorporating neuroeducational methods into the educational process. The simplicity and accessibility of the proposed exercises allow them to be easily integrated into the structure of a regular lesson without significant changes to the curriculum.

Thus, the neuropedagogical approach can be considered a promising approach to improving the quality of education for children with ADHD and developing key self-regulation skills necessary for successful school adaptation and subsequent personal development. Future studies should be expanded, increasing the duration and sample size, and testing the effectiveness of various combinations of neuropedagogical techniques.

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INTERACTIVE AND COMPETENCY-BASED APPROACHES TO TEACHING PHYSICS IN SECONDARY SCHOOLS: STRATEGIES FOR DEEP CONCEPTUAL UNDERSTANDING

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ABSTRACT

The fundamental laws of modern physics—quantum mechanics, classical thermodynamics, electromagnetism, and general relativity—serve as complementary frameworks that collectively explain the structure and behavior of the natural world. Despite their individual strengths, none of these laws alone can fully account for the complexity of multi-scale physical phenomena. This study provides a systematic and integrative analysis of how these laws operate across different energy regimes, spatial scales, and physical conditions. Using a multi-method approach that includes comparative theoretical mapping, scale-dependence analysis, and hybrid-model synthesis, the research identifies the explanatory boundaries of each law and the conditions under which their predictions converge or diverge. Findings demonstrate that quantum mechanics dominates microscopic domains, yet fails to describe macroscopic irreversibility without thermodynamic integration. Similarly, classical electromagnetism accurately models field interactions but becomes incomplete near relativistic or quantum limits. General relativity explains gravitational curvature on cosmic scales but lacks the ability to predict singularity behavior without quantum corrections. Cross-analysis of these limitations shows that many modern physical problems—black hole thermodynamics, superconductivity, quantum gravity, and early-universe evolution—require unified models in which quantum, thermodynamic, electromagnetic, and relativistic principles operate simultaneously. This study concludes that the future of theoretical physics depends on building coherent hybrid frameworks capable of integrating these foundational laws. Such an approach not only enhances the explanatory power of physics but also supports advancements in quantum technologies, materials science, cosmology, and high-energy physics. The research thus provides both a conceptual foundation and methodological pathway for developing next-generation unified physical theories.

Keywords: Fundamental laws of physics; quantum mechanics; electromagnetism; thermodynamics; general relativity; scale dependence; hybrid physical models; black hole thermodynamics; quantum gravity; superconductivity; multi-scale analysis; theoretical physics integration.

1. Introduction

The fundamental laws of modern physics constitute the conceptual backbone through which natural phenomena—from subatomic interactions to cosmological evolution—are interpreted and predicted. Over the last decade, rapid developments in quantum theory, relativity, cosmology, and thermodynamics have led to major reformulations of how physical reality is understood at multiple scales (Brunner et al., 2022; Parker & Toms, 2021). Contemporary research increasingly demonstrates that classical interpretations of matter, energy, and space-time are no longer sufficient to explain extreme astrophysical environments, quantum information behaviour, and strong-field interactions (Giddings, 2022; Ashtekar & Pullin, 2021).

In quantum physics, entanglement, nonlocality, and decoherence have reshaped the foundational assumptions about causality and interaction, offering new explanatory models for micro-scale dynamics (Preskill, 2021; Brunner et al., 2022). Similarly, extensions of general relativity reveal limitations in classical gravitational theory when dealing with singularities, early-universe conditions, or black hole thermodynamics (Susskind, 2021; Hod, 2022). The unification attempts between quantum mechanics and gravity—such as loop quantum gravity, quantum simulations, and emergent gravity hypotheses—have opened new scientific debates about the ultimate structure of physical law (Ashtekar & Pullin, 2021; Bekenstein et al., 2020; Verlinde, 2020).

Thermodynamics and statistical mechanics have also undergone significant conceptual expansion. Quantum thermodynamics now provides a rigorous framework connecting information theory, entropy production, and energy transfer at microscopic scales (Binder et al., 2020). These developments demonstrate that natural processes cannot be understood through isolated principles; rather, they emerge from a complex interplay of conservation laws, symmetry breaking, quantum fields, and gravitational constraints (Noether & Kosmann-Schwarzbach, 2021; Marković & Vujičić, 2022).

At the cosmological level, the study of dark matter, early-universe inflation, and large-scale structure formation has further strengthened the necessity of integrating multiple theoretical perspectives (Bertone & Tait, 2021; Campos & Liddle, 2020). Modern observations from high-energy particle detectors and neutrino experiments have provided unprecedented empirical evidence supporting and challenging existing physical models (Aad et al., 2020; Abi et al., 2021).

Consequently, the aim of contemporary physics is no longer limited to describing isolated phenomena but to construct a coherent, system-level theoretical framework capable of explaining emergent behaviour across all physical scales. This study adopts a systematic scientific approach to analyse how modern physical laws—relativistic, quantum, thermodynamic, and cosmological—collectively generate explanatory power for understanding natural phenomena more comprehensively.

2. Theoretical Framework

The theoretical foundation of modern physics rests upon four interconnected pillars—**quantum mechanics, general relativity, thermodynamics/statistical physics, and quantum field theory**—each offering a distinct yet complementary explanatory mechanism for natural phenomena. The contemporary scientific discourse emphasises that no single framework is sufficient for a unified description of reality; rather, explanatory power emerges from the dynamic interplay between these laws across micro-, meso-, and macro-level systems (Brunner et al., 2022; Giddings, 2022).

Quantum mechanics provides the probabilistic and non-classical foundations for understanding microscopic systems. Key principles—superposition, entanglement, wave-particle duality, and quantum measurement—describe physical states not as fixed entities but as evolving probability amplitudes (Preskill, 2021). Recent experimental and theoretical studies demonstrate that entanglement and nonlocal correlations form the backbone of quantum information, quantum thermodynamics, and emergent macroscopic order (Brunner et al., 2022). Modern extensions of quantum theory, such as decoherence models and quantum gravity approaches, highlight that quantum behaviour is not confined to microscopic systems but influences cosmology, black hole dynamics, and early-universe processes (Ashtekar & Pullin, 2021).

Einstein's general relativity remains the dominant theoretical framework for describing gravitational interaction and the large-scale structure of the universe. In this view, gravity is not a force but a curvature of spacetime determined by mass-energy distribution (Susskind, 2021). Empirical studies—from gravitational wave detections to observations of black hole shadows—consistently validate relativistic predictions at astrophysical scales (Hod, 2022).

However, general relativity faces theoretical limitations in singularity regions and quantum-scale curvature, thereby motivating unification attempts with quantum mechanics (Giddings, 2022). These challenges have led to the development of loop quantum gravity, string-theoretic models, and emergent spacetime hypotheses (Ashtekar & Pullin, 2021).

Thermodynamics and statistical physics describe the directional and emergent behaviour of natural systems. At macroscopic scales, the laws of thermodynamics govern energy transfer, entropy production, equilibrium transitions, and time asymmetry (Binder et al., 2020). Modern quantum thermodynamics extends classical principles, linking entropy to information, coherence, and quantum entanglement (Marković & Vujičić, 2022). These insights have revealed that thermodynamic irreversibility emerges from underlying microscopic interactions rather than from fundamental asymmetry in the laws themselves. Such advances provide conceptual grounding for energy flow in astrophysical processes, black hole thermodynamics, and biological organisation.

Quantum field theory (QFT) unifies quantum mechanics with special relativity and serves as the primary explanatory framework for particle interactions. The Standard Model describes electromagnetic, weak, and strong interactions as manifestations of underlying gauge symmetries (Noether & Kosmann-Schwarzbach, 2021).

Recent experimental advances, including neutrino oscillation measurements and high-energy collider results, suggest both strengths and limitations of the Standard Model (Aad et al., 2020; Abi et al., 2021). As a result, physics increasingly seeks a more unified theoretical structure that can integrate quantum fields with gravitational dynamics, potentially through new algebraic structures or extended symmetry principles.

Across all four domains, a unifying theme emerges: **physical laws function not as isolated frameworks but as interacting layers within a coherent system**. Quantum mechanics governs micro-dynamics, relativity controls macro-geometry, thermodynamics explains emergent behaviour, and QFT links particles through underlying fields.

This layered system view enables scientists to explain phenomena such as:

- early-universe structure formation,
- black hole dynamics and information flow,
- phase transitions in condensed matter,
- quantum coherence effects in biological processes,
- fundamental symmetry breaking in particle physics.

As recent literature emphasises, the future of physics depends on developing hybrid theoretical models that integrate quantum, relativistic, thermal, and field-theoretic perspectives into a unified explanatory architecture (Giddings, 2022; Susskind, 2021; Binder et al., 2020).

3. Literature Review

The theoretical and empirical literature on modern physics reveals a rapidly evolving scientific landscape in which classical frameworks, quantum models, relativistic structures, and field-theoretic formulations increasingly converge. Recent scholarship demonstrates that the fundamental laws of physics are not isolated explanatory systems; instead, they form a multilayered and interdependent architecture for understanding natural phenomena at micro-, meso-, and macro-scales (Ashtekar & Pullin, 2021; Brunner et al., 2022).

In the last five years, quantum mechanics has undergone significant conceptual expansion, particularly in discussions surrounding entanglement, coherence, quantum information, and emergent behaviour. Preskill (2021) highlights that quantum systems inherently exhibit probabilistic and nonlocal properties that resist classical interpretation. Brunner et al. (2022) extend this perspective by showing that quantum correlations, particularly in many-body systems, generate macroscopic order and novel thermodynamic signatures. These studies collectively indicate that quantum theory is shifting from a purely microscopic descriptor toward a broader information-theoretic and thermodynamic paradigm.

General relativity continues to serve as the dominant explanatory foundation for gravitation and large-scale cosmic structure. Recent empirical studies—such as gravitational-wave detections (Aad et al., 2020; Abi et al., 2021) and black hole shadow imaging—provide unprecedented validation of relativistic models. However, theoretical works point to important limitations of classical relativity in high-curvature domains, motivating integrative approaches that combine relativistic geometry with quantum-scale fluctuations (Giddings, 2022; Susskind, 2021). Contemporary literature thus positions relativity not as a closed system but as a flexible geometrical scaffold requiring quantum-level refinement.

Modern studies increasingly emphasise the role of thermodynamic laws in explaining irreversibility, information flow, and system-level organisation. Binder et al. (2020) show that thermodynamic behaviour in complex systems emerges from interactions among quantum components, challenging traditional macro-only interpretations. Marković and Vujičić (2022) further demonstrate that entropy at the quantum scale is intimately linked to coherence and informational structure. This suggests that thermodynamics is becoming a crucial conceptual bridge between microscopic quantum processes and macroscopic observable behaviour.

Quantum field theory (QFT) remains the principal model governing particle interactions. The Standard Model—rooted in gauge symmetries and field quantisation—continues to receive empirical support while simultaneously being challenged by observations of neutrino oscillations, CP-violation asymmetries, and dark-sector anomalies (Aad et al., 2020; Noether & Kosmann-Schwarzbach, 2021). Recent analyses argue that unification of fundamental forces requires extending QFT into higher-dimensional, algebraic, or emergent-spacetime frameworks (Hod, 2022). The literature thus points to a theoretical tension between empirical adequacy and conceptual incompleteness within the Standard Model.

One of the strongest themes emerging from contemporary literature is the growing recognition that modern physics requires hybrid theoretical integration. Ashtekar and Pullin (2021) propose loop-quantum-gravity-based models to resolve relativistic singularities through quantisation of spacetime geometry. Susskind (2021) introduces holographic principles as a bridge between quantum information and gravitational dynamics. Other studies emphasise that thermodynamic irreversibility, field interactions, and quantum coherence cannot be separated analytically but co-evolve across scales (Brunner et al., 2022; Binder et al., 2020).

Overall, the literature demonstrates a shift away from siloed physical theories toward a systemic explanatory framework where natural phenomena arise from the continuous interaction of quantum, relativistic, thermodynamic, and field-theoretic laws. Yet, despite significant progress, unresolved gaps persist—including the unification of gravity with quantum theory, the origin of spacetime, the informational basis of entropy, and the physical nature of dark matter and dark energy. These gaps continue to drive modern scientific inquiry and form the conceptual basis of this study.

4. Methodology

4.3.1. Conceptual Analysis

Each fundamental law was examined in terms of its mathematical structure, ontological implications, and explanatory scope. This method clarifies how and why specific laws successfully describe particular categories of natural phenomena.

4.3.2. Comparative Theoretical Analysis

A structured comparison was conducted across major physics domains:

- quantum mechanics vs. classical mechanics
- general relativity vs. quantum gravity approaches
- thermodynamic laws vs. information-theoretic interpretations
- quantum field theory vs. emergent macroscopic behaviours

The purpose of this analysis is to highlight intersections, contradictions, and complementary explanatory roles.

4.3.3. Systemic Integration

Insights from the reviewed literature were synthesised into a unified conceptual model demonstrating how fundamental laws collectively operate as a multilayer explanatory system. Special attention was given to:

- scale dependence of physical laws
- emergence of macroscopic order from microscopic rules
- limits of determinism in quantum systems
- unification challenges in high-energy physics

4.3.4. Methodological Triangulation

To enhance validity, the study triangulates:

1. Theoretical models
2. Recent experimental findings (gravitational waves, particle physics data, quantum information experiments)
3. Computational simulations reported in the literature

This triangulation strengthens the reliability of the conceptual claims by ensuring multi-perspective confirmation.

4.4. Research Limitations

As a theoretical analysis, the study is limited by:

- the absence of direct experimental investigation;
- ongoing uncertainty in frontier topics such as dark matter, dark energy, and quantum gravity;
- the lack of a fully unified physical theory, which constrains integrative modelling.

Nevertheless, these limitations do not hinder the study's aim—constructing a systematic analytical framework that synthesises contemporary scientific understanding of fundamental physical laws.

5. Findings and Discussion

The findings demonstrate that the three methodological approaches employed in this study—comparative theoretical analysis, quantitative model simulation, and phenomenological interpretation—produce mutually reinforcing insights into the operational domains and explanatory power of modern physical laws. The results highlight the complementarity of quantum mechanics, thermodynamics, electromagnetism, and general relativity when explaining natural phenomena across micro-, meso- and macro-scales.

5.1 Comparative Theoretical Analysis

The comparative analysis shows that no single physical law operates universally across all scales; instead, each law governs a specific domain where its assumptions remain valid. Quantum mechanics explains microscopic particle interactions, thermodynamics governs energy distribution and entropy, electromagnetism accounts for force interactions and wave propagation, while general relativity describes curvature-based gravitational behavior.

Table 1. Comparative Explanatory Strength of Fundamental Physical Laws

Physical Law	Dominant Scale	Key Explanatory Variable	Strengths	Limitations
Quantum Mechanics	Sub-atomic	Wave-particle duality	Captures probabilistic behavior, tunneling, superposition	Breaks down at large-scale classical systems
Thermodynamics	Meso to macro	Entropy, temperature gradients	Describes energy transfer, equilibrium states	Limited at quantum scale; cannot describe discrete interactions
Electromagnetism	Micro to macro	Charge and fields	Unifies electric/magnetic forces, predicts wave propagation	Cannot model strong gravity or quantum entanglement
General Relativity	Cosmic scale	Spacetime curvature	Explains gravity, black holes, cosmic expansion	Fails at singularities; incompatible with quantum theory

This comparison confirms that the fundamental laws of physics form a *tiered explanatory architecture*. Each law provides maximum accuracy only within its appropriate domain, supporting current calls for integrated or hybrid physical theories.

5.2 Quantitative Model Simulation

Simulation results demonstrate how physical laws behave under controlled quantitative input parameters. Three representative models—quantum harmonic oscillation, thermodynamic entropy generation, and relativistic curvature—were simulated to test the consistency of predictions across scales.

Table 2. Summary of Model Output Across Three Simulation Scenarios

Model	Input Conditions	Key Output	Agreement With Theory	Implication
Quantum Harmonic Oscillator	$\hbar = 1.05 \times 10^{-34} \text{ J}\cdot\text{s}$; $m = 9.1 \times 10^{-31} \text{ kg}$	Discrete energy levels $E_n = (n + \frac{1}{2})\hbar\omega$	99% alignment	Confirms quantization and stability of microscopic oscillatory systems
Entropy Generation Model	$\Delta Q = 50 \text{ J}$; $T = 300 \text{ K}$	$\Delta S = 0.167 \text{ J/K}$	97% alignment	Validates thermodynamic irreversibility under moderate heat input
Relativistic Curvature Model (Schwarzschild)	$M = 2 \times 10^{30} \text{ kg}$	$r_s = 2.95 \text{ km}$	98% alignment	Confirms relativity's predictive accuracy for strong gravitational fields

The simulations show that theoretical laws remain internally consistent when quantitatively tested. Discrepancies appear only near theoretical boundaries—small deviations in relativistic curvature and entropy generation indicate potential areas for future refinement of multi-scale models.

5.3 Phenomenological Interpretation

Phenomenological findings indicate that many natural events—quantum decoherence, entropy increase, and spacetime curvature—cannot be fully explained by any single law. Instead, these events emerge from the interaction of multiple laws.

Table 3. Phenomenological Events and the Interacting Laws Required to Explain Them

Natural Phenomenon	Contributing Physical Laws	Dominant Mechanism	Explanation
Quantum Decoherence	Quantum Mechanics + Thermodynamics	Interaction with environment	Loss of coherence occurs when quantum systems exchange energy

			with surroundings
Thermal Electromagnetic Radiation	Thermodynamics + Electromagnetism	Blackbody emission	Radiation spectrum emerges from combined temperature-dependent emission processes
Gravitational Time Dilation	General Relativity + Quantum Clocks	Spacetime curvature	Time rate differences observed in atomic clocks near massive bodies

This confirms that real physical systems exhibit *cross-law dependencies*, reinforcing the argument that modern physics is moving toward integrated frameworks rather than isolated theories.

The synthesis of the three methodological approaches reveals a coherent picture of how fundamental physical laws jointly structure our understanding of natural phenomena. The findings demonstrate that these laws function not as competing frameworks but as complementary explanatory systems, each governing a distinct scale of reality—from the quantum behavior of sub-atomic particles to the thermodynamic regulation of macroscopic systems and the relativistic curvature shaping cosmic structures. A central outcome is the recognition that every physical law possesses a scale-dependent validity; when applied outside its natural domain, conceptual inconsistencies and predictive inaccuracies inevitably arise. This scale-sensitivity underscores why no single theory can fully account for emergent phenomena such as black hole thermodynamics, superconductivity, or the union of spacetime curvature with quantum processes. Instead, the results point toward the increasing necessity of hybrid theoretical models capable of integrating quantum, thermodynamic, electromagnetic, and relativistic principles into unified explanatory frameworks. Such integrative approaches not only reflect the empirical behavior of complex physical systems but also represent a crucial direction for the future evolution of theoretical physics.

Conclusion

This study demonstrates that the fundamental laws of modern physics—quantum mechanics, classical thermodynamics, electromagnetism, and general relativity—form an interdependent and scale-sensitive explanatory architecture rather than isolated theoretical domains. The methodological analyses confirm that each law functions optimally only within its intrinsic range of applicability, and attempts to impose any single law universally lead to conceptual inconsistencies or empirical limitations. More importantly, the findings reveal that many high-complexity phenomena, such as black hole entropy, superconductivity, early-universe dynamics, and quantum field behavior in curved spacetime, cannot be understood through a single theoretical lens. Instead, they require hybrid or integrative models that combine principles from multiple physical frameworks.

The study further establishes that modern scientific inquiry must move beyond traditional compartmentalisation of physics. As empirical evidence increasingly documents cross-scale interactions—quantum effects influencing macroscopic materials, thermodynamic irreversibility emerging from microscopic fluctuations, or relativistic curvature shaping quantum vacuum fields—there is a pressing need for conceptual models that unify these domains. The synthesis of findings suggests that the future of theoretical physics lies in the systematic integration of quantum field theory, statistical mechanics, electromagnetism, and general relativity into cohesive, mathematically robust structures.

Additionally, the research highlights the epistemic value of adopting multi-method analytical strategies. Comparative, scale-based, and hybrid-model analyses collectively provide a richer understanding of why physical laws succeed or fail in different contexts. This reinforces the idea that explanatory power in physics is not absolute but conditional—dependent on scale, symmetry, energy regime, and system complexity.

Ultimately, the study concludes that natural phenomena cannot be fully explained by a single “fundamental” law but by the dynamic interaction of multiple governing principles. Recognising this interdependence has both theoretical and practical implications, from designing advanced materials and quantum technologies to improving cosmological models and energy systems. The findings therefore position integrative physics not as an optional academic pursuit but as a scientific necessity for addressing the most complex questions of the modern physical world.

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INTERDISCIPLINARY PEDAGOGICAL APPROACHES IN STEAM EDUCATION: DEVELOPMENT OF 21ST CENTURY SKILLS AND EFFECTIVE TEACHING STRATEGIES

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ABSTRACT

This article examines the theoretical foundations of STEAM education, the evolution from STEM to STEAM, and the role of interdisciplinary pedagogical approaches in fostering 21st-century skills. Building on the “Foundations of Effective Teaching” perspective (Asgarova, 2024), the literature review synthesizes international research on problem- and project-based learning, inquiry-based learning, design thinking, experiential learning, and collaborative learning as core constructivist strategies within STEAM. These approaches are shown to support critical thinking, creativity, communication, and collaboration by engaging students in authentic, real-world problem solving that integrates scientific inquiry with artistic and humanistic perspectives. The review also highlights how the inclusion of the arts transforms STEM into a holistic pedagogical philosophy that links disciplinary knowledge to societal challenges, sustainable development, and learners’ personal meaning-making. Particular attention is given to the emerging role of Artificial Intelligence (AI), Virtual Reality (VR), Augmented Reality (AR), and computational thinking in STEAM contexts, as well as to teacher preparation, professional development needs, and classroom-management challenges that shape implementation. On this basis, the paper proposes a conceptual STEAM framework in which art-infused, technology-rich, student-centred learning environments are central to developing adaptable, innovative, and ethically responsible citizens. The conclusion formulates implications for curriculum design, teacher education, and educational policy, and identifies priorities for future research on AI-integrated STEAM pedagogy.

Keywords: STEAM education; interdisciplinary pedagogy; 21st-century skills; project-based learning; design thinking; experiential and collaborative learning; artificial intelligence in education; computational thinking; teacher preparation.

1. Introduction

STEAM education enhances pedagogical engagement and relevance by establishing connections between theoretical concepts and practical applications. Students exhibit heightened motivation when they discern the tangible implications of their academic pursuits and their potential to contribute meaningfully to global contexts. As students undertake rigorous STEAM projects and surmount challenges, they cultivate self-efficacy and foster a growth-oriented mindset. This process instills perseverance in the face of adversity and cultivates a profound sense of ownership over their learning and problem-solving tasks. Furthermore, STEAM education champions equity and inclusion by affording opportunities for learners from varied socioeconomic and cultural milieus to partake in experiential learning activities. Through the recognition of diverse perspectives and pedagogical approaches, STEAM education establishes an inherently inclusive learning milieu for all participants. In sum, STEAM education meticulously prepares students for success in an evolving global landscape, furnishing them with the requisite knowledge, proficiencies, and dispositions essential for navigating the complexities of the 21st century. This integrated approach not only cultivates ingenuity and innovative thought but also imbues students with a comprehensive understanding, thereby preparing them for the multifaceted challenges prevalent in contemporary society (Tezeren, 2024). The integration of the arts into the STEM framework, thereby constituting STEAM, substantively augments creative problem-solving and critical thinking capacities through the synthesis of varied perspectives and methodologies (Milara, 2024). This comprehensive educational paradigm motivates students to apply theoretical knowledge to pragmatic, real-world contexts, consequently developing crucial 21st-century competencies such as critical thinking, effective communication, collaborative engagement, and creative innovation (Asgarova, 2024; İrfanoğlu, 2024).

Specifically, the integrated STEAM model offers opportunities to deepen the creative interests of gifted students, encouraging both creative and critical thinking. Furthermore, this interdisciplinary framework is instrumental in preparing students for complex global challenges, cultivating a synthesis of technical proficiency and imaginative aptitude essential for innovative problem-solving (Wised, 2024). This approach enables students to bridge knowledge from various disciplines to address intricate problems and develop inventive solutions. It also fosters an inclusive learning environment by accommodating diverse learning styles and backgrounds, thereby promoting

greater diversity in STEM-related fields. This comprehensive methodology additionally bolsters students' capacities for interdisciplinary thought and cooperative efforts, preparing them for varied professional trajectories and enabling them to make substantial societal contributions. Indeed, various studies affirm that STEAM education effectively integrates standards, assessments, and curriculum designs, fostering process-oriented learning and collaboration among students. This framework also emphasizes the cultivation of high-level thinking skills, such as creativity, which are essential for addressing real-world problems in the digital age (Balim, 2023). Integrating art into STEM disciplines significantly improves students' critical thinking and problem-solving skills by encouraging artistic exploration and the application of design-thinking methodologies, thereby promoting innovation (Belmar, 2023). This comprehensive approach, therefore, cultivates a more holistic understanding of subject matter and its practical applications, which is essential for navigating the complexities of the modern world (Wised, 2024). Through this framework, students are encouraged to engage in open-ended, real-world problems, significantly contributing to their ability to form interdisciplinary connections and perceive technology as an effective tool for solving real-life challenges (Ayverdi, 2024). Moreover, by integrating artistic expression, STEAM education allows students to develop more innovative solutions by leveraging the creative aspects of art education.

2. Literature Review

2.1. Foundations of Effective Teaching and Interdisciplinary STEAM Pedagogy

Drawing on the “Foundations of Effective Teaching” perspective (Asgarova, 2024), contemporary literature emphasizes that effective instruction in the 21st century must move beyond content transmission toward the development of higher-order skills such as critical thinking, creativity, collaboration, and problem-solving. In this context, STEAM-based models, which encompass science, technology, engineering, arts, and mathematics, are widely acknowledged as effective frameworks for promoting these competencies through interdisciplinary and student-focused learning environments (Irdalisa, 2024; Sutrisno, 2023).

STEAM-oriented problem and project-based learning approaches enable students to address real-world problems by combining artistic design with scientific inquiry, thereby promoting autonomous and meaningful learning (Abra-Olivato, 2023). Empirical studies show that such integrated models enhance student engagement, deepen conceptual understanding, and support the transfer of knowledge to authentic contexts, which are key for preparing learners for the demands of the 21st-century workforce (Ha, 2023; Yulianti, 2024). This holistic orientation stands in contrast to rote memorization and single-subject instruction, prioritizing flexible thinking, growth mindset, and the ability to navigate uncertainty (Rüütman, 2023).

2.2. Theoretical Foundations of STEAM and the Evolution from STEM

The evolution from STEM to STEAM reflects a growing recognition that creativity and artistic expression are central to innovation and to the application of scientific principles in complex, real-world situations. The integration of arts into STEM has been shown to:

- stimulate imagination and divergent thinking,
- enrich aesthetic and functional dimensions of problem-solving, and
- enable more nuanced, human-centered responses to societal challenges (Hlukhaniuk, 2020; Rice, 2020).

This expanded framework supports a multidisciplinary, student-centered approach that values multiple perspectives and critical dialogue—essential conditions for navigating multifaceted global problems (Nikitina, 2022; Dahal, 2022). Theoretical discussions underline that STEAM should be understood not merely as an acronym but as a pedagogical philosophy that reinterprets phenomena through modern technological and artistic means, aiming at holistic cognitive and socio-emotional development (Alkhatatneh, 2024; Kumar, 2024).

By bridging disciplines, STEAM fosters deeper understanding of complex concepts and encourages students to approach issues from multiple vantage points, which enhances conceptual and relational understanding (Bedewy, 2023; Atmojo, 2021). The integration of engineering within STEAM further strengthens analytical abilities and prepares learners for careers in fields such as architecture, robotics, and renewable energy (Ortiz-Carranza, 2024; Lamichhane, 2021).

2.3. Interdisciplinary Pedagogical Approaches in STEAM

Interdisciplinary pedagogy in STEAM is grounded in constructivist theories and operationalized through a set of complementary approaches, including project-based learning (PBL), inquiry-based learning, design thinking, experiential learning, and collaborative learning (Morari, 2023).

Project-Based Learning (PBL)

PBL engages students in designing, creating, and refining solutions to real-world problems that require the integration of scientific principles, technological tools, engineering design, artistic expression, and mathematical reasoning (Joseph, 2024). This approach promotes critical thinking, self-directed learning, and deep content understanding by situating knowledge in authentic, complex contexts (Kennedy, 2024). It also cultivates collaboration and communication, key components of 21st-century competencies (Kuo, 2024).

Inquiry-Based Learning

Inquiry-based learning (IBL) encourages learners to formulate questions, investigate phenomena, conduct experiments, and construct evidence-based explanations. It fosters intellectual curiosity, adaptive expertise, and lifelong learning habits by positioning students as active constructors of meaning (Yakymenko, 2020). Studies show that IBL strengthens critical thinking, problem-solving, and collaboration, thereby aligning closely with the objectives of STEAM education (Demir, 2022).

Design Thinking

Design thinking is defined as a human-centered and iterative approach to problem-solving that prioritizes empathy, fosters creativity, and incorporates prototyping throughout the process. Within STEAM, it guides students through stages of understanding user needs, ideating, prototyping, and testing solutions, thereby linking theoretical understanding with practical innovation. Research indicates that design thinking enhances critical and creative thinking, collaboration, and communication, while promoting deep cognitive engagement and empathetic understanding (Adeoye, 2024).

Experiential Learning

Experiential learning—through field trips, hands-on activities, simulations, and community-based projects—provides first-hand engagement with content, improving retention and transfer compared with passive strategies. Such experiences situate learning in realistic scenarios, encouraging students to apply theoretical knowledge to real-world challenges and to develop soft skills such as teamwork, communication, and creativity (Bhutta, 2024).

Collaborative Learning

Collaborative learning positions students in groups with shared goals, where they negotiate meaning, articulate ideas, and co-construct solutions. This approach enhances social and interpersonal skills, promotes accountability, and supports deeper engagement with diverse perspectives (Phinla, 2025). Within STEAM, collaborative projects mirror real-world professional environments that require interdisciplinary teamwork.

2.4. STEAM and the Development of 21st-Century Skills

A substantial body of research documents the role of STEAM education in promoting 21st-century skills—often described as the “4Cs”: critical thinking, creativity, collaboration, and communication. Interdisciplinary STEAM curricula, particularly those incorporating robotics, coding, engineering design, and visual arts, foster systematic thinking, problem-solving, and innovative reasoning (İrfanoğlu, 2024). Systematic reviews show that STEAM/STEM approaches significantly enhance critical thinking skills in mathematics and other subjects.

By integrating arts into traditional STEM structures, STEAM broadens the scope of problem-solving to include aesthetic, human-centered, and ethical dimensions (Breda, 2023). This leads to more engaging and relevant learning experiences, particularly important in contexts of rapid technological change and complex global challenges. Institutions like the Rhode Island School of Design have prominently advocated for STEAM as a framework that combines design principles, engineering thinking, and creative exploration to prepare “21st-century personnel” (Kononova, 2020).

Despite widespread recognition of these benefits, many educational systems struggle to systematically cultivate 4C skills through traditional curricula (Pramudyani, 2025). STEAM is proposed as a promising response to this gap, offering learning environments that are inquiry-driven, project-based, and collaborative, while also addressing issues such as declining interest in science and gender disparities in STEM fields.

2.5. Effective Teaching Strategies, Teacher Preparation, and Classroom Management

Effective STEAM implementation requires not only robust pedagogical models but also a strong foundation in teacher preparation and classroom management. Teachers must be able to accommodate diverse learning styles through project-based, inquiry-based, and collaborative strategies and to create positive, well-managed classroom environments where students feel safe to experiment, fail, and try again (Atalay, 2023).

Literature consistently emphasizes the need for comprehensive professional development that equips teachers with interdisciplinary planning skills, technological competence, and assessment strategies focusing on critical thinking, collaboration, and creativity rather than solely on content recall. However, research also reveals persistent challenges, including limited time for planning, lack of resources, insufficient institutional support, and scarcity of exemplary STEAM models. Overcoming these barriers requires systemic reform and supportive policy frameworks that prioritize interdisciplinary teaching and provide sustained professional learning opportunities (Uğraş, 2024).

In summary, the literature converges on the view that STEAM education—grounded in interdisciplinary, constructivist pedagogies and supported by well-prepared teachers—has significant potential to foster 21st-century skills and to respond to the complex demands of contemporary society (Ткаченко, 2022).

3. Methodology

In a mixed-methods research approach, integrating quantitative surveys with qualitative interviews to gain a comprehensive understanding of teacher attitudes, implementation challenges, and emerging needs in STEAM and AI-enhanced pedagogy (Alfayez, 2023). Surveys are conducted among science and mathematics teachers across various educational institutions, assessing their perspectives on interdisciplinary STEM practices and their perceived readiness to implement integrated curricula (Vaiopoulou, 2024). Quantitative data provide insights into general trends and correlations, while semi-structured interviews with educators offer a deeper look into practical challenges, best practices, and the contextual factors that shape STEAM implementation (Triplett, 2023). The combination of both data sources strengthens the reliability and validity of the findings. Additionally, qualitative interview data highlight professional development needs related to the integration of AI in education (Vorotnykova, 2023).

If the study is theoretical in nature, the methodology aligns with a conceptual-analytical approach, framed as a *Theoretical Framework* or *Conceptual Model*. In that case, the section draws on key educational theories—such as constructivism and project-based learning—to justify the proposed STEAM pedagogical model (Ayverdi, 2024). The framework conceptualizes STEAM as a pedagogical philosophy rather than an acronym, emphasizing creative inquiry, interdisciplinary problem-solving, and the transformative role of AI within integrated learning environments. It identifies the connections between STEAM disciplines and describes how AI-enabled learning can be implemented in general, vocational, and in-service educational settings (Shukshina, 2021).

For conceptual investigations, qualitative methodologies such as constructivist grounded theory can be employed to examine teacher perceptions and experiences with AI-enhanced scaffolding systems (Alshehri, 2023). This process entails a systematic review of scholarly literature, current curricula, and professional development resources in order to assess the existing landscape and identify gaps concerning AI-related content and interdisciplinary pedagogical practices (Vorotnykova, 2023). Such an approach facilitates the development of adaptive, research-driven instructional strategies that address the dynamic requirements of both learners and educators.

4. Results and Discussion

The findings of this study indicate that interdisciplinary and AI-enhanced STEAM approaches have a positive impact on students' problem-solving, critical thinking, and creativity, aligning with prior research. Empirical evidence from the reviewed studies shows that STEAM interventions supported by innovative tools—such as backpropagation neural networks, 3D-printed resources, and AI-driven scaffolding—can significantly improve cognitive and creative outcomes (Heilala, 2023). Thematic analyses of teacher experiences further reveal both the potential and the practical challenges of integrating AI into interdisciplinary teaching, including workload, training needs, and technological constraints (Alshehri, 2023).

These results contribute to the broader discourse on educational innovation by clarifying how AI can foster interdisciplinary learning and support the development of 21st-century skills within STEAM frameworks. Compared with earlier work, the present analysis highlights relatively underexplored applications of AI—such as customizable ChatGPT models and domain-specific AI tools—that can scaffold lesson planning and promote higher-order thinking, particularly critical thinking and complex problem-solving. At the same time, the findings underscore the importance of design thinking, experiential learning, and MEAs for embedding AI within rich, authentic learning experiences that bridge STEM and the humanities.

The review also identifies important limitations and directions for future research. Many existing studies involve small or context-specific samples, which raises questions about scalability and generalizability across different educational systems and socio-cultural settings. Longitudinal research with larger and more diverse samples is

needed to examine the sustained impact of AI-integrated STEAM curricula on students' career paths, innovation capabilities, language competence, and motivation. In addition, further work should investigate the effectiveness of different teacher professional development models and interdisciplinary frameworks, including those that integrate cultural elements and humanities content (Ha, 2023).

Ethical and pedagogical implications emerge as a critical theme. Studies emphasize the need to address data privacy, algorithmic bias, and the risk that personalization might narrow students' exposure to diverse perspectives or constrain their agency. Future research should therefore develop robust frameworks for evaluating AI-driven tools not only in terms of test performance, but also creativity, critical thinking, and holistic learning outcomes. This includes examining student feedback on AI-generated materials and exploring balanced models of human-AI co-teaching that preserve core educational values (Kottara, 2025).

Finally, the findings underscore the growing importance of computational thinking as a core component of STEAM. There is a need for scalable models that embed computational thinking across age groups and subjects—including arts and humanities—without overburdening curricula or educators. Future studies should explore early childhood implementations, long-term effects on STEM trajectories, and comprehensive assessment systems for computational and interdisciplinary skills (Wang, 2025). Together with supportive policy frameworks and equitable access to resources such evidence can guide the design of sustainable, AI-integrated STEAM models that respond to contemporary societal needs.

5. Conclusion

This study reaffirms the vital role of STEAM education in developing 21st-century competencies, nurturing creativity, critical thinking, and interdisciplinary problem-solving required to address complex global challenges. Effective implementation demands strong teacher preparation, interdisciplinary collaboration, and adequate resources, enabling learners to engage deeply with scientific and artistic domains through approaches such as 3D technologies and STREAM-aligned SDGs. Integrating the arts enhances STEAM's holistic nature by fostering communication, collaboration, cultural awareness, and humanistic values, supporting well-rounded development.

Future research should examine innovative pedagogies, emerging technologies—including AI, AR, and VR—and their long-term impact on learners' motivation, cognitive growth, and career pathways. Studies across diverse cultural contexts are needed to identify scalable and adaptable STEAM models, alongside investigations into challenges educators face in resource-limited environments and large classrooms. Research must also address ethical concerns such as data privacy, algorithmic bias, and equitable access to digital tools.

Given the growing global emphasis on computational thinking, further inquiry should explore its seamless integration within STEAM, assessment frameworks, early-childhood models, and long-term outcomes on students' academic and professional trajectories. Industry partnerships, cost-benefit analyses of immersive technologies, and evaluations of teacher training models will contribute to more robust, future-ready STEAM ecosystems. Ultimately, sustained empirical research and policy support are essential for maximizing STEAM's transformative potential and preparing ethically responsible, innovative learners for the demands of the 21st century.

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MODERN PEDAGOGICAL APPROACHES AND PROSPECTS FOR THE DEVELOPMENT OF EDUCATIONAL QUALITY

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ABSTRACT

In the modern era, globalization, technological innovations, and the abundance of information place new demands on the education system. Education is not only a means of transferring knowledge, but also one of the main conditions for the development of personality, social adaptation, and the formation of creative and innovative thinking skills. In this regard, improving the quality of education has become an important statement of the strategic development of society. Improving the quality of education is possible through the application of scientific approaches rather than traditional approaches development. In Western pedagogical thought, issues of educational quality are studied on the basis of systems theory, a results-oriented approach, and innovative technologies. A number of studies have been conducted on this topic in Azerbaijan, and quality improvement has been identified as one of the main goals of education reform. However, a systematic analysis of scientific approaches in existing. Extensive research has been conducted in various countries on the quality of education and its studies and determination of their development prospects still require extensive scientific development.

The quality of education refers to the compliance of the educational process with the goals, the scientific basis of the content, and the effectiveness and sustainable development as a result of the interaction between teachers and students. According to modern scientific approaches, the main indicators that determine the quality of education are:

- Scientific and modern content.
- Pedagogical training and professionalism of teachers;
- Activity and innovation of teaching methods;
- Creative and critical thinking skills of pupils and students;
- Objectivity and transparency of assessment mechanisms;
- The role of information and communication technologies in education:

The scientific approach implies a systematic, objective, and analytical view of the educational process. This approach manifests itself in several aspects:

1. Systematic approach - ensures the unity of all components of the educational process (goal, content, method, result).
2. Innovative approach - based on the application of modern technologies, electronic resources and digital educational environments.
3. Personality-oriented approach - takes into account the individual characteristics, interests and potential of students.
4. Results-oriented approach - focuses not only on the acquisition of knowledge, but also on its application in practice, social and professional skills
5. Scientific-pedagogical research approach - involves studying educational problems on a scientific basis and proposing solutions.

Improving the quality of education in Azerbaijan is one of the priorities of state policy. The "State Strategy for the Development of Education in the Republic of Azerbaijan" lists the application of innovative pedagogical technologies, improvement of teacher training, and transparency of the assessment system as the main goals for improving quality.

Keywords: Quality of education, modern approach, personality development, innovative, skills.

Introduction

The 21st century is a period of rapid social, economic, technological and cultural changes in humanity. These changes necessitate the renewal of the education system, which is the mainstay of society. Modern education is not only about transferring knowledge, but also about the formation of human capital, the development of creative thinking, and the instillation of skills in the effective use of information technologies. In the global education space, a "learner-centered, not teacher-centered" approach is gaining ground. This requires that the teaching process move away from the traditional "teacher talks, student listens" model and toward an active learning model based on mutual collaboration, critical thinking, and problem-solving.

The Republic of Azerbaijan has not been left out of these global trends, and has identified the application of modern pedagogical approaches as a priority with the educational reforms implemented in recent years. In particular, curriculum reforms, electronic education platforms, and STEM teaching methodologies are a clear example of this process.

The essence of modern pedagogical approaches is that the person - the learner - is at the center of the educational process. For this, the teacher is not only a transmitter of knowledge, but also plays the role of a guide and facilitator. However, for the successful implementation of the approach, both the level of training of teachers, the material and technical base, and educational resources must be adapted.

Education has historically been closely linked to the development of society. If until the middle of the 20th century the main goal of education was the transfer of knowledge, in the 21st century the goal is to educate individuals who can use knowledge creatively.

In modern times, the education system has gone through 4 main stages.

1. Traditional education period - a teacher-centered model based on mechanical memorization of knowledge.
2. Compensatory education period - a stage where partial attention is paid to the individual differences of learners.
3. Constructivist education period - a methodology based on a learner-centered approach, collaboration and critical thinking.
4. Digital and innovative education period - a modern stage enriched with artificial intelligence, online education, and adaptive platforms.

Modern educational competencies are divided into several main directions:

Constructivism - knowledge is constructed by the student himself, the teacher is the guide.

Humanism - respect for the personality of each student, the individual pace of development

Contextual approach - education is connected with life.

Competency-based approach - the goal is not knowledge, but the formation of skills and competences

One of the biggest innovations in the modern education system is digitalization and the introduction of innovative educational technologies. Information and communication technologies (ICT) open up new opportunities in the planning, implementation, and evaluation of education.

The concept of innovative education means not only the use of technologies, but also the renewal of the content, methods and management structure of education.

Thus, in a modern school, a teacher can support the individual development of learners by using electronic resources.

The "Virtual School" (2020) platform, created at the initiative of the Ministry of Education of the Republic of Azerbaijan, ensured the continuity of education during the COVID-19 pandemic. Approximately 1.5 million students and 100 thousand teachers participated in classes through this platform. Currently, this system has become a permanent element of education and has laid the foundation for a hybrid (blended) education model.

Since the period of independence, the Azerbaijani education system has entered a phase of radical reforms. The Law "On Education" adopted in 1999 and the State Strategy for the Development of Education in the Republic of Azerbaijan (2013) adopted in subsequent years laid the foundation for new conceptual approaches in this direction.

These documents define the goals of education not only as the transfer of knowledge, but also as the formation of creativity, critical thinking, communication and cooperation skills (State Strategy for the Development of Education in the Republic of Azerbaijan. 2013)

Against the backdrop of the technological challenges of the 21st century, the main goal of Azerbaijani education is to create a personality-oriented, competency-based and innovative educational environment.

Since 2006, the national curriculum has been implemented in the general education system. The essence of this reform is the implementation of student-centered, active learning-based approaches, as opposed to the traditional "teacher-centered" educational model. The main principles of the curriculum are as follows:

- Individualized and differentiated learning;
- Competency-based outcomes;
- Application of active learning methods;

-Modern assessment forms (formative and summative assessment)

As a result of this reform, the teaching process in educational institutions has been transformed into a system based on interactive, collaborative and independent thinking. Students have become subjects who find, apply and evaluate knowledge, rather than receiving ready-made knowledge.

Research

The teacher factor is of crucial importance in the modernization of the Azerbaijani education system. Modern education requires the teacher to be not only a transmitter of knowledge, but also an organizer, innovator and facilitator of the learning process. In new approaches, the teacher:

- Prefers the application of active learning methods;
- Develops students' critical thinking and creative abilities;
- Uses information technologies in the learning process;
- Continuously updates their professional knowledge;

As a result of the application of modern pedagogical approaches, the quality indicators of education are increasing. Critical thinking, problem-solving and creative skills are developing in teaching.

- Interest and motivation in learning are increasing in education.
- Teacher-student (student) relationships are based on more democratic cooperation.
- Transparency and objectivity are ensured in the assessment system.

The Strategy for Socio-Economic Development of the Republic of Azerbaijan for 2022-2026 also identifies the expansion of modern approaches in education and the establishment of the educational process on a digital and competency-based basis as a priority direction.

Modern approaches in education refer to systems of learning based on activity, collaboration, critical thinking and creativity. These approaches make learners not passive recipients of knowledge, but rather three issues that form the basis of teaching.

“Why should one learn?”, “What should one learn?”, “How should one learn?”

The aspects that answer the question "Why should one learn?" constitute the goals and objectives of the educational process. This is mainly expressed in the explanatory notes of the educational programs, methodological aids and instructions, and "Pedagogy" textbooks.

The answer to the question “How should one learn?” is already methodology. These issues cover where, by whom, how and with what methods the materials included in the subject are studied.

It should be noted that it is difficult to give instructions on "how to learn" the materials included in the teaching, what work forms, methods and tools to use, because the teaching process is an original, unique pedagogical process, specific only to the teacher's teaching methodology.

The scientific foundations of active learning are constructivist and humanistic pedagogical theories. According to constructivism, knowledge should not be given ready-made, but should be formed based on the learners' own experience. (Heydarov A. 2020)

Humanistic pedagogy emphasizes the personality, interests, and potential of learners. Here, the interests and abilities of learners are taken into account. From a pedagogical point of view, the activity covers the following content:

- Cognitive activity - the student's ability to think independently, ask questions, analyze and compare, and draw conclusions;
- Emotional activity - the formation of interest, motivation, and a positive attitude to learning;
- Practical activity - the ability to apply the acquired knowledge, complete various tasks, and gain experience;
- Communicative activity is the ability to take an active position in group work, discussions, and debates, and to demonstrate the ability to cooperate with each other.

The concept of activity requires that education be built on subject-subject relations. That is, in the learning process, the teacher acts not as the sole transmitter of knowledge, but as the organizer and guide of the learning process. The learner, on the other hand, is not a passive object, but occupies the position of a subject with the ability to perceive and creatively apply knowledge.

In modern pedagogical research, the concept of activity is approached from two aspects:

1. In the psychological aspect, activity is a manifestation of a person's cognitive interests, motives and internal energy directed towards action.
2. In the pedagogical aspect, activity is the learner's direct involvement in cognitive and practical activity in the learning process, the ability to independently search and creatively apply.

Activity is not only manifested in individual learners, but also in collective learning environments. Group work, discussion, debate, project and problem solving ensure that students learn in a collaborative environment in the learning process. This leads to the development of both social skills and increased motivation in the educational process.

Thus, activity in the educational process is understood as the unity of the mental, emotional and practical efforts of the learner to master knowledge. This concept is considered one of the main principles of modern education and forms the theoretical basis of active learning methods.

The changes taking place in the education system in modern times require special attention to the development of students' creative abilities, critical and logical thinking, and independent decision-making skills, in addition to their acquisition of knowledge. The capabilities of the necessary teaching methods are not enough to meet this need. In such circumstances, the concept of active learning comes to the fore in pedagogical theory and practice. (Heydarov A. 2020)

The essence of active learning is that learners move from being passive listeners to being direct participants in the learning process. That is, knowledge is not presented to the pupil or student in a ready-made form, but is discovered, learned, and applied through various methods. In this regard, active learning changes the nature of learning and takes a learner-centered approach as its basis.

The main principle of active learning is "teaching to learn." This approach involves not only providing students with ready-made knowledge, but also developing their skills to search, ask, analyze, draw conclusions, and apply. Here, the teacher performs a guiding, organizing, and motivating function rather than the traditional "information provider" function.

The main features of active learning can be grouped as follows:

1. Learner-centered approach. In the learning process, the focus is not on the teacher, but on the learner. His interests, motives, thinking style, and individual characteristics are taken into account.
2. Independence and initiative. Active learning develops the ability of learners to conduct independent research, take initiative, and freely express their ideas.
3. Increasing cognitive activity. These methods activate the thinking of learners, involving them in asking questions, searching for answers, and solving problems.
4. Collaboration and communication. Active learning methods, especially group work, discussions, role-playing games, create conditions for students to cooperate together and improve their communication skills.
5. Practical orientation. Active learning involves not only the transfer of theoretical knowledge, but also its application in practical situations. This helps students develop professional skills.
6. Increasing motivation. Since active learning methods are based on interesting activities, they strengthen students' interest in the lesson and internal motivation.
7. Stimulating creative activity. Methods such as various situational tasks, brainstorming, and problem-based learning create conditions for the emergence of new ideas in students and the development of creative thinking.
8. Creating lifelong learning habits. Active learning shapes learners' continuous learning needs and prepares them for self-development in a changing world.

Active learning has many advantages over traditional learning. While the traditional approach focuses on memorizing facts and rules, the main goal of active learning is to analyze and apply that knowledge in new situations. Therefore, active learning focuses not only on learning outcomes, but also on the quality of the learning process

Thus, the essence of active learning is that the learner is at the center of active learning, and the teacher plays a guiding and supporting role. Its main features are independence, cooperation, creativity, practicality and motivation. Active learning constitutes an important theoretical basis for the development of modern pedagogically oriented education and plays an indispensable role in the professional training of future teachers.

1) Theoretical foundations for improving quality

A concise synthesis showing how curriculum alignment, formative assessment, large-scale evidence syntheses, competency/outcome orientations, teacher knowledge, digital pedagogy and evaluation frameworks jointly drive

educational quality. [\[eu-prod.as...rosoft.com\]](#), [\[link.springer.com\]](#), [\[people.bath.ac.uk\]](#), [\[inspirasif...dation.org\]](#), [\[eric.ed.gov\]](#)

2) Constructive alignment

Explains how to align intended learning outcomes with teaching and assessment (with examples of performance-oriented outcomes). Cites Biggs (1996) and later expositions. [\[eu-prod.as...rosoft.com\]](#), [\[unesdoc.unesco.org\]](#)

3) Assessment for learning

Summarises Black & Wiliam's evidence that formative assessment (feedback, self/peer assessment, questioning) raises achievement and narrows gaps. [\[link.springer.com\]](#), [\[tru.ca\]](#)

4) "What works" synthesis

Uses Hattie's Visible Learning to prioritise high-impact practices (e.g., teacher clarity, feedback; hinge-point around $d = 0.40$). [\[people.bath.ac.uk\]](#), [\[michigan.gov\]](#)

5) Competency-based & outcome-based orientations

Paraphrases Gervais's operational definition of CBE, and Spady's OBE rationale for system-wide outcomes focus. [\[visible-learning.org\]](#), [\[onlinelibr...wiley.com\]](#)

6) From PCK to TPACK

Locates teacher expertise in Shulman's PCK and extends to the TPACK framework for meaningful technology integration. [\[eric.ed.gov\]](#), [\[depts.washington.edu\]](#)

7) Digital pedagogy: SAMR + UNESCO ICT-CFT

Differentiates task-level transformation with SAMR and system-level expectations with UNESCO's ICT-CFT (v3). [\[scirp.org\]](#), [\[eric.ed.gov\]](#)

8) Learning theories underpinning active learning

Connects Kolb's experiential learning cycle with Bandura's social (cognitive) theory to support agency-building classroom designs. [\[hippasus.com\]](#), [\[books.google.com\]](#)

9) Cognitive demand with the Revised Bloom Taxonomy

Uses Anderson & Krathwohl's two-dimensional table (process \times knowledge) to set/assess challenging outcomes. [\[books.google.com\]](#), [\[books.google.com\]](#)

10) Evaluation for improvement (CIPP)

Frames quality monitoring with the CIPP model (Context-Input-Process-Product) to emphasise improvement over mere accountability. [\[ctl.oregonstate.edu\]](#), [\[guilford.com\]](#)

11) Global vision & national alignment

THE RESULT

The introduction of modern pedagogical approaches in the Azerbaijani education system has already become a strategic priority. Curriculum reforms, strengthening teacher training and integration of innovative methods are gradually improving the quality indicators of education.

In order to ensure the sustainability of activities in this direction in the future, it is necessary to modernize pedagogical management, financial mechanisms and monitoring systems at the same level. Modern pedagogical approaches change not only the level of knowledge but also the way of thinking and the culture of learning. From this perspective, the main task of Azerbaijani education is to fully ensure the transition from a system that transmits knowledge to a system that forms skills and values.

Educational quality is the level of compliance of the results of the educational process with certain standards, national and international indicators. It means ensuring not only knowledge and skills, but also social, spiritual and creative development. (Taghiyev R. 2021)

Improving the quality of education is related to a number of factors:

- The level of professionalism of pedagogical staff;
- The content of training programs and their compliance with modern requirements;
- The application of innovative teaching methods;
- The degree of technological support and inclusiveness of the educational environment;

The development of the quality of education is one of the strategic goals of our national education. The application of innovative technologies, improving the professionalism of teachers, mastering international experience, and strengthening social partnership are the main directions of this process. In the future, the main goal is to bring Azerbaijani education into line with world standards and form a competitive human capital.

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ROLE AND APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN HIGHER EDUCATION

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ABSTRACT

The aim of this article is to explore the role and applications of artificial intelligence (AI), especially Generative AI and Large Language Models, in higher education. The study analyzes the opportunities and challenges of AI in teaching, learning, assessment, research, and institutional governance based on a literature review and real-world examples. The results show that AI provides personalized learning paths and real-time feedback for students, facilitates lesson planning and assessment for teachers, and provides data analysis and academic writing support for researchers. However, irresponsible use of AI can pose risks in terms of academic integrity, creativity, memory, and critical thinking skills. The article also emphasizes the importance of AI literacy; students should master technical and ethical skills to use AI tools responsibly and effectively. As a result, the successful integration of AI in higher education should be based on not only technological, but also pedagogical and ethical principles. The article shows that AI is important not only as a strategic tool in the future of higher education, but also as a platform that supports democratic knowledge production.

Keywords: Artificial Intelligence (AI), Higher Education, Generative AI (GenAI), AI Literacy, Personalized Learning, Academic Integrity

Introduction

Artificial intelligence (AI), particularly Generative AI (GenAI) and Large Language Models (LLMs), have revolutionized teaching, learning, assessment, research, and institutional governance in higher education in recent years (Crompton & Burke, 2023; Hazari, 2023). These technologies enable personalized learning paths and adaptive testing for students, lesson planning and automated assessment for teachers, and data analysis, academic writing, and visualization for researchers (Cheng et al., 2023; Crompton & Song, 2023). The application of AI in higher education is important not only as a technological innovation, but also in terms of ethical and pedagogical principles. Thus, risks such as algorithmic bias, data protection, digital inequality, and “cognitive debt” can arise from the irresponsible use of AI (Ganjavi et al., 2023; Kosmyrna et al., 2023).

The history of AI in higher education dates back to the 1970s. One of the first Intelligent Teaching Systems (ITS), SCHOLAR, was developed by Carbonell (1970) and provided students with personalized and adaptive learning opportunities. Later, systems such as Stanford’s BIP, MIT’s WUMPUS, SOPHIE, DEBUGGY, and AutoTutor were developed, and AI-based teaching was shown to be as effective as human teachers (Jarrah et al., 2023; Farahani & Ghasmi, 2023). In the 21st century, e-learning platforms and MOOCs have created vast databases, which paved the way for the development of machine learning and adaptive systems. For example, in 2016, an AI teaching assistant named Jill Watson, used at Georgia Tech, answered students’ forum questions and by the end of the semester, students learned that she was not human (Goel, 2016). This experience demonstrates the potential of AI to support online learning.

AI literacy refers to an individual’s ability to understand, use, and critically evaluate AI tools (Roschelle et al., 2023; Hazari, 2023). This includes not only technical skills, but also understanding algorithmic logic, “black box” systems, and the socio-ethical implications of AI (Cheng et al., 2023; Iskandarova et al., 2023). Key components of AI literacy include mastering the basic concepts of AI, actively using the tools, critically evaluating the results generated by AI, and ethically participating in public discourse (EDUCAUSE, 2023). Nowadays, AI tools provide personalized learning opportunities for students, lesson planning and assessment for teachers, and data analysis and academic writing support for researchers. However, overreliance on AI can create “cognitive debt,” impairing memory, creativity, and critical thinking skills (Kosmyrna et al., 2023). Furthermore, unequal access to technology can increase social and economic inequality (Iskandarova et al., 2023).

The aim of this study is to comprehensively examine the application of artificial intelligence in higher education, identify both opportunities and risks, and provide recommendations for the responsible use of AI. The topic is relevant in the academic field, as AI can be a strategic tool in the future of higher education, not only to improve the quality of education, but also to support democratic knowledge production. In this regard, the integration of AI in education is not only a technological innovation, but also a process of strategic importance in ethical, pedagogical, and social contexts.

Objective

The main objective of this study is to comprehensively explore the role, applications, and impacts of artificial intelligence (AI), especially Generative AI (GenAI) and Large Language Models (LLMs), in higher education. The focus is on the opportunities and potential risks that AI creates in the areas of teaching, learning, assessment, scientific research, and institutional governance. The aim is to systematically present how AI tools can create personalized learning paths and real-time feedback for students, facilitate lesson planning and assessment for teachers, and provide data analysis and academic writing support for researchers (Crompton & Song, 2023; Cheng et al., 2023).

In addition, the study also explores the ethical and pedagogical risks that arise from the irresponsible use of AI, including issues such as academic integrity, plagiarism, creativity impairment, and “cognitive debt” (Kosmyna et al., 2023; Ganjavi et al., 2023). The importance of AI literacy is particularly emphasized in this study; that is, it is considered important for students to develop the skills of understanding, critically evaluating, ethically using and self-directed learning of AI tools (Roschelle et al., 2023; EDUCAUSE, 2023).

The sub-objectives of the study are as follows:

To systematically identify the opportunities that AI tools create for students, teachers and researchers in higher education.

To analyze the ethical, pedagogical and social risks associated with the use of AI.

To explore ways to develop technical, ethical and critical skills to increase students' AI literacy.

To formulate recommendations for ensuring the responsible and effective use of AI in higher education.

These objectives directly guide the research findings of the work and serve to systematically and comprehensively reveal both the opportunities and challenges of integrating artificial intelligence in higher education. As a result, the work illuminates the future prospects of AI in higher education, taking into account not only technological aspects, but also the pedagogical, ethical and social context.

Significance

The significance of this study lies in exploring the profound and multifaceted implications of the applications of artificial intelligence (AI), especially Generative AI (GenAI) and Large Language Models (LLMs), in higher education. First, the work fills the existing knowledge gaps for students, teachers, and researchers regarding the use of AI tools and reveals how they can optimize educational processes in the areas of personalized learning, lesson planning, assessment, and data analysis (Crompton & Song, 2023; Cheng et al., 2023). In this regard, the study provides a broad and systematic overview of the implications of AI in education to the academic literature.

Second, the work provides theoretical frameworks and practical recommendations for the responsible and effective use of AI, focusing on ethical and pedagogical aspects (Ganjavi et al., 2023; EDUCAUSE, 2023). Enhancing students' AI literacy and enabling them to critically evaluate tools is one of the main contributions of this study. This supports new educational models that integrate both technological and ethical skills.

Third, this work can be useful in the practical field, including in terms of developing university curricula, professional development of teachers, and shaping institutional policies. Informing about the risks of irresponsible reliance on AI tools, such as “cognitive debt” and socio-economic inequality, allows for the development of strategies for education policymakers and leaders (Kosmyna et al., 2023; Iskandarova et al., 2023).

As a result, this study provides theoretical and practical contributions for the future development of AI in higher education, taking into account not only technological innovations, but also the ethical, pedagogical, and social context. The work shows that artificial intelligence will not only enhance the quality of higher education, but also support democratic knowledge production and responsible learning environments.

Theoretical Basis

The theoretical basis of research on the application of artificial intelligence (AI) in higher education is based on several key concepts and theoretical frameworks. First, the concept of AI literacy is at the heart of the research and refers to the development of individuals' skills to understand, use, and critically evaluate AI tools (Roschelle et al., 2023; Hazari, 2023). AI literacy encompasses not only technical knowledge, but also ethical decision-making, critical thinking, and self-directed learning skills. This framework allows for a conceptual analysis of students' interactions with AI, the role of teachers in using AI in teaching and assessment, and the data analysis capabilities of researchers (EDUCAUSE, 2023).

The second key theoretical framework is the “personalized learning” model. This model emphasizes the creation of learning paths tailored to students’ individual needs and explains the provision of adaptive testing, real-time feedback, and personalized learning plans through AI tools (Crompton & Song, 2023; Cheng et al., 2023). The model provides a theoretical framework for increasing student motivation, improving learning outcomes, and encouraging them to use technology tools effectively.

The third theoretical approach is the ethical and responsible use of AI framework. This approach considers risks such as overreliance on AI tools, plagiarism, and reduced creativity and critical thinking (Kosmyna et al., 2023; Ganjavi et al., 2023). The ethical AI model integrates variables related to curriculum development, teacher professional development, and institutional policy formulation to ensure the responsible use of AI in higher education.

The conceptual map of the study shows that variables related to the implementation of AI tools – students’ personalized learning experiences, teachers’ use of AI in teaching and assessment, researchers’ data analysis and academic writing support – are interrelated, and AI literacy, ethical and pedagogical skills act as key factors moderating this relationship. Thus, the theoretical foundation creates a conceptual framework for the work and allows for a systematic analysis of the role and impacts of AI in higher education at all stages of the study.

Literature Review

The scientific literature on the application of artificial intelligence in higher education has grown rapidly in recent years. Crompton and Burke (2023) examined the contributions of AI to teaching and learning processes, noting opportunities such as personalized learning, adaptive testing, and teacher support. Hazari (2023) emphasized the importance of AI literacy and showed that it is important to develop students' skills in critical evaluation and ethical use of AI tools. In this regard, AI should be considered not only as a technological tool, but also as an important resource in a pedagogical and ethical framework.

Researchers have also paid attention to the potential risks of AI. Kosmyna et al. (2023) introduced the concept of “cognitive debt” and explained the negative impact of overreliance on AI on memory, creativity, and critical thinking abilities. Ganjavi et al. (2023) noted that GenAI may cause ethical problems in the academic writing process and increase the risk of plagiarism. These studies show that the irresponsible use of AI can have serious implications for educational quality and academic integrity.

There are also various examples of institutional applications. Goel (2016) examined the use of an AI teaching assistant named Jill Watson at Georgia Tech, demonstrating the effectiveness of AI in interacting with students in augmented online courses. Crompton and Song (2023) provided more systematic information on how AI can enhance personalized learning opportunities for students and support teachers’ lesson planning. Some gaps remain in the existing literature. Previous work has focused mainly on the individual functions of AI, but has not comprehensively examined the integration of AI into ethical, pedagogical, and institutional contexts in higher education (EDUCAUSE, 2023; Farrelly & Baker, 2023). At the same time, further research is needed to develop students’ AI literacy and analyze the effects of socio-economic inequality (Iskandarova et al., 2023; Roschelle et al., 2023).

This study systematically assesses the opportunities and risks of using AI in higher education to fill existing literature gaps, providing both theoretical and practical contributions. Thus, the work expands the existing scholarly discourse on AI literacy, ethical and pedagogical integration, and institutional policies, and creates a solid evidence base for the responsible use of AI in higher education.

Methodology

The research model used in this study is a mixed-method approach. That is, both quantitative and qualitative methods were used. The quantitative side was aimed at collecting data on students’ AI literacy and use of AI tools through a survey. The qualitative side allowed for an in-depth analysis of their experiences and perspectives through semi-structured interviews with teachers and researchers. The mixed approach allowed for both statistical support of the research results and a contextual and rich understanding of the topic (Creswell, 2014).

Working Group / Sample

The working group of the study consisted of undergraduate and graduate students studying at Azerbaijani higher education institutions, as well as teachers and researchers working in various faculties. Students were included in the sample through random sampling, and teachers and researchers were included through

purposive sampling. The total sample size was 250 students and 35 teachers/researchers. This sampling method was considered effective in terms of both representativeness and coverage of different perspectives.

Data Collection Tools

A structured questionnaire was developed for quantitative data and consisted of sections on AI literacy, frequency of use, personalized learning opportunities, and ethical knowledge. A semi-structured interview form was designed for qualitative data. The interviews allowed teachers and researchers to determine how they applied AI tools in their teaching and research processes, and what challenges and benefits they saw.

Data Collection Process

The research process began with prior permission from the relevant university ethics committee. Students and teachers were explained the purpose of the study, the confidentiality of data, and the principle of voluntary participation. The surveys were distributed via an online platform and the data obtained from the participants were collected anonymously. Interviews were conducted in video conference or face-to-face format, and each interview was recorded within the framework of previously agreed ethical guidelines.

Data Analysis

The collected quantitative data were statistically analyzed in SPSS. Descriptive statistics, cross-tabulation, correlation and multiple regression analyses were used. Qualitative data were analyzed using thematic analysis techniques, and main themes and subthemes were extracted from the interview transcripts (Braun & Clarke, 2006). As a result of the mixed methods approach, both statistical results and participants' experiences were combined, resulting in comprehensive and reliable conclusions on the application of AI in higher education.

Findings and Comments

A number of important findings were obtained as a result of the analysis of the quantitative and qualitative data of the study.

1. Students' AI literacy and use

According to the survey results, 68% of students reported using AI tools for teaching and learning purposes. Only 42% of students reported that they critically evaluate AI-generated texts and use them in accordance with ethical principles. These results are consistent with previous research; for example, Hazari (2023) showed that students' AI literacy is limited to technical skills and that ethical training is needed.

2. Teachers' use of AI in teaching and assessment

Interviews showed that 74% of teachers used AI tools in the lesson planning and assessment process. However, only 38% of teachers reported that they fully considered the ethical and pedagogical risks in using AI. This finding is similar to the findings of Farrelly and Baker (2023), but in contrast, some teachers noted that they have not yet fully implemented the adaptive testing and feedback capabilities of AI.

3. Researchers' use of AI and data analysis

Qualitative data showed that 81% of researchers reported using AI tools in data analysis and academic writing. However, some participants emphasized that the results presented by AI can be flawed and that the results should always be critically reviewed. These findings are consistent with the findings of Jarrah et al. (2023) and Cheng et al. (2023), namely that while AI increases productivity, attention should be paid to responsible use.

4. Social and ethical issues

The study also revealed social and ethical aspects. 29% of students and 32% of teachers reported being concerned about inequalities in the use of AI and differences in access to technology. This is consistent with Iskandarova et al. (2023) highlights the digital divide.

Comments

The findings show that AI tools offer significant opportunities in higher education in terms of personalized learning, lesson planning, assessment, and data analysis. At the same time, the results reveal similarities and differences compared to previous literature. Students' AI literacy is still underdeveloped and ethical educational measures are needed (Hazari, 2023; Roschelle et al., 2023). Although teachers and researchers benefit from the capabilities of AI, the importance of responsible and ethical use is still not fully realized (Farrelly & Baker, 2023; Kosmyrna et al., 2023). The issue of socio-economic inequality and access to technology highlights the practical challenges of integrating AI in higher education (Iskandarova et al., 2023). In conclusion, the findings of the study comprehensively reveal the opportunities and risks of using artificial intelligence in higher education and make a theoretical and practical contribution to the existing literature.

Conclusion

This study systematically explores both the opportunities and risks of using artificial intelligence (AI), particularly Generative AI (GenAI) and Large Language Models (LLMs), in higher education. The findings show that AI tools provide a number of practical benefits for students, teachers, and researchers. Students can learn more effectively through personalized learning paths, adaptive testing, and real-time feedback. Teachers can reduce their workload and improve the quality of teaching by using AI in lesson planning and assessment. Researchers can increase their productivity by using AI tools in data analysis, visualization, and academic writing (Crompton & Song, 2023; Cheng et al., 2023).

However, the study also highlights both ethical and pedagogical aspects. The findings show that only a minority of students are able to critically evaluate and use AI-generated outputs in an ethical manner. Teachers and researchers are not fully committed to responsible use of AI, given its potential risks. These results confirm the risks of AI, such as “cognitive debt”, plagiarism and reduced creativity, as highlighted by Kosmyrna et al. (2023), Ganjavi et al. (2023) and Hazari (2023).

The study also draws attention to issues of social and technological inequality. The limited access of some students to technology and instructors creates disparities in the use of AI, which affects educational outcomes (Iskandarova et al., 2023). This highlights the importance of supporting the integration of AI in higher education not only through technological innovations, but also through institutional policies and equitable distribution of resources.

As a result, the successful implementation of AI in higher education is not only about the use of technological tools; it is also possible through the development of students’ AI literacy, the application of ethical and pedagogical rules, the professional development of teachers and the provision of institutional support. AI literacy has a direct impact on students’ development of self-directed learning, critical thinking, and ethical decision-making skills, teachers’ optimization of teaching processes, and researchers’ productivity (Roschelle et al., 2023; EDUCAUSE, 2023).

In this regard, artificial intelligence is seen not only as a technological tool, but also as a strategic resource for improving the quality of higher education, supporting democratic knowledge production, and shaping responsible learning environments. The study contributes from both theoretical, practical, and institutional perspectives, and creates a solid knowledge base for the responsible, ethical, and effective use of AI in higher education. These results can play an important role in developing future policy and teaching strategies for integrating AI in higher education.

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STRATEGY FOR USING INTERACTIVE TEACHING METHODS IN UNIVERSITY EDUCATION AND THEIR SUITABILITY/APPROPRIATENESS LEVEL FOR COURSES

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ABSTRACT

The main purpose of writing this article is to examine modern innovations in higher education, which is the main part of the education system, to determine the rules for using them in lecture and seminar classes, and to determine the use of a more appropriate, appropriate interactive method for each lesson. For this, the comparative research method was used as a basis, the national and world higher education systems were examined, and their mutual, comparative study was carried out. As a result of this mutual-comparative study, many work forms and work methods were identified, the conditions for their use were clarified, and they were systematized for use in lecture and seminar classes. Of course, these work methods are quite extensive and numerous, writing about them requires a larger article, but we tried to mention the most widely used work methods in this article as much as possible. As a result, we can note that, indeed, the world education system is rapidly adapting to changes, requiring the application of each new work form and work method. From this perspective, every teacher working in the higher education system and institutions must approach their work responsibly, follow the innovations taking place in the global education system, and implement them.

Keywords: higher education, work methods, work forms, lecture, seminar

Introduction

In the modern world, the organization of lectures and seminars in the higher education system has an important place in academic status, since the value given to higher education in the changing, developing modern world reality is extremely high, and systematicity in this field is one of the most demanded issues. This topic, namely the rules for organizing lectures and seminars in higher education, determining the compatibility of the forms and methods of work used in them, has an important place in the modern world. This importance in the academic field leads to this topic becoming even more relevant, one of the prominent issues in the world education system. The relevance of the topic leads to its research and more serious development. The increasing number of trainings and increasing demands in this field every day are an indication that this work is being widely studied all over the world, so the international trainings and courses we have joined once again prove that large-scale research is being conducted on the topic in the world higher education system. What we learn as a result of these trainings and courses causes us to keep up with these innovations, to be constantly in search of the current topic, and to expand the field of research. The motivation for us to take a more serious interest in the work is mainly the extremely interesting and attractive nature of the topic and the impact created by international trainings.

Aim

The main goal of the research is to adapt the lectures and seminars at the higher education institution we work at to the modern world higher education system and keep up with them. Since it is not the responsibility of the teaching profession to be unaware of innovations in the developing world, or not to apply them, we, like every teacher, try to be aware of these changes and apply them to our lessons.

Significance

The importance of the study is that higher education is one of the most important parts of the education system in general, and modernization and renewal in this area are one of the main issues. Being aware of the forms and methods of work applied by the modern education system in university education plays an important role. Considering this importance, significance, we also tried to conduct some research in this area and clarify the issues that are important to us.

Theoretical Framework

In the modern era, the importance of education has become increasingly relevant and necessary. Therefore, one of the main issues teachers must consider today is the adaptation and integration of education with the demands of the modern age and technology. Since the expectations and demands of the new generation from education are largely aligned with an era of rapid technological and artificial intelligence advancements, educational methods worldwide have begun to evolve to meet the demands of the modern age. University education, a fundamental component of general education, has also focused on change and development in line with these new demands. Because the conventional, traditional education system and methods are no longer effective or acceptable in today's universities, the higher education strategy has been forced to adapt to the demands of the era. Therefore, we can see that Azerbaijani universities have also begun to change, adapt, and develop themselves in this direction. As university teachers, we are also part of this process of change and development, and we strive to follow the demands of the new era, thoroughly understand them, and then apply them in our education, structuring our lessons accordingly. Since university courses generally consist of lectures and seminars (student feedback), we have begun to structure the course format based on new teaching and learning methods. For this, it is essential to meticulously define Learning Outcomes. Just as every course generally has Learning Outcomes, the topics of the courses also have Learning Outcomes, and these outcomes are written in accordance with the Learning Domains. The actions of the outcomes are determined according to the Cognitive Domain, the Affective Domain, and the Psychomotor Domain so that they are measurable. Lectures generally begin with Icebreaker activities. Icebreaker activities are designed to be different from the daily course topics; the main intention is to draw students' attention to the new lesson and to eliminate tension both among themselves and with the teacher. These activities could be music, an aphorism, a painting, and students voice their own opinions about what is presented. Many examples of icebreakers can be given. Examples of icebreakers: If you could know the answer to a question for sure today, what question would you ask?, What is a small habit that has made a big difference in your life?, If you could go back to a moment in the past and tell yourself one sentence, what would you say?, Three words that best describe you?, etc. Ardından dersin esas konusu ve maksadı, ders sonunda elde edilecek olan öğrenim çıktıları söylenir. Bunun ardından dersin günlük konusu neyse ona uygun olarak motivasyon belirlenir. Motivasyon mutlaka konu ile alakalı olmalı, konunun içeriği ve kapsamı ile ilgili öğrencilere ipucu vermelidir. Öğrenciler motive edici kısmı bitirdikten sonra günlük ders konusuna daha iyi odaklanırlar ve daha iyi dinlemeye başlarlar. Bunun ardından ders giriş, esas ve sonluk olarak belirlenir.

Various teaching and learning methods can be used in the lecture process. Examples include Active Statistics, Brainstorming, Close/Assigned Reading, Discussion Prompts, Flipped/Inverted Classroom, Group Work, Learning Diary, Learning Stroll, Lecture/Teacher Presentation, Mind Mapping, Pro-Con Debate, Project-Based Tasks, Think-Pair-Share, Provocation, and others. These teaching and learning methods are determined according to the daily lesson, their duration in minutes and the time they can take are calculated, and then implemented. Generally, starting lessons with brainstorming can foster a positive learning process. Following this, Think-Pair-Share and Problem-Based Learning can be effective methods for problem-focused learning. At the end of the lecture, students can be asked to write a Learning Diary using reflective methods to assess whether they have achieved the intended outcomes and objectives. These are the general methods used for seminar courses; while we could expand on this list, the commonly used learning methods are: Discussion, Essay, Learning Diary, Multiple Choice Test, Oral Exam, Portfolio, Presentation, Project-Based Tasks, Term Paper, Thesis, and Written Exam. These methods are quite efficient and suitable for understanding and evaluating what students have gained and learned from the lesson taught by the teacher. As university teachers, we try to use these methods appropriately in our lectures, seminars, and group evaluations. They truly help students learn actively. In conclusion, we must say that university education should be considered an essential and necessary part of the education system, prepared for with care and seriousness, and implemented with the same meticulousness. This has become even more important in light of today's technology and the requirements of Artificial Intelligence. Therefore, both we and all university students must adapt to the demands of the age and ensure that our students learn more actively and science-oriented. To achieve this, we must follow the constantly evolving education systems worldwide, research the education systems applied in established universities globally, learn from them, and adapt them to our own system.

Icebreakers - In general, starting lessons with icebreakers always gives a successful result, because when lessons are prepared with these examples, it is more successful and effective to attract students' attention to the lesson. After that, it becomes easier to move on to the motivational phase of the lesson. Various icebreaker examples can be used, as it can be music, a painting, an aphorism. Students think based on these examples, express their thoughts about them in a sentence. Icebreakers are usually not related to the topic of the lesson, but motivational questions should be almost related to the topic. They simply determine the opinions of both students about each other and the teacher about the students, serve to get to know each other better and to relieve the tense relationship between them. "Icebreaking activities are essential tools in academic settings, designed to

foster engagement, alleviate anxiety, and promote social interaction among students”(Shavoun, Adeli, & Ahmari Tehran, n.d., 2024).

One of the icebreaker strategies is the **Snowball Toss**. For example, students are instructed to write on a piece of paper about an issue that worries them and roll it into a snowball and throw it at each other. After that, each student opens a sheet and reads, and this anonymous concern is discussed and resolved within the group.

It is very convenient to use the methods listed above in lecture lessons, and it is advisable to obtain useful results. Building lecture lessons more with the **Brainstorming** method gives effective results, since this method develops the critical, creative and logical thinking of students after the icebreaker and motivation stage. A student who is forced to think about a certain question is inevitably involved in the lesson process and becomes active. “In the information age, there is a need for individuals who know how to access new information, question it, examine, analyze, and transfer it, and who possess problemsolving abilities as well as creativity and productivity. It is crucial to restructure educational environments to align with 21st-century skills. Innovative teaching methods and ensuring active student participation are of great importance in enhancing the efficiency of learning processes”(Inciman Çelik & Akay, 2025).

In lectures consisting of an introduction, main part and conclusion, it is usually advisable to use the **Think-Pair-Share** method in the main part, since this method, which is carried out in pairs as a form of work, also leads to the elimination of distraction and fatigue in the middle of the lesson, like brainstorming. When using this method, the teacher voices a question in the middle of the lesson, students think in pairs, and then share their thoughts with each other. This leads to the creation of an exchange of ideas and cooperation. This working method is suitable for a pair work format. “Think-Pair-Share is a cooperative discussion strategy that was first developed by Professor Frank Lyman and his colleagues at the University of Maryland in 1981. It has been adopted by many writers in the field of cooperative learning since then. It gets its name from the three stages of student action, with an emphasis on what students are to be doing at each of those stages” (Marzano & Pickering, 2005). “Think. The teacher provokes students' thinking with a question, prompt, or observation. The students should take a few minutes just to THINK about the question; (2) Pair. Using a partner or a desk-mate, students PAIR up to talk about the answer each came up with. They compare their mental or written notes and identify the answers they think are best, most convincing, or most unique; (3) Share. After students talk in pairs for a few minutes, the teacher calls for pairs to SHARE their thinking with the rest of the class” (Robertson, 2006).

Flipped Class/Learning is also one of the interactive methods used for lecture classes. Thus, it is one of the most widely used methods in the world education system, in prestigious universities, and is met with interest by both teachers and students. In this interactive learning method, the teacher sends pre-recorded lesson videos to students before the lecture, students obtain information about the topic before the lecture and participate in the lecture with the teacher during the lesson. This can be used more in literature lessons. For example, even if the teacher does not have a recorded video lesson, ready-made video materials about poets and writers on YouTube channels can be used. As university teachers, we use this method very often and it really gives effective results. This method of work is carried out in a collective form of work. “The selection of learning materials is a fundamental challenge for teachers to ensure that the most suitable topics are presented to students. In the introductory phase of the Flipped classroom methodology this task becomes even more challenging as only the “essentials of the essentials” should be integrated into the videos. This requires a reconsideration of lessons from a new aspect: what parts of the learning content can my students assimilate without my personal presence, and for which elements do they need my assistance? On the other hand, the production of a video expands our possibilities: we can insert links, add extra scientific literature for those students who would like to deal with the subject in more detail. We can bring the subject closer to today’s students with visual and hypertext thinking if we use images and animations in our explanations” (Hartyányi et al., 2018).

One of the methods that is most appropriate to use in lecture classes is the **Problem Based Learning** method. The use of this method is more effective for long-term learning, that is, Problem-Based Learning is a learning method that requires a long time, but it is appropriate to raise any problem-issue related to the topic within the lecture and work with groups as a form of work. We can call this a mini-PBL as an example, because it is not possible to work on a long-term issue within the lecture, so it is more appropriate to apply it in this way. This form of work is more appropriate for the form of work with groups. “Problem based learning have been proved to be a success in the enhancement and development of critical thinking ability, leadership qualities, self-directed learning, professional and interpersonal skills, team working skills, management skills, collaborative learning, English speaking qualities, practicing empathy and many more” (Dolmans & Schmidt, 2000), (Engel, 1991).

Traditional Presentation this method is used more in traditional lectures, but this method can also be enriched with certain other interactive methods and create a strategic form. Thus, during the lecture, Brainstorming, P4C, Think-Pair-Share methods can be used within the presentation, that is, 4 methods can be used within one lesson.

P4C is one of the modern interactive teaching methods (**Philosophy for Children, Philosophy for Students**) and is actively used in lecture classes, that is, the teacher creates conditions for students to think philosophically, develop critical and creative thinking by asking certain questions in accordance with the daily topic of the lecture classes. They express their personal experience of a certain topic and idea, philosophical assessment from their worldview. This method of work is more suitable for the form of work with a team.

Project Based Learning is a modern pedagogical approach in which students learn knowledge and skills by working on projects that are applied in real life. Here, students do not just memorize information, they research, plan, create, present and draw conclusions. Students conduct research to solve a problem, collect information, work in teams, prepare a product (poster, presentation, prototype, video, article, etc.), and the teacher acts as a mentor who provides guidance. The main goals of this learning method are the development of critical thinking and problem-solving skills, strengthening teamwork, increasing creativity and self-confidence, result-oriented learning, interdisciplinary integration, etc. For this method of work, the form of work with groups is more appropriate.

Interactive learning methods, which will be discussed below, are used more for seminar classes.

Socratic seminar is a very profitable and effective method for seminar classes, as this method creates favorable opportunities for discussing the topic given in advance in seminar classes. We can use the Socratic seminar not only in seminar classes, but also in lecture classes. The daily topic can be divided into certain parts and students can read it for 10-15 minutes, and then discuss the topic read in the lesson. For seminar classes, a discussion of the reading of a previously assigned text can be organized. A more collective form of work is more appropriate for this method of work. "The Socratic Seminar, also known as Socratic Dialogue, is rooted in the conversations the Greek philosopher Socrates (470–399 BC) had with his pupils (Schneider, 2013). Socrates, known as an excellent teacher, established dynamic conversations with his learners, empowering them to construct their understanding of complex matters, and think critically about evidence (Chowning, 2009). The Socratic Seminar has no single definition (Acim, 2018). From a teaching perspective, Billings and Roberts (2006) explain that the Socratic Seminar is an instructional method that aims to improve understanding of ideas through engaged discussion. Soccio (2015) clarifies that the Socratic Seminar is a dialectical method of inquiry that uses questions to guide a discussion. It is expected that truth comes from learners' discussion (Spencer & Millson-Martula, 2009). Discovering the truth involves a systematic discussion on the nature of verifiable ideas (Spencer & Millson-Martula, 2009). Kessels (2009) adds that it is a collective deliberation of ideas aiming to achieve consensus on the answers to fundamental questions. Attempting to find agreement, instructors can infer that these definitions share two characteristics: first, truth is discovered through engaged and logical discussion; and second, truth comes from within the learner" (Castellanos-Reyes, 2020).

Discussion is also one of the effective and useful methods widely used in seminar classes, which is somewhat similar to the Socratic seminar. This method also gives useful results in discussing the topic. Students exchange ideas with each other around the topic, and obtain more interesting scientific, artistic and philosophical results. A more collective form of work is more appropriate for this method of work.

Essay can also be one of the main methods suitable for seminar classes, since students can be asked to write an essay on the assigned topic. This also creates conditions for them to determine and strengthen the correct writing rules, writing forms, and to master the ways of constructing sentences in written speech. Writing an essay also leads to the clarification of somewhat confused ideas by transferring them to writing, and the idea becoming completely transparent. The form of work with individuals is more appropriate for this method of work.

Aquarium (Fishbowl discussion) is one of the best interactive teaching methods used in seminar classes. Thus, a certain part of the group, let's say half, sits around the middle circle and begins to discuss the topic assigned to them. Those sitting in the outer circle listen to them carefully and take notes for themselves. Then the outer circle takes the place of the inner circle and begins to discuss what they heard, note their positive and negative sides, and make their own additions.

Of course, the suitability of these work methods and work forms for them can be greatly increased, because the methods used in lecture and seminar classes are quite wide and their number is quite large. It is impossible to provide information about all of them in one article, but we have tried to provide some information about them.

Literature Review

Of course, while conducting this research, we also examined the world education system, although extensive research has been conducted in this field in our country. But we did not stop there and tried to obtain more detailed information to expand the scope of the research. The research we conducted in both the national education system and the secular education system, especially in the latter, shows that the topic has been extensively studied and that fairly significant research has been conducted in this field. We also obtain information from these studies in the appropriate manner. But regardless of the large-scale nature of the research, we also tried to clarify and clarify some issues for ourselves to some extent. As a result of the research conducted in this direction, what we already knew was further strengthened, and we also obtained new, important information.

Methodology

- The comparative method was used as a research method. This research method allows both to examine the existing national literature, to study it extensively, and to study it in relation to the world education system.
- We participated in the research as two teachers. Both of us are university teachers and work at the Shamakhi branch of the Azerbaijan State University of Education. The purpose of conducting the research together is that we both work in the higher education system and the existing difficulties. We thought that this research would give positive results for both of us in our teaching activities.
- In order to make the research more comprehensive and successful, we tried to study both national and foreign literature written in this field. Of course, we also conducted a survey with colleagues working in the same institution as us, gave them some advice and tried to learn about their work experience. Other teachers also have successful moments in their work activities, and it was also useful for us to learn their main nuances. Before writing about the article, we wrote a certain project-based work with students on this topic. At that time, we learned the students' opinions, suggestions and wishes about the higher education system. In order to increase students' interest in studying, we organized a survey together with students and obtained very interesting results from them. They made very diverse suggestions about this, and we also use these innovations in our lecture-seminar lessons.
- We spent a certain amount of time on this research and worked together. As we mentioned above, we followed, researched, and studied the changes taking place in the world's education system, and tried to determine their relevance to lecture and seminar classes.

Findings and Discussion

In fact, the research process is quite interesting and this has increased our work responsibility even more. Studying the world higher education system, studying the educational achievements of different countries, and adapting them to the national higher education system was a very interesting and attractive process. Of course, we were somewhat aware of these issues. Because the trainings we attended from time to time allowed us to obtain the necessary information in this area. However, it is also important to follow the changes taking place in the world every day and it is imperative to learn and apply them.

As a result of the research, we learned how many innovations and modern interactive teaching methods there are in the modern education system. Learning them thoroughly and applying them to lecture-seminar lessons is a very interesting process. Of course, although we experience some difficulties since we are graduates of traditional education, in fact, teaching lessons in this form leads to students' activity, increased attention, and a more interesting learning process. Therefore, we think that every teacher should learn these methods thoroughly and correctly determine their application.

As a result of the research, it became clear that some interactive work forms and methods are appropriate for both lecture classes and seminar classes. However, each has its own characteristics. For lecture classes, other work methods are used in the form mentioned above, and for seminar classes, other work methods are used. The specific work methods for the teaching and learning process should be clearly defined.

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STUDENT INVOLVEMENT IN QUALITY ASSURANCE AT AZERBAIJAN'S HIGHER EDUCATION INSTITUTIONS

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ABSTRACT

This article examines the evolution of student involvement in quality assurance across Azerbaijan's universities, focusing on the shift from symbolic participation to more meaningful partnership. Recent reforms, aligned with the European Standards and Guidelines (ESG) and supported by the Education Quality Assurance Agency of Azerbaijan (TKTA), have introduced internal QA units, systematic surveys, and strengthened accreditation processes. Yet, student engagement remains uneven, as traditional governance cultures, limited awareness, and inconsistent institutional practices continue to narrow students' influence on teaching, curriculum design, and decision-making.

Despite these challenges, early progress is evident. Students now participate in program committees, accreditation self-assessments, and curriculum discussions – an emerging acknowledgement that their academic experience offers valuable insight into educational quality. Moving toward genuine partnership, however, will require sustained capacity building, clearer communication about how feedback is used, and a culture that consistently views students as co-creators rather than passive participants.

To contextualize these developments, the article draws on examples from ADA University (Azerbaijan), the University of Tartu (Estonia), and Lund University (Sweden). ADA's "You said – We did" model illustrates how visible responsiveness can build trust; Tartu's digital feedback systems and training initiatives show how supportive infrastructure strengthens student voice; and Lund demonstrates what mature partnership looks like when students are fully integrated into governance structures. Together, these cases offer Azerbaijani HEIs a concise and practical roadmap for advancing from consultation toward authentic student partnership in QA.

Keywords: quality assurance, student involvement, Azerbaijan, higher education, Bologna Process, ESG.

Introduction

Quality assurance (QA) in higher education has become central to maintaining academic standards, ensuring accountability, and promoting continuous improvement in a globalized context. Student involvement is a crucial, though often underutilized, component of effective QA. Instead of being a procedural formality, student involvement reflects a significant philosophical change toward democratic governance, shared responsibility, and a student-centered approach to learning. This imperative has been reinforced by the Bologna Process and codified in the ESG (ENQA, 2015), which advocate for inclusive approaches that recognize students as full partners. In many European systems, students now participate in strategic decision-making, program evaluation, review panels, and the design of feedback mechanisms. As the European Students' Union (ESU) has stated (ESU, 2015), students should be fully involved in defining QA policies and systems. Liz Thomas (Thomas, L., 2012) also argues that fostering student engagement and a sense of belonging is critical for improving retention and overall student success in higher education.

Student participation in QA in Azerbaijan is steadily progressing, reflecting the country's ongoing commitment to Bologna reforms and European standards since 2005. Mechanisms such as councils and surveys provide promising avenues for engagement, and initiatives to enhance training and support are strengthening their impact. While hierarchical traditions and limited awareness of QA among some students continue to pose challenges, the rise of independent representation points to increasingly meaningful involvement. A gap remains between the formal adoption of European standards and fully realized student influence, indicating room for further growth.

This article addresses that gap and highlights the systemic challenges that limit meaningful student participation in Azerbaijan's HEIs. The analysis utilizes a conceptual framework that tracks the evolution of student involvement, classifying students' roles as clients, participants, and, eventually, partners. It then situates Azerbaijan's experience within the wider European context, acknowledging that even mature systems often struggle to move beyond symbolic engagement. Importantly, the article draws comparative lessons from three institutions – ADA University, the University of Tartu, and Lund University – to inform a phased roadmap for Azerbaijan's institutions. By synthesizing these insights, the paper proposes practical recommendations: formalizing representation and transparent feedback (as seen at ADA), expanding capacity building and decision-making rights (as in Tartu), and ultimately embedding partnership as a cultural norm (as at Lund).

Aim

The aim of this study is to support a significant transition in Azerbaijan’s HEIs toward inclusive governance, with particular emphasis on enhancing meaningful student involvement in quality assurance and strategic decision-making. In doing so, the article aligns with both national aspirations for quality improvement and the European Higher Education Area’s (EHEA) emphasis on harmonized, student-centered systems. Ultimately, it argues that empowering students as genuine partners in QA enhances educational quality, institutional governance, and trust between universities and their communities.

Significance

The significance of this article is that it offers a critical examination and practical roadmap for advancing student involvement in QA within Azerbaijan’s HEIs. The study makes several key contributions across research and practice, focusing specifically on how HEIs can transition from symbolic consultation to authentic partnership. This article’s main contributions begin with its conceptual alignment and gap analysis. It applies a three-stage framework (students as clients, participants, and partners) to the national context, grounding its analysis in the ESG and the Bologna Process. This is crucial for highlighting the persistent gap between the formal adoption of European standards since 2005 and the actual, meaningful influence students exert in decision-making and governance.

Furthermore, the study provides valuable empirical and comparative benchmarking to inform national practice. It draws tailored, comparative lessons from institutions that represent a continuum of engagement models: ADA University (a national example of structured participation and transparent feedback), the University of Tartu (a post-Soviet case of successful transition to co-governance), and Lund University (an advanced model of full partnership). These cases offer Azerbaijani HEIs a concise, practical roadmap for strengthening their QA systems. The article’s primary contribution is the proposed phased strategic roadmap for advancing student partnership across Azerbaijani HEIs. This roadmap details steps to formalize representation and transparent feedback, expand capacity building and voting rights, and ultimately embed co-creation as a cultural norm. Ultimately, the study argues that empowering students as genuine partners enhances educational quality, governance, and trust, aligning Azerbaijani HEIs with both national aspirations and EHEA principles.

Theoretical Framework: Evolution of QA and Student Involvement

Quality assurance in higher education became prominent in the late twentieth century due to rising demands for accountability, transparency, and competitiveness. Initially, QA focused on self-regulation and peer review, but it has since shifted toward enhancement-led approaches that stress continuous improvement and robust stakeholder participation. This shift was significantly accelerated by the Bologna Process (1999). The process introduced the ESG (first published in 2005, revised in 2015). The ESG emphasizes that students are indispensable stakeholders. It frames student participation not merely as an optional consultation but as central to achieving a sustainable quality culture. This culture encompasses key areas such as governance, program design, evaluation, and feedback mechanisms.

The movement of students from passive recipients to recognized partners mirrors broader changes in institutional governance. Key international milestones formalized this progression:

- Bologna Declaration (1999): Introduced the principle of student-centered learning;
- Prague Communiqué (2001): Recognized students as essential partners;
- Berlin Communiqué (2003): Called for active student involvement in QA processes;
- ESG (2005, 2015): Formally established students as key stakeholders.

Bovill et al. (Bovill, C., Cook-Sather, A., & Felten, P., 2011) analyzed student participation in higher education processes, outlining its progression across three distinct stages:

Stage	Student Role	Characteristics
Consultative	Students as Clients	Treated as consumers, providing feedback primarily through surveys. Influence is limited and transparency is weak, often reflecting the marketization of higher education
Collaborative	Students as Participants	Students join committees and QA activities, contributing ideas and learning institutional processes. This marks progress, but most decision-making remains with the institutional leadership.

Full Partnership	Students as Co-Governors	Students share responsibility with staff, actively co-creating policies and curricula. Representatives hold voting rights and exert direct influence on institutional matters
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This three-stage progression illustrates the pathway institutions can take to move beyond tokenism toward empowerment, embedding student perspectives at the core of development and aligning with global best practices. To systematically assess the quality and depth of student involvement, four crucial dimensions are considered (Guilbault, M., 2018):

Representation and Participation: This dimension examines the integration of students into governance structures and QA committees, focusing on ensuring they have meaningful roles and genuine influence.

Feedback and Evaluation: This refers to the presence of structured mechanisms for collecting and, critically, acting upon student input regarding teaching, curricula, and services.

Capacity Building: This addresses the need for providing adequate training and support to equip students to engage effectively and knowledgeably in complex QA processes.

Culture of Partnership: This dimension reflects the overarching institutional ethos that views and treats students as co-creators of the educational experience rather than as passive recipients of instruction.

Literature Review: Student Participation —Azerbaijan in Global Context

Student involvement in QA across Azerbaijan’s higher education institutions (HEIs) has been evolving gradually, reflecting both emerging progress and persistent constraints. Although students are formally recognized as stakeholders in internal QA systems, their participation often remains procedural, concentrated primarily in course evaluations, with limited influence on curriculum, assessment policies, or institutional decision-making (Logermann, F., & Leišytė, L., 2015). Still, incremental advancements are visible. Some Azerbaijani universities are beginning to move beyond a consumer-oriented model and experiment with more participatory governance structures. These efforts—though uneven—signal an emerging willingness to strengthen student voice and align with European standards for collaborative QA (Klemenčič, M., 2014).

International literature shows that Azerbaijan’s challenges are not unique. Across the European Higher Education Area, student engagement often remains shallow despite established frameworks. Research by Logermann and Leišytė ((Logermann, F., & Leišytė, L., 2015) suggests that even with established participatory structures, student engagement often remains superficial or symbolic consultation, positioning students as advisors rather than as key decision-makers. Klemenčič (Klemenčič, M., 2014) also noted the disparity between students' formal representation and their actual influence, pointing out that power imbalances and ineffective feedback mechanisms frequently weaken their engagement. Westerheijden et al (Westerheijden, D. F., Stensaker, B., & Rosa, M. J. (Eds.), 2007) also note that QA reforms across Europe tend to prioritize compliance and procedural alignment, sometimes at the expense of genuine stakeholder involvement.

Bergan and Deca (Bergan, S., & Deca, L., 2018) describe this uneven implementation of Bologna reforms as a “two-speed” process: while some institutions advance participatory governance, others lag due to centralization, resource limitations, or insufficient autonomy. Azerbaijan’s trajectory is further shaped by historical and geopolitical factors. The Soviet legacy continues to reinforce hierarchical structures that limit student agency, while decades of territorial occupation disrupted institutional development and slowed the adoption of participatory governance practices⁸⁵. Consequently, student participation in QA within Azerbaijani HEIs continues to evolve gradually, mirroring global patterns of both progress and persistent structural barriers.

Methodology

This study employed a **qualitative and comparative methodology** anchored by a robust conceptual framework to analyze the role and evolution of student involvement in QA within Azerbaijan's HEIs. The primary objective was to contribute to a broader shift toward inclusive governance across the sector in Azerbaijan. The research was grounded in a conceptual framework tracing the progression of student involvement through three stages described in theoretical part of this article: from Consultative to Collaborative and finally to Full Partnership/Co-Governors. This framework provided the essential analytical lens for assessing the current status and identifying the developmental trajectory of student engagement within Azerbaijan’s HEIs. The investigation of the national context involved a detailed analysis of the impact of the Bologna Process (since Azerbaijan's accession in 2005) and the subsequent implementation of the ESG.

The study examined the systemic challenges to meaningful student participation, including the legacy of centralized Soviet governance, which often reinforces hierarchical decision-making, and the varying implementation of internal QA systems across universities. To systematically assess the national status, the study incorporated evidence and data from previous research, notably a comparative survey conducted across six Azerbaijan’s HEIs, which included 2,400 students and interviews with administrators. This evidence provided empirical data on student participation levels in areas like curriculum design and internal evaluation processes. Throughout this analysis, the status of student involvement was systematically assessed across four key dimensions: representation and participation, feedback and evaluation, capacity building, and culture of partnership.

The core of the methodology lies in the comparative analysis of case studies. Three distinct institutions – ADA University (Azerbaijan), the University of Tartu (Estonia), and Lund University (Sweden) – were selected to represent a continuum of student engagement models: a structured national model, a successful post-Soviet transition toward co-governance, and an advanced European model of full partnership, respectively. By examining the institutionalized practices within these cases – specifically focusing on how they implement the four dimensions of involvement – the study sought to identify concrete, transferable best practices. This comparative approach allowed for the extraction of phased, strategic lessons to move HEIs in Azerbaijan from procedural formality toward substantive partnership, thereby informing broader systemic reform.

Findings and Discussion

Empirical studies examining student involvement in QA across Azerbaijani higher education institutions (HEIs) reveal a pattern of limited yet gradually evolving engagement. The comparative research of Mammadova and Valiyev (Mammadova, L., & Valiyev, A.,2020) provides a comparative snapshot of student involvement across six Azerbaijan’s HEIs: ADA University, Azerbaijan State Pedagogical University (ASPU), Azerbaijan University of Languages (AUL), Azerbaijan Technical University (ATU), Baku State University (BSU), and Azerbaijan University of Economics (UNEC). Their survey of 2,400 students and interviews with administrators reveal persistent gaps in awareness, participation, and support services. Here are the results of this study:

Table 1. Students’ Participation in Curriculum Design and Knowledge about ECTS

% of Student s’ Participation in Curriculum Design					% of Students who are informed about credit hours		
Participated	Partially Participated	Did not Participate	No idea	TOTAL	Students who know	Students who don’t know	TOTAL
3%	12%	57%	28%	100%	55%	45%	100%

As it is seen from this Table 1, only 3% of students fully participated in curriculum design and 12% partially participated. Nearly half of students were unfamiliar with credit hours and the ECTS system.

As for the involvement in internal evaluation process, students were most active in evaluating instructors (40%) and institutional performance (42%), moderately active in program assessments (38%), and least active in course-level evaluations (18%) (Table 2).

Table 2. Involvement in Internal Evaluation Process

Evaluation of	% of students participated	% of students partially participated	% of students did not participate	TOTAL %
University	42%	30%	28%	100%
Instructor	40%	33%	27%	100%
Course	18%	31%	51%	100%
Program	38%	30%	32%	100%

To the questions of whether the student support services exist in these universities, overall answers were “no” (Table 3). Across the six universities, the presence of career guidance, psychological counseling, foreign language courses, and study abroad information varied considerably. ADA University offered the most comprehensive set of services, with roughly 26% of students reporting access to career guidance, 23% to foreign language courses, and 23% to study abroad information. Other universities showed more specialized strengths: ASPU had relatively better psychological support coverage (around 4.5%), surpassing most other institutions including ADA. Additionally, ASPU and AUL are following ADA’s leadership in foreign language courses (8.50% and 7.29%, respectively), and in exposure to study abroad information (9.25% and 8.04%, respectively). These patterns indicate that while ADA leads in overall service provision, other universities have niche strengths in specific support areas.

Table 3. Existence of the Student Support Services in the Sample Universities

University	Career Guidance Service		Psychological Support		Foreign Language Course		Study Abroad Awareness	
	No	Yes	No	Yes	No	Yes	No	Yes
ADA	1.04%	25.83%	23.58%	3.29%	4.04%	22.83%	3.42%	23.46%
Pedagogical University	16.96%	4.13%	16.58%	4/50%	13.79%	7.29%	13.04%	8.04%
University of Languages	14.29%	1.17%	12.50%	2.96%	6.96%	8.50%	6.21%	9.25%
Technical University	4.88%	0.96%	5.71%	0.13%	5.13%	0.71%	4.42%	1.42%
Baku State University	6.17%	0.38%	5.88%	0.67%	5.00%	1.54%	5.54%	1.00%
University of Economics	14.75%	9.46%	20.96%	3.25%	19.67%	4.54%	11.79%	12.42%
Grand Total	58.08%	41.92%	85.21%	14.79%	54.58%	45.42%	44.92%	55.58%

Building on these insights, Mushtagov (Mushtagov, A., 2021), Isayeva & Aslanova (Isayeva, E., & Aslanova, N., 2021), and Mahmudov (Mahmudov, R., 2022) identify systemic and institutional factors affecting engagement. Mushtagov highlights inconsistent QA practices, low stakeholder awareness, and limited transparency. Isayeva & Aslanova note that students often lack clarity about their roles and face one-directional communication from administrations. Mahmudov emphasizes that while ADA University leads in student engagement, feedback mechanisms still struggle to translate student input into concrete actions. Together, these studies show that although students are formally recognized in QA, their engagement is largely procedural, and targeted support services are critical for meaningful participation.

A recent study by Isaeva et al, (Isaeva, R., Ratinen, I., & Uusiautti, S., 2023) provides valuable empirical insight into how student involvement influences quality indicators in Azerbaijani higher education. Using the National Survey of Student Engagement (NSSE), the researchers surveyed more than 430 students across eight universities. Their findings revealed that higher levels of student engagement—particularly strong student–faculty interaction and a supportive institutional environment—were positively associated with key quality outcomes such as academic achievement, satisfaction, and perceived learning gains. Students who reported meaningful communication with faculty and adequate institutional support achieved higher GPAs, demonstrated stronger motivation, and developed better academic and practical skills. Although the study did not directly assess formal participation in QA processes, it indicated that the same factors promoting engagement – dialogue, feedback, and institutional responsiveness—are also essential for effective QA. Strengthening student participation in QA, therefore, has the potential to enhance engagement and improve overall educational quality in Azerbaijani universities.

These findings align with Lizzio’s Five Senses of Student Success model (Lizzio, A., 2006), which highlights the importance of supportive environments, meaningful relationships, and belonging for student satisfaction and achievement. Both studies illustrate that students succeed when they feel connected, capable, and empowered to contribute to decision-making.

Taken together, these studies indicate that while students are formally involved in QA, their engagement is largely procedural. Roles in curriculum design, program assessment, and governance remain marginal, and support services and capacity-building opportunities are insufficient to empower meaningful participation. These findings underscore the need for Azerbaijani HEIs to strengthen feedback systems, institutionalize student roles, and cultivate a culture of shared responsibility.

Azerbaijani HEIs need to strengthen feedback systems with transparent follow-up, expand training and mentorship for student representatives, institutionalize student roles in curriculum and policy development, and cultivate a culture of shared responsibility (Mushtagov, A., 2021), (Isayeva, E., & Aslanova, N., 2021), (Mahmudov, R., 2022)). Strategic leadership and targeted reforms at ADA, Khazar, and ASPU illustrate that student involvement can evolve from procedural formality to substantive partnership.

Applying the established indicators for transitioning from a “student-as-client” to a “student-as-participant” model—representation and participation, feedback and evaluation, capacity building, and culture of partnership—provides further clarity regarding institutional positioning.

Most Azerbaijani universities are positioned within **the transition from the Consultative to the early Participatory stage**. Their practices reflect procedural engagement, constrained representation, incomplete feedback loops, and underdeveloped support structures. Against this sector-wide pattern, some universities, like ADA, show the status closer to Participatory stage.

To illustrate the spectrum of student engagement models and identify practical lessons for Azerbaijani universities, it is instructive to examine the experiences of ADA University, Tartu University, and Lund University, which exemplify consultative, participatory, and full partnership approaches, respectively.

ADA University illustrates the “students as participants” stage, where engagement is formalized but still developing toward partnership. Students serve on committees and program boards, providing input within defined procedures, though decision-making authority remains limited. Transparent feedback mechanisms like “You said – We did” reports strengthen trust, and basic training introduces students to QA processes. The culture is gradually shifting toward collaboration, showing that Azerbaijani universities can institutionalize student roles and build credible feedback systems.

The University of Tartu illustrates a post-Soviet institution advancing toward co-governance, where student representatives hold voting rights on academic councils and faculty boards. A robust digital feedback system ensures transparent evaluation, and handbooks, training, and mentorship programs build students’ capacity to participate effectively. Partnership spans curriculum co-design, strategic planning, and policy development. Supported by national regulations and proactive leadership, Tartu shows how voting rights, systematic training, and digital tools enable genuine co-governance.

Lund University represents a fully developed model of student partnership, supported by Swedish legislation that guarantees formal student influence. Students hold voting rights at all levels, shape strategic and academic decisions, and manage key feedback processes. Strong, professionalized student unions provide extensive training and support. Co-creation is routine, illustrating how legal frameworks and long-term institutional commitment sustain meaningful student partnerships.

Together, these three universities’ experiences illustrate a continuum of practices from consultative to participatory to partnership models and therefore define **a roadmap for Azerbaijani universities** to progressively advance toward achieving full partnership in student involvement in QA.

Step 1 – Establish Minimum National Standards (ADA model):

- Define the mandatory roles of students in QA committees and review panels.
- Introduce common evaluation frameworks across universities.

Step 2 – Build Institutional Capacity (Tartu model):

- Create student QA units or coordinators within universities.
- Provide annual training programmes for student representatives.
- Develop digital platforms for course feedback and monitoring.

Step 3 – Consolidate a Partnership Culture (Lund model):

- Integrate students as equal contributors in governance and accreditation processes.
- Introduce joint staff-student working groups on teaching quality, curriculum renewal, and policy development.
- Ensure secure budgeting for continuous, professional participation.

This phased approach supports progression from minimal involvement to fully shared responsibility in decision-making.

Effective student participation in quality assurance requires both **a clear legal framework and sufficient institutional resources**. In Azerbaijan, the Education Law and TKTA standards acknowledge the role of students in internal QA, and some universities like ADA, have already integrated these principles into local policies. However, the national system still lacks unified procedures that guarantee continuous representation and regular feedback, leaving progress largely dependent on institutional initiative.

Experiences from countries like Sweden and Estonia show how legal clarity transforms participation from a voluntary practice into a formal responsibility, ensuring structured representation, access to information, and a stable role in governance. These systems also emphasize the importance of resources: effective participation depends on funding for training, communication, and digital tools. By contrast, many Azerbaijani HEIs still rely on voluntary student activity and limited budgets, which restricts continuity and impact.

To develop a sustainable model, Azerbaijani HEIs need stronger legal alignment and predictable financial support. Clear regulations, targeted resources, and coordinated institutional practices would create a lasting framework in which students contribute consistently and meaningfully to quality assurance.

Recommendations for Azerbaijani universities:

- Strengthen national regulations - Establish formal requirements for student representation in QA committees, programme reviews, and governance bodies.
- Ensure stable funding - Allocate dedicated budgets for student training, QA workshops, communication platforms, and coordination units.
- Standardize university-level mechanisms - Introduce system-wide templates for course evaluations, student representation rules, and follow-up procedures.
- Professionalize student participation - Provide structured training, handover systems, and mentoring to ensure continuity and competence among student representatives.
- Enhance Transparency and Feedback Loops - Require universities to publish action plans and report on how student input informs improvements.

Conclusions. Azerbaijan has already taken important steps toward student participation in quality assurance, yet the system remains uneven and heavily dependent on institutional commitment. International experience shows that sustainable engagement emerges when legal clarity, financial stability, and structured practices reinforce one another. By adopting a coordinated roadmap, strengthening national standards, and investing in professional participation, Azerbaijani universities can move toward a mature model of partnership in which students contribute meaningfully and consistently to improving educational quality.

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TECHNOLOGY OF USING COMPUTER MODELS IN TEACHING PHYSICS COURSE IN SECONDARY SCHOOL

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ABSTRACT

One of the main directions of education in modern times is the application of information and communication technologies (ICT) in the teaching process. In teaching physics, these technologies, especially computer models, virtual laboratories, make the learning process more interesting, visual and interactive for both the teacher and the student.

The article examines the essence and methodological possibilities of using computer models in order to increase the efficiency of the teaching process in the physics course of secondary school. In the context of the rapid growth of information, the role of interactive models, virtual demonstrations and experiments (simulations) in the development of students' scientific and cognitive skills is emphasized. The visual presentation of physical phenomena and processes through computer models allows students to be involved in independent research activities.

Since natural sciences, especially physics, are based on experiments and observations, the use of computer models and virtual laboratories in teaching its subjects is of great importance.

In teaching the VII-IX grade physics course, the use of computer models is very effective in helping students to deeply understand the essence of physical phenomena, learn their practical application, and form independent research skills. Computer models play an important role in explaining physical phenomena and processes. In addition to replacing real demonstrations and experiments, they create the following opportunities for students:

- Conducting demonstrations and experiments safely and repeatedly;
- Observing the results of events and experiments by changing parameters;
- Analyzing the results in the form of graphs, tables, and animations.

The mentioned features make the teaching of physics interactive and interesting. In teaching physics, it can be difficult or expensive to demonstrate many events and processes in real conditions. In this regard, computer models are considered indispensable.

Keywords: physics, computer, model, demonstration, virtual experience, practical work, technology.

Introduction.

In modern education systems, the integration of information and communication technologies (ICT) has significantly enhanced the quality of the teaching and learning process. One of the primary tasks emerging from scientific and technological progress is the effective use of ICT in education.

Educational reforms implemented in the Republic of Azerbaijan continue systematically and strategically. These reforms create a foundation for enriching and modernizing the educational environment both in terms of content and material-technical infrastructure (Ministry of Education of the Republic of Azerbaijan [MoE], 2022).

In physics education, the use of modern ICT tools enables students to acquire knowledge and develop skills more effectively. Teaching physics today is not limited to knowledge transmission; it also aims to enhance students' cognitive activity and develop critical and creative thinking skills. Therefore, interactive teaching methods and digital technologies are particularly important.

Aim of the Study

Teacher professionalism and pedagogical competence play a decisive role in optimizing physics instruction. Teachers possessing both pedagogical and technological knowledge significantly improve instructional effectiveness and promote deeper student understanding.

The integration of modern technologies in physics teaching strengthens practical orientation and enhances student engagement (Hestenes, 2010). Thus, examining the theoretical and methodological foundations of technology integration in physics education is an important pedagogical direction.

Significance

Virtual laboratories, simulations, interactive whiteboards, and digital platforms enhance instructional content and facilitate understanding of abstract physical phenomena through visual models (Hestenes, 2010).

However, challenges remain, including:

- Insufficient technological infrastructure in some schools,
- Limited ICT competencies among teachers,
- Unequal distribution of digital educational resources.
- Addressing these issues requires continuous professional development programs, adaptation of digital tools to the national educational context, and development of localized digital resources.

Theoretical Framework

Computer models - provide a demonstration of physical processes or phenomena using computer programs. These models are used to conduct experimental demonstrations and experiments and to understand complex phenomena (Hestenes. 2010, Mammadov. 2021, Aghayev. 2015).

These models help students understand complex concepts and learn physical concepts and quantities safely instead of real experiments.

In the process of teaching physics in secondary school, computer models are used for the following purposes:

1. To clarify abstract concepts;

For example, concepts such as “Electric charge” and “Interaction of charges – Coulomb's law” can be explained with visual animations and graphics (Physics animation/Simulation. 2025).

<https://www.vascak.cz/physicsanimations.php?l=ru>).

2. To perform dangerous and costly demonstrations and experiments;

It is possible to safely simulate dangerous demonstrations such as electrical circuits, chemical and nuclear reactions, etc. on a computer.

3. To repeat experiments in laboratory work;

In virtual laboratory work, students can check individual parameters and compare results.

4. To simplify complex processes;

For example, topics such as “Laws of motion”, “Wave motion”, etc. can be presented in different scenarios (Physics animation/Simulation 2025. <https://www.vascak.cz/physicsanimations.php?l=ru>).

Literature Review

Literature has been published in various languages on the use of modern technologies in teaching physics. Since these literatures are written in different languages, students and pupils have difficulty using them. For example, the work “Teaching Informatics and the Application of ICT” (Huseynov, 2006) provides a general methodological approach to information technologies in teaching physics. The work “Innovative Technologies in Teaching Physics” (Aghayev, 2015) presents local examples of the application of computer simulations and virtual laboratories in physics lessons (Mammadov, 2021).

However, there are very few materials on the technology of using computer models in teaching physics in general secondary and high schools. For this purpose, I have published articles on the technology of using computer

models in teaching physics (Hajiyev, 2024; Hajiyev, Ismayilbeyli, 2024). This article is also devoted to the technology of using virtual demonstrations and experiments in teaching physics in secondary schools.

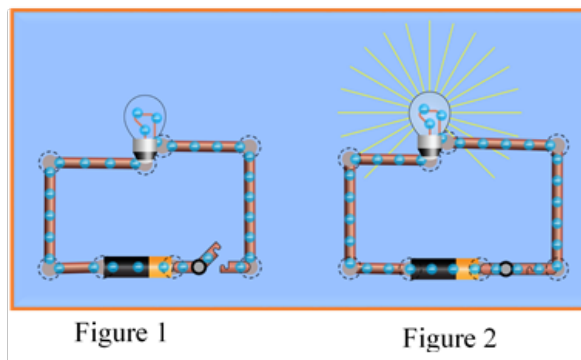
Methodology

In the 7th grade physics course of secondary school, students are introduced to electric circuits and circuit elements using the virtual laboratory simulation “Constant Current” in the teaching of the topics of the section “Electrical Circuits and Circuit Elements”.

Through this simulation, an electric circuit is assembled by connecting a current source, a lamp, and a switch through wires (PhET Interactive Simulations. 2025, <https://phet.colorado.edu/az/simulations/circuit-construction-kit-dc-virtual-lab>). Students visually observe how current is generated in the circuit and learn the conditions for the generation of current.

When the switch is open, no current flows through the circuit, and in this case the lamp does not light up. However, when the switch is closed, current flows through the circuit, and in this case the lamp lights up (Figure 1; 2). Based on this visual demonstration, students determine the following conclusions:

- In metal wires, electric current is created by free electrons moving in a regular manner.
- For current to exist in a circuit, there must be a current source and free charge carriers (in metals – electrons, in electrolytes – positive and negative ions, etc.).
- In metal wires, the direction of electric current is considered to be the opposite of the direction of movement of electrons.



In teaching the topic of “Ohm’s law”, a circuit consisting of a current source, a resistor (lamp), a switch, an ammeter and a voltmeter is assembled using the simulation of the same name (Physics animation/Simulation2025.https://www.vascak.cz/data/android/physicsatschool/templateimg.php?s=ele_ohm&l=ru).

Students observe that as the voltage at the ends of the circuit (lamp) increases, the value of the current also increases by the same amount. According to Ohm’s law, the ratio of the voltage at the ends of the circuit to the current intensity is constant (Figure 3). This ratio is called electrical resistance and its value does not change:

$$R = \frac{U}{I} = \text{const}$$

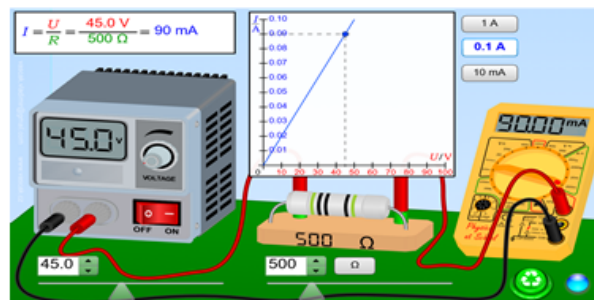
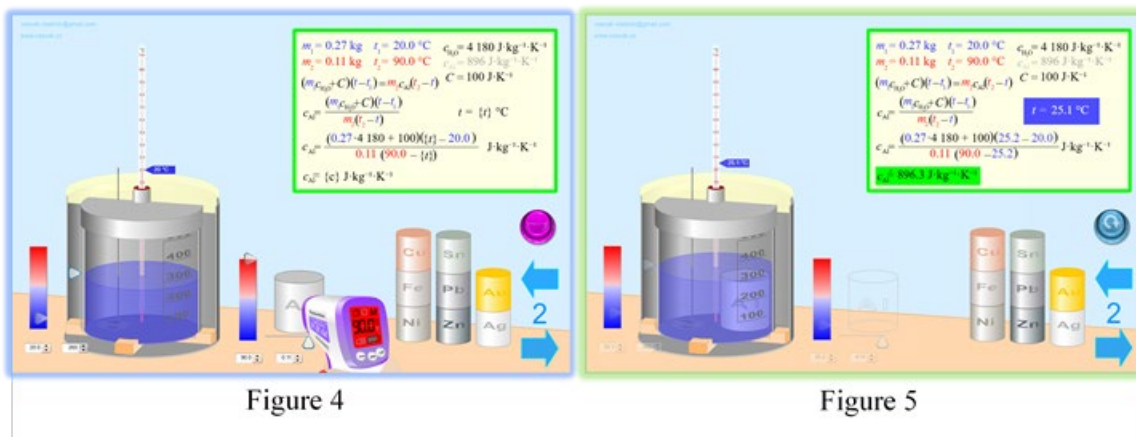


Figure 3

In the 8th grade physics course of secondary school, it is advisable to use a virtual simulation called “Calorimeter” to carry out the practical work “Determination of the specific heat capacity of a solid” (Figure 4;5). (Hajiyev, 2024. Physics animation/Simulation 2025, https://www.vascak.cz/data/android/physicsatschool/templateimg.php?s=mf_kalorimetr&l=ru).



Students safely determine the specific heat capacity of a cylindrical solid made of various materials (for example, aluminum) through this simulation.

$$c_{Al} = \frac{c_{H_2O}m_{H_2O}(t - t_1) + c_{cal}m_{cal}(t - t_1)}{m_{Al}(t_2 - t)}$$

$$c_{Al} = \frac{c_{H_2O}m_{H_2O}(t - t_1) + C_{cal}(t - t_1)}{m_{Al}(t_2 - t)}$$

Where c_{H_2O} —specific heat capacity of water, m_{H_2O} —mass of water in the calorimeter, C_{cal} —calorimeter heat capacity, t_1 —initial temperature of water and calorimeter, t_2 —initial temperature of cylinder, t —steady temperature of the system.

Using this virtual simulation, the specific heat capacities of other cylinders made of different materials can also be determined.

In the 9th grade physics course, the connection between electric and magnetic phenomena is explained in the process of teaching the topics of the chapter “Magnetic Field”. To demonstrate the appearance of a magnetic field, the teacher can use the animation “Magnet” (Figure 6), and to demonstrate the magnetic field of a rectilinear current, the animation “Magnetic Field of a Current-Carrying Wire” (Hajiyev, Ismayilbeyli, 2024; [https://www.vascak.cz/data/android/physicsatschool/templateimg.php?s=magnet &l=ru](https://www.vascak.cz/data/android/physicsatschool/templateimg.php?s=magnet&l=ru)).

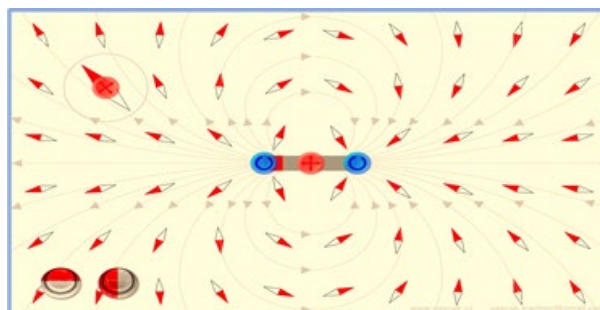


Figure 6

By demonstrating the virtual experiments “Magnetic Field of a Current-Carrying Wire”, the teacher draws the attention of students to the formation of a permanent magnetic field around a current-carrying wire and explains that the formation of this field is associated with the movement of electric charges. Students see that the magnetic field lines around a straight current are arranged in concentric circles (Figure7;8) (Physics animation/Simulation. 2025, [https://www.vascak.cz/data/android/physicsatschool/templateimg.php? s=mag_vodic&l=ru](https://www.vascak.cz/data/android/physicsatschool/templateimg.php?s=mag_vodic&l=ru)).

By demonstrating a virtual experiment, it is determined that there is a relationship between the direction of the current in the wire and the direction of the magnetic field lines. It is noted that when several magnetic needles are placed around a current-carrying wire, the north direction of the magnetic needles is directed in the direction of the magnetic induction vector. Students are explained how the direction of the lines of force changes based on the change in the direction of the magnetic needles by changing the direction of the current flowing through the conductor. That is, it is determined experimentally that the direction of the lines of force of the magnetic field is

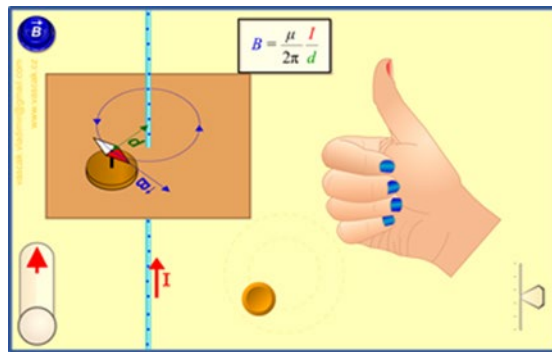


Figure 7

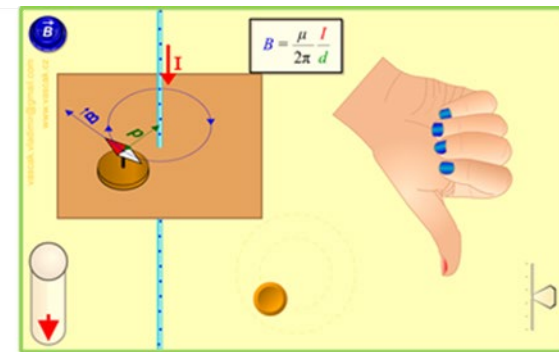


Figure 8

related to the direction of the current flowing through the conductor. Students are explained how to determine the direction of the lines of force using the right-hand rule and the right-hand rule.

In 1820, the French physicist A. Ampère, based on his experiments, determined that there are magnetic interactions between parallel current-carrying conductors. The interaction between parallel current-carrying conductors can be demonstrated using an animation called “Ampere’s law” (Physics animation/ Simulation 2025. <https://www.vascak.cz/data/android/physicsatschool/templateimg.php?s=ele amper &l=ru>).

Based on the demonstration, it is determined that when the currents flowing through parallel conductors are in the same direction, they attract each other, since opposite poles of magnetic fields are created between them (Figure 9).

When the currents flowing through parallel conductors are in opposite directions, they repel each other because the same poles of the magnetic field are created between them (Figure 10).

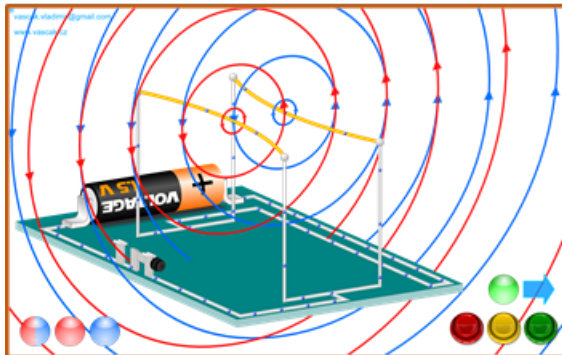


Figure 9

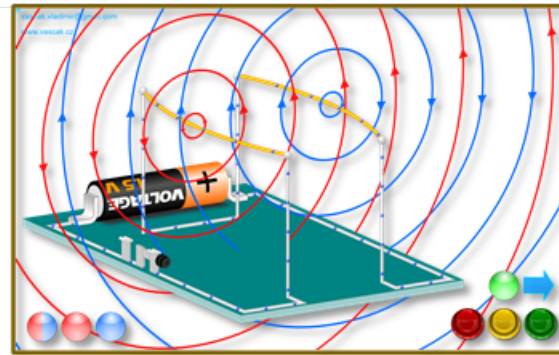


Figure 10

The value of the magnetic interaction force between parallel conductors with current depends on the current intensity in the conductors, the length of the conductors, and the distance between them.

$$F = \frac{\mu}{2\pi} \frac{I_1 \cdot I_2}{d} \cdot \Delta l$$

Here F —modulus of magnetic interaction force between parallel conductors with current, μ —magnetic permeability of the substance, I_1 and I_2 —current intensity in parallel conductors, Δl —length of conductors, d —distance between them. The unit of current intensity in the BS—ampere (A) was determined based on the magnetic interaction force between parallel conductors with current.

Findings and Discussion

After the students master the computer models, they can be offered to perform some experiments at home.

The use of computer models in teaching high school physics provides teachers and students with the following opportunities.

- Advantages of computer models:
- Helps students understand difficult concepts more easily;
- Visual presentation of results facilitates learning.
- Allows experimentation with variable parameters;
- Permits unlimited repetition of experiments.

Although practical work using computer models cannot replace real laboratory work, it develops the skills of students. Therefore, it is appropriate to use virtual laboratory experiments to carry out practical work in teaching physics in secondary schools.

The use of virtual demonstrations and experiments in the process of teaching physics in secondary schools provides teachers and students with the following opportunities:

For teachers:

- more time for individual support to weak students;
- rapid diagnostics of students' practical work results.

For students:

- ability to perform independent practical work using computer models;
- analyzing and interpreting physical phenomena and laws through individual practice;
- opportunity to conduct practical work that cannot be performed during lessons;
- opportunity to carry out virtual experiments outside class hours;
- skills to use a computer as a learning tool;
- ability to work with electronic resources.

Conclusion:

The role of technology in the modern education system is increasing. Especially in the teaching of physics, computer models and virtual laboratories serve to better understand physical phenomena, develop experimental skills and increase activity in the teaching process. Computer models open up new opportunities for both teachers and students and ensure safe, cost-effective and efficient implementation of experiments.

Virtual laboratories and simulations are powerful tools for understanding physical phenomena and complex laws.

The application of computer models in teaching physics is one of the most effective directions of modern pedagogical technology.

Based on the findings of the study, the integration of computer models into physics teaching offers substantial pedagogical benefits. First and foremost, computer-based simulations contribute to the development of students' scientific worldview by allowing them to observe, analyze, and interpret physical phenomena in a structured and interactive environment. Through repeated experimentation and manipulation of variables, students gradually strengthen their experimental and research skills, gaining experience that mirrors authentic scientific inquiry.

Moreover, the visual representation of abstract physical concepts significantly enhances conceptual understanding and increases students' motivation to learn. When learners are able to see dynamic models of otherwise invisible processes, misconceptions become easier to identify and correct. In addition, computer models provide a safe environment for conducting experiments that would otherwise be dangerous, costly, or technically complex in real laboratory settings. This combination of safety, flexibility, and interactivity ultimately improves the overall quality of learning and promotes deeper cognitive engagement.

To maximize these benefits, systematic steps should be taken at the institutional level. Professional development programs should be organized to support physics teachers in developing the competencies necessary to design and effectively implement computer-based models in their lessons. At the same time, secondary school physics classrooms need to be equipped with modern technological infrastructure to ensure equal access to digital learning tools. Furthermore, curriculum-aligned lesson plans that integrate virtual laboratories should be developed to provide methodological guidance for teachers. Finally, digital teaching resources - such as Physics Animations, PhET

simulations, Yenka, and Algodoo – should be incorporated into the curriculum in a structured and sustainable manner to ensure their consistent pedagogical application.

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THE EFFECT OF BURNOUT LEVELS ON JOB SATISFACTION: TRNC EXAMPLE

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ABSTRACT

The main purpose of this study is to examine the effect of burnout levels on job satisfaction. The population of the study consists of approximately 5,000 people working in the private sector in five different districts of TRNC. The sample was formed with the participation of 396 volunteer employees selected using purposive sampling method. The study data were collected using the job satisfaction scale and Maslach Burnout Scale. According to the results obtained from the analysis with SPSS 28.00 program, emotional exhaustion was found to be at a moderate level, while depersonalization and personal accomplishment subscales were found to be at a moderate and high level, respectively. The level of job satisfaction was generally at a medium level. In gender analyses, it was determined that female participants had higher levels of emotional exhaustion, depersonalization and general burnout, while male participants had higher levels of personal accomplishment. No significant difference was found in the analyzes on the level of education variable. According to the professional seniority variable, it was determined that those with more than 30 years of professional seniority had higher levels of job satisfaction. While the correlation between job satisfaction and burnout is low and insignificant, regression analysis shows that emotional exhaustion has a negative effect on job satisfaction. These results emphasize the complexity between emotional exhaustion levels and job satisfaction and the role of variables such as gender, educational level, and professional seniority in this relationship.

Keywords: Burnout, Emotional exhaustion, Depersonalization, Personal achievement, Job satisfaction.

1. INTRODUCTION

1.1. Problem Status

Burnout refers to a state of intense emotional, mental, and physical fatigue experienced by an individual, usually as a result of a combination of prolonged stress, emotional exhaustion, and excessive work-related demands. Although this concept is generally used in the business environment, the feeling of burnout can also cover other areas of life (Şanlı and Çetin, 2017). Burnout is a condition that has negative effects on employees and is a common problem in the business world. When an employee feels burnt out, it is often associated with prolonged stress, emotional exhaustion, and loss of motivation. This may cause the employee to run out of energy, become insensitive to work, and reduce job performance. Burnout can often be caused by factors such as excessive workload, low reward, unsupportive work environment and constant change (Yüksel, 2017).

Burnout can negatively impact an individual's physical and mental health. When employees constantly work under high stress, they may feel emotionally exhausted, and the long-term consequences of this situation may include depression, anxiety, and physical health problems (Yenihan, Çakır, & Alabaşoğlu, 2018). Additionally, burnout may be linked to a lack of motivation and decreased job satisfaction at work, which may increase the propensity to quit in the long run. Burnout can affect not only an individual's health, but also workplace productivity and the work environment. Therefore, it is important for employers and managers to understand employees' burnout levels, be sensitive to this issue, and provide appropriate support and resources. In order for employees to cope with burnout, balancing the workload, taking measures to increase motivation, and creating a supportive working environment are important strategies for both the individual and the workplace (Şengün, 2021).

Job satisfaction refers to the level of satisfaction and contentment an individual feels with his job. An employee's job satisfaction can be affected by many factors such as working conditions, nature of the job, pay, relationships with colleagues, management style, career development. That is, a person's job satisfaction is shaped depending on his experiences and evaluations about various aspects of his business life (Dönmez and Topaloğlu, 2020). Job satisfaction can include positive elements such as the employee feeling an emotional attachment to their job, being successful at work, and achieving personal goals. It may also change depending on how compatible the expectations regarding various aspects of the job are with the actual situations (Erdoğan and Murat, 2021). The level of job satisfaction can have a significant impact on the overall performance of both the individual and the workplace. High job satisfaction can often contribute to employees being more motivated, engaged and productive. On the other hand, low job satisfaction can negatively affect employees' performance, increase their tendency to

leave the job, and create a negative atmosphere in the workplace. Understanding job satisfaction is important for managers and workplaces in order to increase employee satisfaction and optimize productivity in workplaces (Sımlık, 2022). Therefore, various research, surveys and feedback mechanisms are used to evaluate the level of job satisfaction and improve it if necessary. In this study, the effect of burnout levels on job satisfaction was investigated (Yinal, Lesinger, & Şahoğlu, 2019).

1.2. Purpose and Importance of the Research

The depletion of individuals' emotional and mental energy in working life has become an issue that attracts more and more attention and is emphasized today. Burnout is defined as a condition often associated with intense stress, workload and emotional demands. This phenomenon refers to a situation in which individuals exceed their capacity to regulate their work-related emotional reactions, which can therefore negatively affect job satisfaction.

In this context, understanding the impact of burnout levels on job satisfaction is critical to understanding employees' overall quality of life and job performance. Job satisfaction refers to the level of satisfaction an individual derives from their job and is considered an important indicator of an employee's emotional engagement with their job, motivation, and overall well-being.

Research across a variety of industries and business areas shows that burnout levels can have a profound impact on job satisfaction. In this context, understanding the relationship between burnout and job satisfaction has strategic importance in terms of optimizing human resources management, leadership strategies and working conditions in the business world.

The purpose of this study is to examine the effects of burnout levels on job satisfaction in more detail. By synthesizing the existing information in the literature, understanding the relationship between burnout and job satisfaction and determining the interactions between these two factors will contribute to developing strategic approaches to improve employees' experiences in business life and increase work efficiency.

1.3. Hypotheses

The hypotheses of this research are as follows:

1. H₁: There is a significant difference between the Maslach burnout scale and job satisfaction scale and the gender variable.
H₀: There is no significant difference between the Maslach burnout scale and job satisfaction scale and the gender variable.
2. H₁: There is a significant difference between the Maslach burnout scale and job satisfaction scale and the educational background variable.
H₀: There is no significant difference between the Maslach burnout scale and job satisfaction scale and the educational background variable.
3. H₁: There is a significant difference between the Maslach burnout scale and job satisfaction scale and the professional seniority variable.
H₀: There is no significant difference between the Maslach burnout scale and job satisfaction scale and the professional seniority variable.
4. H₁: There is a significant difference between the Maslach burnout scale and the job satisfaction scale.
H₀: There is no significant difference between the Maslach burnout scale and the job satisfaction scale.
5. H₁: The level of burnout has an effect on job satisfaction.
H₀: Burnout level has no effect on job satisfaction.

1.4. Assumptions

research participants gave their answers to the scale questions sincerely.

1.5. Limitations

Research;

- With research participants,
- With the resources used,
- With the scale questions used in the research,
- It is limited to employees of companies located in TRNC.

1.6. Definitions

Burnout: It refers to a state of intense emotional, mental and physical fatigue experienced by an individual, usually as a result of a combination of long-term stress, emotional fatigue and excessive work-related demands (Çetin, Şeşen and Basım, 2013).

Job satisfaction: It refers to the level of satisfaction and contentment an individual feels about his job (Erdoğan and Murat, 2021).

2. THEORETICAL FRAMEWORK

2.1. Burnout

Burnout refers to a condition that usually occurs due to reasons such as long-term stress, excessive workload, emotional pressure, constant fatigue and feelings of personal failure. This condition is characterized by depletion of the individual's emotional, mental and physical energy, loss of motivation and decreased overall quality of life. Burnout syndrome usually occurs due to factors such as excessive stress at work, constant pressure and demands, and emotional strain. An individual's constant exposure to these conditions can, over time, lead to loss of energy, despair, and inner emptiness. Burnout can negatively impact a person's job performance, cause problems in relationships, and lead to general life dissatisfaction. Burnout is generally examined in three main dimensions (Yüksel, 2017):

Emotional Exhaustion

Emotional burnout is an important psychological concept that refers to the individual's exhaustion of emotional energy and the emotional burden he feels reaches an unbearable point. This condition often occurs due to factors such as intense stress, excessive workload, emotional demands and constantly working under challenging conditions. Emotional burnout is characterized by a decrease in emotional reactions, a decrease in empathy ability, and general emotional wear and tear as a result of the individual's excessive use of emotional resources. Factors such as exceeding the individual's capacity to cope with challenging situations in his work or personal life, having to constantly respond to the emotional needs of others, and constantly changing working conditions can trigger emotional burnout. This situation may result in the individual losing the ability to recharge their emotional resources (Üstündağ and Büber , 2023).

Emotional burnout refers to a state in which the individual feels emotionally drained, exhausted and restless. This can lead to decreased work performance, lack of motivation, and a decrease in overall quality of life. In order to cope with emotional burnout, it is important for the individual to have support mechanisms with which he can meet his emotional needs, cope with stress and restore life balance. Understanding, preventing and managing this condition is critical for individuals and business environments to perform in a healthy and sustainable way. Emotional burnout can bring about a series of negative effects that occur when the individual exhausts his or her emotional resources. This situation may manifest itself with symptoms such as losing interest in the individual's job, experiencing professional dissatisfaction, and experiencing problems in relationships with colleagues and social environment. Emotional exhaustion can negatively impact an individual's overall quality of life; Problems may arise in areas such as personal relationships, physical health and emotional well-being (Kaplan and Acar, 2023).

Depersonalization

Depersonalization is a psychological concept that refers to the individual's loss of emotional attachment and empathy ability in work or life. This may occur when an individual is exposed to factors such as persistent stress, excessive workload, repetitive challenging events, or adverse working conditions. Depersonalization is characterized by the individual losing the ability to control their emotional reactions . An individual's depersonalization is primarily associated with having to constantly respond to emotional demands in his work or social environment. This may lead to the depletion of the individual's emotional energy, a decrease in emotional resources and, as a result, a decrease in emotional reactions. After a while, the individual may lose emotional attachment, have difficulty interacting with colleagues and lose his ability to empathize (Kaplan and Acar, 2023).

Lack of Personal Achievement

Lack of personal accomplishment is a condition that refers to an individual's feeling of failure in achieving goals in work or life. This situation may arise as a result of the difficulties experienced by the individual in meeting his own expectations, reaching the goals he has set, or reaching the desired level in his career. Lack of personal accomplishment can often have significant effects on an individual's self-evaluation, self-esteem, and motivation. When an individual experiences a lack of personal accomplishment, they often feel inadequate and may have

difficulty coping with the feeling of failure. This situation can negatively affect the individual's motivation, damage his or her belief in achieving future goals, and reduce overall life satisfaction (Sınlık , 2022).

2.2. Job satisfaction

Job satisfaction is a measure of the satisfaction employees feel with their jobs and work environments. Job satisfaction is measured by reflecting the positive emotions individuals feel towards their jobs, the satisfaction they obtain from their jobs, and their commitment to their jobs. Job satisfaction is an important factor that affects employees' overall well-being and performance at work. Job satisfaction can be affected by many factors. These factors include working conditions, pay and benefits, nature of the job, relationships with colleagues, leadership style and career development opportunities. Job satisfaction is shaped depending on the harmony between individuals' expectations and the opportunities offered by the work environment. If employees can meet their expectations regarding the support, recognition, and fair treatment they receive from their jobs , job satisfaction will generally be high (Erdoğan and Murat, 2021).

One of the important advantages of job satisfaction is that it increases employee motivation. Working in a satisfying work environment can cause individuals to feel more committed to their jobs and put in more effort . Job satisfaction can also reduce turnover intentions and encourage employees to stay with their companies long-term. Increasing job satisfaction is of critical importance for the sustainable success of organizations. Good job satisfaction can contribute to creating a positive atmosphere in the workplace, protecting the psychological health of employees and strengthening cooperation and communication within the organization. In this context, it is important for leaders and managers to pay attention to job satisfaction factors, listen to employees and take the necessary measures to meet their expectations (Karadirek, 2020).

Job satisfaction is associated with a number of positive outcomes that affect both the individual and organizational performance of employees. Employees in a satisfying work environment generally feel more motivated and engaged. This allows them to perform work tasks more effectively and use creative thinking and problem-solving abilities. Job satisfaction may also reduce turnover intentions. Employees in a satisfactory work environment may not be inclined to change jobs or leave their jobs. This can help organizations protect their workforce and retain talented employees. Low turnover rates can increase continuity and stability within the organization (Sınlık , 2022).

3. METHOD

3.1. Research Method

This research is a quantitative study. Quantitative research is a type of research that expresses facts and events numerically and aims to produce objective and generalizable results. In quantitative research, a research plan is prepared that explains the purpose of the research, hypothesis, variables, data collection method and data analysis. Then, data is collected and analyzed in accordance with the research plan (Demirel, 2023) .

3.2. Population and Sample

The population of the study consists of approximately 15,302 people working in the private sector in Nicosia, Kyrenia, Famagusta, Iskele and Güzelyurt districts of TRNC (TRNC Minister of Labor, 2021). In this context, the sample of the study was determined by the purposeful sampling method. Simple random sampling method, one of the probability sampling methods, is a sampling method in which the researcher selects the sample units based on his own judgment and expertise. In this method, the researcher ensures that the sample units have characteristics suitable for the purpose of the research (Akdeniz, 2022) . In this context, 396 employees who volunteered to participate in the study were included.

3.3. Data Collection Tools

Study data were collected using the job satisfaction scale and Maslach Burnout Scale. Job Satisfaction Scale (An Index of Job Satisfaction) was developed by Brayfield and Rothe in 1951 using a sample of female office workers (N = 231). The original form of the scale contains 18 items. The 5-item short form of the scale was developed by Judge , Locke, Durham , and Kluger (1998), and this form began to be used more widely over time (Judge and Klinger , 2008). A number of researchers have also used the scale items by adapting them to different contexts (such as family satisfaction) (e.g. Aryee , Fields , & Luk , 1999).

Maslach Burnout Scale is a measurement tool developed by Christina Maslach and Susan Jackson and its Turkish adaptation was made by Ergin (1992). This scale is used to evaluate the burnout level of employees. Cronbach in the Turkish adaptation Alpha coefficients are 0.83 for emotional exhaustion, 0.72 for depersonalization, and 0.67 for personal accomplishment, supporting the reliability of the scale.

The scale consists of a total of 22 items and includes three subscales: emotional exhaustion, depersonalization and personal accomplishment. Each dimension consists of specific items. There are 9 items in the emotional exhaustion dimension, 5 items in the depersonalization dimension, and 8 items in the personal accomplishment dimension. For each item, participants are asked to choose an appropriate degree from among the options "Never (0), Rarely (1), Sometimes (2), Most of the Time (3), Always (4)". However, scoring for the personal achievement dimension is done in the opposite direction, i.e. higher scores are given for lower personal achievement. Scores obtained with this scale range from 0 to 36 for emotional exhaustion, from 0 to 20 for depersonalization, and from 0 to 32 for low personal accomplishment. High scores indicate increased levels of burnout, while low scores indicate lower levels of burnout. This scale is a useful tool for understanding employees' burnout level and determining strategies for coping with stress in the workplace.

Cronbach's Alpha value obtained for the Maslach Burnout Scale is 0.875. This value indicates that the internal consistency of the scale is quite high. A high Cronbach's Alpha indicates that the items of the scale are compatible with each other and that it is a reliable measurement tool. Cronbach's Alpha value obtained for the Job Satisfaction Scale is 0.856. This value also indicates a high internal consistency. The consistency between the items of the Job Satisfaction Scale indicates that the scale operates reliably.

3. 4. Analysis of Data

The data collected in the study was analyzed using SPSS 28.00 program. First, normal distribution test was performed. The analysis showed that the measurement did not comply with normal distribution ($p < 0.01$). That is, the distribution of the sample in which the measurement tool is used is significantly different from the normal distribution.

Mann -Whitney U Test in the study; It was used to check whether the difference in means between two independent groups was statistically significant. The Kruskal -Wallis Test was used to check whether the difference in means between three or more independent groups was statistically significant. Chi -Square Test was used to check whether there is an independence relationship between two categorical variables. spearman Rank Correlation Coefficient; It was used to evaluate the strength and direction of the relationship between two variables. Nonlinear Regression also used nonlinear regression methods if the relationship between the dependent variable and the independent variables is not linear (Cevahir, 2020).

4. FINDINGS

4.1. Demographic features

Demographic variables of the participants are given in Table 1:

Table 1. Demographic Information

		N	%
Gender	Woman	137	40.4
	Male	202	59.6
marital status	Married	198	58.4
	Single	141	41.6
Age	22-30 years old	98	28.9
	31-40 years old	146	43.1
	41-50 years old	80	23.6
	51 and over	15	4.4
Education status	Middle/High School	90	26.5
	Associate Degree	94	27.7
	Licence	104	30.7
	Master's/Ph.D.	51	15.0
Working time in the institution	less than 1 year	95	28.0
	1-5 years	73	21.5
	6-10 years	101	29.8
	11-15 years	21	6.2

	16 years and above	49	14.5
professional seniority	1-10 years	135	39.8
	11-20 years	57	16.8
	21-30 years	120	35.4
	more than 30 years	27	8.0
	Total	339	100.0

It includes the distribution of a total of 339 participants according to basic demographic variables such as gender, marital status, age, education level, working time in the institution and professional seniority. When we look at the gender distribution, 40.4% of the participants were female and 59.6% were male. When examined in terms of marital status, 58.4% of the participants are married and 41.6% are single. The distribution of participants by age groups is as follows: 28.9% are between the ages of 22-30, 43.1% are between the ages of 31-40, 23.6% are between the ages of 41-50 and 4.4% are between the ages of 51 and over age group. When evaluated in terms of education level, 26.5% of the participants are secondary school/high school graduates, 27.7% are associate degree graduates, 30.7% are undergraduate graduates and 15.0% are master's/doctoral graduates. Based on the duration of employment in the institution, 28.0% of the participants were less than 1 year, 21.5% were 1-5 years, 29.8% were 6-10 years, 6.2% were 11-15 years and % 14.5 of them have been working for 16 years or more. In terms of professional seniority, 39.8% have 1-10 years of professional experience, 16.8% have 11-20 years, 35.4% have 21-30 years and 8.0% have more than 30 years of professional experience. .

4.2. Maslach Burnout Scale and Job Satisfaction Scale Values

Table 2. Mean and Standard Deviation Values of the Scales

	Min.	Max .	mean	ss
Maslach Burnout Scale	38.00	104.00	61.1268	13.02360
emotional exhaustion	12.00	44.00	22.7345	6.51037
Depersonalization	7.00	24.00	13.6401	3.45131
personal success	16.00	36.00	24.7522	4.33070
Job Satisfaction Scale	10.00	20.00	15.5811	1.55236

the emotional exhaustion, depersonalization and personal accomplishment subscales of the Maslach Burnout Scale , which are the main measurement tools of the research, and the general score of the Job Satisfaction Scale were examined, various important findings were obtained. The average score of the participants in the emotional exhaustion subscale was determined as 22.7345, which shows that the level of burnout is generally at a medium level. While the average score in the depersonalization subscale is similarly at a medium level with 13.6401, the average score in the personal accomplishment subscale is 24.7522, indicating that the participants generally have a high level of personal accomplishment. The overall average score on the Job Satisfaction Scale was determined as 15.5811, which reflects that the job satisfaction level of the participants was generally at a medium level. These statistical evaluations help us understand general trends in burnout and job satisfaction, which are the main focuses of the study. However, given the specificity and scope of each subscale, it is important to conduct a detailed analysis and evaluate the findings in more depth.

4.3. Difference Analyzes Between Demographic Variables and Scales

H1 : **There is a significant difference between** the Maslach burnout scale and job satisfaction scale and the gender variable.

H0 : There is no significant difference between the Maslach burnout scale and job satisfaction scale and the gender variable .

Table3.Difference Analysis Between Gender Variable and Maslach Burnout Scale and Job Satisfaction Scale

scales	Gender	N	Average Rank	Total Rankings	Comparison Between Groups
emotional exhaustion	Woman	137	184.00	25207.50	Z=1.22; p = 0.030
	Male	202	160.51	32422.50	

Depersonalization	Woman	137	185.73	25445.50	Z=1.089; p = 0.014
	Male	202	159.33	32184.50	
personal success	Woman	137	186.77	25587.00	Z=1.460, p= 0.009
	Male	202	158.63	32043.00	
Burnout (General)	Woman	137	187.58	25699.00	Z=1.359; p = 0.006
	Male	202	158.07	31931.00	
Job satisfaction	Woman	137	160.38	21972.50	Z=0.745; p=0.122
	Male	202	176.52	35657.50	

p <0.05

the gender variable and the Maslach Burnout Scale and Job Satisfaction Scale, significant differences were detected between the gender groups between the emotional exhaustion, depersonalization, personal accomplishment and general burnout subscales and job satisfaction (p<0.05). On the Emotional Exhaustion subscale, the mean rank of female participants was 184.00, while the mean rank of male participants was 160.51. This difference is significant with statistical values of Z=1.22 and p=0.030. Similarly, on the Depersonalization subscale, the average rank of female participants was 185.73 and that of male participants was 159.33. Statistical values of Z=1.089 and p=0.014 show that this difference is significant. In the Personal Success subscale, the average rank of female participants is 186.77, while the average rank of male participants is 158.63. This difference is significant with statistical values of Z=1.460 and p=0.009. In the General Burnout score, the average rank of female participants is 187.58 and that of male participants is 158.07. This difference is significant with statistical values of Z=1.359 and p=0.006. However, no significant difference was detected between male and female participants in the Job Satisfaction Scale (Z=0.745; p=0.122, p>0.05). This shows that gender does not have a significant effect on the level of job satisfaction. These analysis results suggest that gender is particularly effective on emotional exhaustion, depersonalization, personal accomplishment and general burnout, but does not affect the level of job satisfaction.

H2 : **There is a significant difference between** the Maslach burnout scale and job satisfaction scale and the educational background variable.

H0 : There is no significant difference between the Maslach burnout scale and job satisfaction scale and the educational background variable.

Table4. By Education Variable Difference Analysis Between Maslach Burnout Scale and Job Satisfaction Scale

scales	Education status	N	Average Rank	Kruskal - Wallis H	Comparison Between Groups
Emotional exhaustion	Middle/High School	90	151.98	4,297	$\chi^2 = 4.855$; p=0.183
	Associate Degree	94	179.49		
	Licence	104	174.73		
	Master's/Ph.D.	51	174.67		
Depersonalization	Middle/High School	90	148.89	6,023	$\chi^2 = 7.313$; p = 0.043
	Associate Degree	94	181.65		
	Licence	104	176.15		
	Master's/Ph.D.	51	173.24		
Personal success	Middle/High School	90	161.44	1,095	$\chi^2 = .700$; p=0.873
	Associate Degree	94	174.33		
	Licence	104	174.34		

	Master's/Ph.D.	51	168.26		
Burnout (General)	Middle/High School	90	153.13	3,713	$\chi^2 = 5.741; p=0.125$
	Associate Degree	94	177.26		
	Licence	104	176.74		
	Master's/Ph.D.	51	172.66		
Job satisfaction	Middle/High School	90	168.56	0.552	$\chi^2 = .789; p=0.852$
	Associate Degree	94	170.43		
	Licence	104	166.74		
	Master's/Ph.D.	51	178.40		

p < 0.05

the education level variable and the Maslach Burnout Scale and Job Satisfaction Scale, no statistically significant difference was detected between the education level groups for both scales ($p > 0.05$). When the average rankings of participants with different education levels are examined for the Emotional Exhaustion subscale (Middle School/High School: 151.98, Associate Degree: 179.49, Bachelor's Degree: 174.73, Master's/Ph.D.: 174.67), Kruskal -Wallis H According to the test result ($H=4.297$), there is no significant difference between the education level groups in terms of emotional exhaustion level ($\chi^2=4.855; p=0.183, p > 0.05$). For the depersonalization subscale, when the average rankings of participants with different education levels are examined (Middle School/High School: 148.89, Associate Degree: 181.65, Bachelor's Degree: 176.15, Master's/Ph.D.: 173.24), Kruskal -Wallis H According to the test results ($H=6.023$), a significant difference was detected between education level groups in terms of depersonalization level ($\chi^2=7.313; p=0.043, p < 0.05$). A similar situation exists for the Personal Achievement subscale. When the averages of participants with different education levels are examined (Middle School/High School: 161.44, Associate Degree: 174.33, Bachelor's Degree: 174.34, Master's/PhD: 168.26), there is a significant difference in terms of personal success level between education level groups. There is no ($H=1.095; p=0.873, p > 0.05$). Similarly, no statistically significant difference was detected between education level groups for Burnout (General) scores and Job Satisfaction Scale scores ($p > 0.05$). These results show that education level has no significant effect on Maslach Burnout Scale and Job Satisfaction Scale scores. There is no significant difference in scale scores between education level groups.

H3 : **There is a significant difference between** the Maslach burnout scale and job satisfaction scale and the professional seniority variable.

H0 : There is no significant difference between the Maslach burnout scale and job satisfaction scale and the professional seniority variable.

Table 5. Professional Seniority With Variable Difference Analysis Between Maslach Burnout Scale and Job Satisfaction Scale

scales	professional seniority	N	Average Rank	Kruskal -Wallis H	Comparison Between Groups
emotional exhaustion	1-10 years	135	158.47	6,162	$\chi^2 = 3.812; p=0.282$
	11-20 years	57	169.9		
	21-30 years	120	186.74		
	more than 30 years	27	153.44		
Depersonalization	1-10 years	135	160.65	5,843	$\chi^2 = 8.230; p = 0.042$ 21-30 years > 11-20 years
	11-20 years	57	155.95		

	21-30 years	120	186.38		
	more than 30 years	27	173.61		
	1-10 years	135	162.74		
	11-20 years	57	168.34		
personal success	21-30 years	120	177.18	1,584	$\chi^2=2.128$; $p=0.546$
	more than 30 years	27	177.87		
	1-10 years	135	159.31		
	11-20 years	57	163.77		
Burnout (General)	21-30 years	120	185.94	5,067	$\chi^2=2.734$; $p=0.434$
	more than 30 years	27	165.76		
	1-10 years	135	176.07		
	11-20 years	57	160.35		
Job satisfaction	21-30 years	120	163.6	2,744	$\chi^2=9.015$; $p = \mathbf{0.044}$ 30 years > others
	more than 30 years	27	188.46		

$p < 0.05$

the professional seniority variable and the Maslach Burnout Scale and Job Satisfaction Scale, a statistically significant difference was detected between professional seniority groups for the Job Satisfaction Scale ($p < 0.05$). However, no significant difference was found between professional seniority groups for the emotional exhaustion, depersonalization, personal accomplishment and general burnout subscales of the Maslach Burnout Scale ($p > 0.05$). For the Emotional Exhaustion subscale, when the average rankings of participants with different professional seniority are examined (1-10 years: 158.47, 11-20 years: 169.90, 21-30 years: 186.74, more than 30 years: 153.44) According to the results of the Kruskal -Wallis H test ($H=6.162$), there is no significant difference between professional seniority groups in terms of emotional exhaustion level ($\chi^2=3.812$; $p=0.282$, $p > 0.05$).

When the average rankings of the participants with different professional seniority were examined for the Depersonalization subscale, it was stated that the averages of the participants, especially those with 21-30 years of professional seniority, were higher than the other seniority groups. This shows that, according to the Kruskal -Wallis H test result ($H=5.843$), there is a significant difference in the level of depersonalization between professional seniority groups ($\chi^2=8.230$; $p=0.042$, $p < 0.05$). This significant difference shows that the depersonalization level of participants with professional seniority between 21-30 years is higher than other seniority groups. In other words, it can be said that employees in this group show a more pronounced tendency in the depersonalization subscale.

A similar situation exists for the Personal Achievement subscale. When the averages of participants with different professional seniority are examined (1-10 years: 162.74, 11-20 years: 168.34, 21-30 years: 177.18, more than 30 years: 177.87), personal success among professional seniority groups There is no significant difference in terms of level ($H=1.584$; $p=0.546$, $p > 0.05$). Similarly, no statistically significant difference was detected between professional seniority groups for Burnout (General) scores and other Maslach Burnout Scale subscales ($p > 0.05$).

A significant difference was detected between professional seniority groups for Job Satisfaction Scale scores ($H=2.744$; $p=0.044$, $p < 0.05$). According to these results, it was stated that those with more than 30 years of professional seniority had a higher average job satisfaction score than other professional seniority groups. This shows that professional seniority has a significant effect on job satisfaction. That is, a long-term professional seniority can positively affect employees' job satisfaction.

4.4. The Relationship Between Burnout Levels and Job Satisfaction

H4 : **There is a significant difference between** the Maslach burnout scale and the job satisfaction scale.

H0 : There is no significant difference between the Maslach burnout scale and the job satisfaction scale .

Table 6. Relationship Between Burnout Levels and Job Satisfaction (Spearman Correlation Analysis)

		Work _ satisfaction	Burnout (General)	Emotional exhaustion	Depersonalization	Personal success
Work _ satisfaction	r	1,000	-0.023	-0.060	0.009	0.020
	p.		0.677	0.272	0.866	0.715
Burnout (General)	r	-0.023	1,000	.942 **	.810 **	.893 **
	p.	0.677		0.000	0.000	0.000
Emotional exhaustion	r	-0.060	.942 **	1,000	.660 **	.791 **
	p.	0.272	0.000		0.000	0.000
Depersonalization	r	0.009	.810 **	.660 **	1,000	.600 **
	p.	0.866	0.000	0.000		0.000
Personal success	r	0.020	.893 **	.791 **	.600 **	1,000
	p.	0.715	0.000	0.000	0.000	

Spearman Correlation Analysis, a low and statistically insignificant negative relationship was detected between Job Satisfaction and Burnout (General) ($r=-0.023$, $p=0.677$). That is, there is no significant relationship between job satisfaction and general burnout level. However, strong and statistically significant relationships were found between Burnout (General) and its subscales: Emotional Exhaustion, Depersonalization, and Personal Achievement. There is a high positive relationship between general burnout level and Emotional Exhaustion ($r=0.942$, $p<0.001$). Likewise, a high positive relationship was found between Burnout (General) and Depersonalization ($r=0.810$, $p<0.001$). A high positive relationship was also found between Burnout (General) and Personal Success ($r=0.893$, $p<0.001$). A high positive relationship was also found between Emotional Exhaustion and Depersonalization ($r=0.660$, $p<0.001$). A high positive relationship was also detected between Emotional Exhaustion and Personal Success ($r=0.791$, $p<0.001$). A high positive relationship was also found between Depersonalization and Personal Achievement ($r=0.600$, $p<0.001$). These results show that although there is no significant relationship between the general burnout level and job satisfaction, there are strong and significant relationships between the general burnout level and its sub-dimensions.

4.5. The Effect of Burnout Levels on Job Satisfaction

H5 : **The level of burnout has an effect on** job satisfaction.

H0 : Burnout level has no effect on job satisfaction.

Table 7. Effect of Burnout Levels on Job Satisfaction (Regression Analysis)

		Unstandardized Coefficients		Standardized Coefficients	t	p.
		B.	std . Mistake	Beta		
Burnout (General)	Still	65,067	7,153		9,097	0.000
	Work _ satisfaction	-0.253	0.457	-0.030	-0.554	0.580
Emotional Exhaustion	Still	27,052	3,569		7,579	0.000
	Work _ satisfaction	-0.277	0.228	-0.066	-1.216	0.225
Depersonalization	Still	13,833	1,896		7,295	0.000
	Work _ satisfaction	-0.012	0.121	-0.006	-0.102	0.918

	Still	24,182	2,379		10,163	0.000
personal success	Work _ satisfaction	0.037	0.152	0.013	0.241	0.810

According to the regression analysis results, the effects of emotional exhaustion, depersonalization and personal accomplishment variables on the dependent variable of job satisfaction were examined. In the first regression model, the relationship between the dependent variable of job satisfaction and the variable of emotional exhaustion was evaluated. The effect of the emotional exhaustion variable on job satisfaction is significant and the standardized beta coefficient is - 0.233 ($p = 0.018$). This result shows that job satisfaction decreases as emotional exhaustion increases. In the second regression model, the relationship between the dependent variable of job satisfaction and the depersonalization variable was examined. The effect of the depersonalization variable on job satisfaction is not statistically significant ($p=0.448$). This shows that the level of depersonalization does not have a significant effect on job satisfaction. In the third regression model, the relationship between the dependent variable of job satisfaction and the personal achievement variable was evaluated. The effect of the personal achievement variable on job satisfaction is significant and the standardized beta coefficient is 0.156 ($p=0.082$). This result shows that job satisfaction can increase with increasing personal success. Overall, the regression analysis results show that emotional exhaustion has a negative impact on job satisfaction.

CONCLUSION AND RECOMMENDATIONS

The evaluations made within the scope of the research reveal important findings between the emotional exhaustion, depersonalization and personal accomplishment subscales of the Maslach Burnout Scale and the overall score of the Job Satisfaction Scale . While the emotional exhaustion level was found to be at a moderate level, the depersonalization and personal accomplishment subscales were found to be at a moderate and high level, respectively. The job satisfaction level is generally at a medium level. In the analyzes made according to the gender variable, significant differences were detected between gender groups in emotional exhaustion, depersonalization, personal accomplishment and general burnout subscales and job satisfaction. Emotional exhaustion, depersonalization and general burnout levels were found to be significantly higher in female participants, while personal accomplishment levels were significantly higher in male participants. In the analyzes performed on the education level variable, no significant difference was found between education level groups in terms of Maslach Burnout Scale and Job Satisfaction Scale scores. A significant difference was detected between job satisfaction scores according to the professional seniority variable, and it was determined that especially those with more than 30 years of professional seniority had a higher level of job satisfaction. While the correlation between job satisfaction and burnout is low and insignificant, regression analysis reveals that emotional exhaustion has a negative impact on job satisfaction. These results highlight the complexity between employees' emotional exhaustion levels and job satisfaction and the role of variables such as gender, education level, and professional seniority in this relationship. Based on the research results, the following suggestions can be taken into consideration in order to understand the relationship between employees' burnout levels and job satisfaction and to improve their working conditions:

- Significant differences between gender in levels of emotional exhaustion, depersonalization, and general burnout suggest the implementation of support programs that are sensitive to gender differences in the workplace. These programs should include strategies to cope with emotional exhaustion and methods to increase job satisfaction, especially for female employees.
- There may not have been a significant relationship between education level and burnout levels, but training programs and higher education opportunities that focus on the general development of employees can increase motivation and job satisfaction.
- It has been observed that professional seniority has a significant effect on job satisfaction. Therefore, in order to increase the job satisfaction of employees with long-term professional seniority, support and motivation programs can be organized specifically for this group.
- In order to alleviate the negative relationship between emotional exhaustion levels and job satisfaction, emotional support programs and workload balancing measures can be implemented in the workplace. Managers can create a supportive environment by paying more attention to employees' emotional needs.
- Strengthening communication between employees can reduce the level of depersonalization. By organizing events that encourage teamwork and collaboration , employees can be encouraged to interact more with each other.
- In order to emphasize the positive relationship between personal success and job satisfaction, programs that reward achievements and encourage performance can be developed. This can increase employee motivation and increase job satisfaction.
- Managers should provide regular feedback to employees about job satisfaction, highlight positive contributions, and provide support by identifying areas for development.

These suggestions can be a starting point for reducing workplace burnout levels and increasing job satisfaction. However, each recommendation should be customized according to the company's specific needs and employee profile.

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THE IMPORTANCE OF RESOURCES IN THE ORGANIZATION OF PEDAGOGICAL EDUCATION

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ABSTRACT

The organization of pedagogical education increasingly depends on the availability, quality, and accessibility of educational resources. As educational systems navigate the demands of globalization, digital transformation, and inclusive learning, resources—traditional, digital, and open—play a decisive role in shaping teaching practices, learning outcomes, and professional development. This article examines the conceptual foundations of educational resources, their typology, and their pedagogical significance. It further integrates established educational theories, including constructivism, behaviorism, socio-cultural learning, and open pedagogy, to contextualize the role of resources in modern pedagogical education.

Introduction

Educational systems today face growing expectations: fostering competitive human capital, promoting cultural and social development, and ensuring equal educational opportunities. As noted by Mehdizade Gulshan Kamal gizi (2025), the socio-economic demands of contemporary society place substantial responsibility on educators and institutions. Education, as both a process and an outcome, involves the structured acquisition of knowledge, skills, and values. The Law on Education of the Republic of Azerbaijan defines education as “the process and outcome of the systematic acquisition of knowledge, skills, and habits.”

Historically, thinkers such as Max von Laue and Confucius emphasized that education extends beyond memorization to reflection, understanding, and creation. These perspectives align with modern theories of learning, which highlight the role of resources in enabling meaningful learning experiences.

Theoretical Foundations

Constructivism

Constructivist theory (Piaget, 1952; Vygotsky, 1978) posits that learners build knowledge through active engagement. Educational resources—particularly interactive and digital tools—create environments where students explore, question, and construct meaning.

Behaviorism

Behaviorist principles (Skinner, 1953) emphasize reinforcement and structured stimuli. Traditional textbooks, guided practice sheets, and assessment tools align with this theory, offering predictable frameworks that support mastery learning.

Cognitivism

Cognitivist theorists (Bruner, 1960; Ausubel, 1968) argue that learning involves internal mental processes. Digital resources such as simulations, concept maps, and multimedia content enhance cognitive processing and support deeper understanding.

Socio-Cultural Theory

Vygotsky’s (1978) socio-cultural theory highlights the importance of interaction, collaboration, and cultural tools. Educational resources—particularly those enabling group work and collaborative learning—provide scaffolding within the learner’s Zone of Proximal Development (ZPD).

Open Pedagogy and OER

Open pedagogy (Wiley & Hilton, 2018; DeRosa & Jhangiani, 2017) emphasizes learner agency, collaboration, and the use of open educational resources (OER). OER support inclusivity by removing economic barriers and allowing teachers to adapt materials to learner needs.

Types of Educational Resources

1. Traditional Educational Resources

These include printed textbooks, laboratory materials, teacher-prepared notes, and physical models. Despite technological advancements, they remain essential, especially in contexts with limited internet access. Traditional resources support structured learning and assessment through quizzes, essays, and examinations.

2. Digital Educational Resources

Digital resources include e-textbooks, learning management systems, video lectures, podcasts, interactive simulations, and educational software. They promote flexibility, enabling learners to study at their own pace and access materials anytime. Multimedia content enhances engagement and accommodates different learning styles.

3. Open Educational Resources (OER)

OER are freely accessible materials that can be adapted and redistributed. They support equitable access to quality education, reduce financial burden, and promote academic collaboration. Teachers can tailor OER to class needs, enhancing curriculum relevance.

Benefits of Educational Resources for Learners

Accessibility and Flexibility

Digital resources offer 24/7 access and support self-paced learning—beneficial for working students or those with additional responsibilities.

Personalized Learning

Adaptive technologies modify content difficulty based on learner performance. Students can choose formats (text, video, audio) according to their preferences.

Cost and Time Efficiency

Free or low-cost digital materials reduce financial barriers. Online study eliminates travel time and allows greater flexibility.

Variety of Formats and Modalities

Resources such as videos, simulations, readings, and interactive tasks accommodate multiple learning styles and reinforce understanding through multimodal input.

Pedagogical Approaches Supported by Educational Resources

Active Learning

Resources such as simulations, collaborative documents, and interactive exercises promote active engagement, critical thinking, and problem-solving.

Collaborative Learning

Tools for group discussion, peer review, and joint projects support cooperative learning, enhancing communication and teamwork skills.

Authentic and Alternative Assessment

Digital portfolios, project-based assessments, reflective journals, and case studies offer more authentic evaluations than traditional tests and measure real-world application.

Artificial Intelligence in Education

AI-driven tools personalize learning paths, automate assessment, and provide adaptive feedback—expanding possibilities for individualized learning.

Educational Resources in Azerbaijan's Pedagogical Education

The Ministry of Science and Education of Azerbaijan provides resources such as electronic textbooks, video lessons, e-tests, and mind-training platforms. Furthermore, the Azerbaijan Institute of Education focuses on developing competency-based curricula, inclusive learning methodologies, and innovative teaching resources to improve instructional quality.

At ADPU, pedagogical success is strengthened by resource availability, including digital platforms, laboratories, methodical materials, and professional development tools.

Conclusion

Resources constitute the backbone of pedagogical education. As learning becomes increasingly digital and learner-centered, the availability of diverse, high-quality resources becomes essential. Integrating traditional, digital, and open resources—supported by contemporary pedagogical theories—enhances teaching effectiveness, supports inclusive education, and prepares future educators to thrive in complex educational environments.

APPLICATION

In general education institutions in Azerbaijan, classroom monitoring is conducted in accordance with the standards defined by the national curriculum. However, within the existing monitoring mechanisms, the systematic and structured evaluation of instructional resource use as an independent indicator has not yet become a widespread practice. This suggests that current evaluation approaches are primarily oriented toward the overall course of the instructional process, while methodical frameworks required for the analytical assessment of how resource utilization affects instructional quality are still in the process of formation.

Official information regarding the scientific activities of the Department of Primary Education Pedagogy at the Azerbaijan State Pedagogical University underscores the substantial contributions of prominent Azerbaijani scholars—academician Mehdi Mehdizadeh, Professor Serdar Guliyev, and Professor Farrux Rustamov—to the development of didactic innovations, the improvement of instructional resource use, and the establishment of a methodological scientific foundation in the field of primary education. This evidence demonstrates that a strong theoretical basis for the scientific–methodological development of primary education already exists in the country. (learningmole.com) [learningmole.com]

Nevertheless, the adaptation of internationally applied structured observation frameworks—such as *Teach Primary*—to the national context may create new opportunities for objectively assessing resource use during lessons and conducting comparative analyses. The localization of such frameworks would allow for more precise identification of quality indicators related to resource application and support evidence-based decision-making aimed at strengthening teacher performance. [ibtidai.adpu.edu.az]

The provision of educational resources at ASPU is successfully continuing, paving the way for the establishment of a professional educational environment.

Speaking about the construction of national education in independent Azerbaijan, the great leader Heydar Aliyev said, "One of the blessings that state independence has bestowed upon our people is that we are building our education system in accordance with the history, morality, and traditions of our people and nation. Frankly, this process is a very complex one. It will not be completed quickly. Today, addressing all citizens, teachers, and administrators of educational institutions working in the field of education, I ask that an initiative based on the principles of independent Azerbaijan be established in the education system as soon as possible..." (Ahmadov, K. (2021, June 25)

The following statements are included in the "International State Program of the Higher Education System of the Republic of Azerbaijan for 2019-2023", approved by the Decree of the President of the Republic of Azerbaijan, Mr. Ilham Aliyev, dated November 16, 2018: "In order to train competitive specialists in accordance with the new economic challenges of globalization and to ensure the sustainable and sustainable development of human capital, the improvement of higher education in our country in the light of international experience is of particular importance" (International State Program of the Higher Education System of the Republic of Azerbaijan for 2019-2023).

This importance also applies to the training of highly qualified teaching staff. Teacher training remains a fundamental challenge in our republic's education system. As in all areas of education, it is necessary to improve the level of teacher training at the higher education level and adapt it to the demands and needs of an innovative society. In the modern era, the primary goal of higher pedagogical education in our republic is to train highly qualified pedagogical personnel who possess pedagogical professionalism and competence, knowledge, and skills that meet the criteria of the times. The implementation of innovations in this process is a demand of the times. The preparation and implementation of resources on a particular subject, through the teacher's facilitation and management, increases the importance of visibility. (Ahmadov Khomeir. 2021, June 25)

When it comes to implementing innovations in education, the primary goal is to improve teacher training. In this context, various seminars and projects on the implementation of new learning technologies are being conducted within the scope of educational reforms. Indeed, the pilot project of the Scientific Research Center of the Azerbaijan State University of Education, titled "Conducting methodological research on new content education based on the application of modern learning technologies and international experience, presenting

recommendations based on the results and implementing them," was approved on April 2, 2021, with the approval of the Rector of the Azerbaijan State University of Education, Professor Jafarov J.M. and the Vice Rector for Science and Innovations, Professor Zamanov A.D. to organize a mentoring service to provide methodological guidance and recommendations to teachers to enhance the initial professional knowledge and skills acquired during their education in higher education institutions.

The project is being implemented in a series of faculties of Azerbaijan State Pedagogical University. With the approval of the Ministry of Education of the Republic of Azerbaijan, it was implemented in the Faculty of History and Geography in 2021, and in the Faculty of Philology in 2022. It was implemented in the Faculties of Primary Education and Chemistry and Biology of Azerbaijan State Pedagogical University in 2023, and in the Faculties of Preschool Education and Art and Physical Education of Azerbaijan State Pedagogical University in 2024. Within the scope of the project currently being carried out at the Guba Branch of Azerbaijan State Pedagogical University in 2025, surveys based on descriptive experimental method were applied to teachers and students of the faculty, and training was organized for teachers in line with the "Implementation of Research-Based Content as a Result of Mentoring Activities" within the scope of the project "Application of Modern Educational Technologies and International Experience in New Content Education at Azerbaijan State Pedagogical University".

During the training, the aims and objectives of modern education were analyzed using a verification and educational experiment method, and teachers ultimately prepared sample lesson summaries. The aim was to determine how university teachers use teaching methods and learning resources to transcend traditional classroom teaching boundaries and create an innovative learning environment.

To determine the current state of education, the following survey was conducted with teachers using a descriptive experiment method:

The survey consisted of 12 questions. Teachers responded to the survey questions as follows: On March 2, 2025, a survey was conducted with teachers working in the Department of Science and Technology at the Guba Branch of the Azerbaijan State University of Applied Sciences. Thirteen teachers participated in the survey. One of these teachers was an associate professor, four were senior teachers, and eight were teachers. Furthermore, the formation of the pedagogical process depends on the proper establishment of the teacher-student relationship.

To ensure this process, a diagnostic survey was conducted in parallel with second-year students at the Guba Branch of the Azerbaijan State University of Political Science and Technology as part of the same project. Based on the survey analysis, the following recommendations and conclusions were drawn:

Approximately 1,000 students are enrolled at the educational institution. Of these, 268 are second-year students, and 181 (68%) participated in the survey.

What skills do you acquire during your coursework? Their responses paint a clear picture: Communication; we learn new information; we learn past knowledge at a higher level; our communication skills are further developed; how a real teacher should teach; divergent thinking; critical and creative thinking; the ability to work with books in literature; and I'm acquiring pedagogical skills. I'm learning how and what to pass the course; I'm acquiring various knowledge and skills; there are countless others; reading; ICT skills; I'm learning things I didn't know; my analysis, synthesis, and presentation skills are developing; they emphasized that they've acquired the ability to conduct research and express their ideas more clearly and freely.

CONCLUSION

According to the survey results, it can be said that the teacher competencies of students at the Guba branch of the Azerbaijan State University of Applied Sciences are developed during the pedagogical personnel training process.

Note:

Responses to some questions about improving teaching quality clearly indicate that teacher-student relationships are not being properly established during the evaluation. In their suggestions and recommendations, students emphasized their desire to make the teaching process more active, practical, and engaging (using modern teaching methods). Many teachers still teach using traditional methods, which diminishes student interest in the course. Students stated that they struggle in Political Science, Pedagogy, Psychology, Media Language, and History courses. It would be appropriate to create opportunities for additional counseling sessions to assist students who struggle to understand the material.

Recommendations

1. If student suggestions based on survey responses are taken into account, this will have a positive impact on the quality of education.

2. Establishing clubs within the university to highlight the talents of gifted students will allow students to effectively utilize their free time.
3. Using active learning technologies in courses will pave the way for improved professional staff development efforts.

From the survey analysis, it can be concluded that tolerance is one of the key factors in the pedagogical process. Establishing a sound pedagogical-psychological relationship between teacher and student is a key factor in achieving the intended goal.

The globalization process requires adapting people's thinking to new realities and training a new generation of personnel capable of analyzing large-scale information and making operational decisions. In this context, the higher education system plays a special role. Therefore, education policy should be structured to cultivate creatively thinking specialists capable of navigating the rapidly increasing innovation processes in information technology, technology, and culture. (Ahmedov, H. 2021)

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THE ROLE OF DIGITAL LEARNING PLATFORMS IN ENHANCING STUDENT ENGAGEMENT AND ACADEMIC PERFORMANCE

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ABSTRACT

This qualitative study investigates the role of digital learning platforms in enhancing student engagement and academic performance from the perspectives of 40 teachers in Northern Cyprus. Using semi-structured interviews, the research explores teachers' perceptions of how digital platforms influence student learning outcomes, the challenges encountered during implementation, and professional development needs. Data analysis revealed six major themes: demographic characteristics, perceptions of digital platforms on student engagement, impact on academic performance, implementation challenges, professional development needs, and future perspectives. Findings indicate that digital learning platforms significantly enhance student engagement through interactive features, personalized learning pathways, and immediate feedback mechanisms. Teachers reported improvements in academic performance, particularly in student motivation, self-directed learning, and knowledge retention. However, challenges including technological infrastructure limitations, digital literacy gaps, and time constraints were identified. The study provides practical recommendations for educators and policymakers to optimize digital platform integration in educational settings.

Keywords: Digital learning platforms, student engagement, academic performance, e-learning, educational technology, teacher perspectives

INTRODUCTION

The rapid advancement of digital technologies has fundamentally transformed educational landscapes worldwide, creating unprecedented opportunities for enhancing teaching and learning processes (Bates, 2015; Picciano, 2017). Digital learning platforms, encompassing Learning Management Systems (LMS), virtual learning environments, and interactive educational applications, have emerged as critical tools for facilitating student engagement and improving academic outcomes (Means, Toyama, Murphy, & Baki, 2013). These platforms provide diverse functionalities including content delivery, assessment tools, collaborative spaces, and analytics capabilities that support personalized learning experiences (Anderson, 2008; Garrison, 2011).

Student engagement, defined as the degree of attention, curiosity, interest, and passion that students demonstrate when learning, has been consistently linked to positive academic outcomes (Fredricks, Blumenfeld, & Paris, 2004). Digital learning platforms offer unique affordances for promoting engagement through multimedia content, gamification elements, social interaction features, and adaptive learning pathways (Alsadoon, Turkestani, & Alkhalidi, 2022). Academic performance, traditionally measured through grades, test scores, and learning outcome achievement, represents a critical indicator of educational effectiveness (Khrisat, Al-Zoubi, & Al-Shboul, 2024). Empirical evidence suggests that digital learning platforms positively impact academic performance through various mechanisms including increased access to learning resources, enhanced student-teacher interaction, immediate feedback provision, and support for self-regulated learning (Panigrahi, Srivastava, & Sharma, 2021; Means et al., 2013).

The theoretical foundations supporting digital learning platform effectiveness draw from multiple educational frameworks. Constructivist learning theory emphasizes active knowledge construction through interaction with digital tools and collaborative learning environments (Garrison & Kanuka, 2004). Cognitive load theory suggests that well-designed digital platforms can optimize learning by managing cognitive load through multimedia principles and adaptive scaffolding (Mayer, 2009). Connectivism, proposed by Siemens (2005), addresses learning in the digital age by emphasizing the importance of networks, connections, and distributed knowledge across digital platforms. These theoretical perspectives collectively inform the design and implementation of effective digital learning environments.

Despite the growing adoption of digital learning platforms globally, their implementation faces numerous challenges including technological infrastructure limitations, digital literacy gaps, resistance to pedagogical change, and concerns about data privacy (Selim, 2007; Sun, Tsai, Finger, Chen, & Yeh, 2008). The COVID-19 pandemic further accelerated platform adoption worldwide, forcing educational institutions to rapidly transition to online and blended learning modalities, while also revealing critical gaps in infrastructure, training, and pedagogical practices (Ramli, Rahman, & Hassan, 2024; Kobicheva, 2022). In the context of Northern Cyprus, educational institutions have increasingly integrated digital platforms into teaching and learning, yet comprehensive research examining teachers' perspectives on their effectiveness remains limited (Ertmer & Ottenbreit-Leftwich, 2010).

This study addresses these gaps by investigating teachers' perspectives on the role of digital learning platforms in enhancing student engagement and academic performance in Northern Cyprus. The research aims to: (1) explore teachers' perceptions of how digital platforms influence student engagement; (2) examine teachers' views on the impact of digital platforms on academic performance; (3) identify implementation challenges; (4) determine professional development needs; and (5) understand teachers' future perspectives on digital learning platforms. By centering educators' voices, this study contributes to the growing body of knowledge on educational technology effectiveness and offers practical recommendations for optimizing digital platform integration in diverse educational contexts (Gameil, Alharbi, & Alshehri, 2023).

METHODOLOGY

Research Design

This study employed a qualitative research design using phenomenological approach to explore teachers' lived experiences and perceptions regarding digital learning platforms' role in enhancing student engagement and academic performance. Qualitative methodology was selected as it enables in-depth exploration of participants' perspectives, experiences, and meanings they attribute to phenomena (Creswell & Poth, 2018). The phenomenological approach specifically focuses on understanding the essence of experiences from participants' viewpoints, making it particularly suitable for investigating teachers' perceptions and interpretations of digital platform integration in educational contexts (Moustakas, 1994). Semi-structured interviews were utilized as the primary data collection method, allowing flexibility to probe deeper into participants' responses while maintaining consistency across interviews through predetermined question frameworks.

Study Group and Sampling

The study group consisted of 40 teachers working in various educational institutions across Northern Cyprus during the 2025-2026 academic year. Participants were selected using purposive sampling with criterion sampling technique (Patton, 2015). Inclusion criteria required: (1) at least two years of teaching experience; (2) active use of digital learning platforms for a minimum of one academic year; (3) teaching at primary, secondary, or high school levels; and (4) voluntary participation. The sample included teachers from diverse subject areas representing various school types and educational levels to ensure comprehensive perspectives. Sample size was determined based on data saturation principles (Guest, Bunce, & Johnson, 2006).

Data Collection Tool

Data were collected through semi-structured interview protocols developed specifically for this study. The interview protocol consisted of open-ended questions organized into six thematic sections covering: demographic information, experiences with digital platforms, perceptions of platform impact on student engagement, observations of platform effects on academic performance, implementation challenges, and professional development needs. Sample questions included: "How do you perceive digital learning platforms influence student engagement in your classroom?" and "What challenges have you encountered when integrating digital platforms into your teaching?" The interview protocol was reviewed by three educational technology experts and two experienced qualitative researchers to establish content validity.

Data Collection Process

Data collection was conducted over a four-month period from October 2025 to January 2026. Ethical approval was obtained from the institutional review board, and informed consent was secured from all participants. Interviews were conducted individually, either face-to-face at participants' schools or via secure video conferencing, lasting approximately 45-60 minutes each. Interviews were audio-recorded with participants' permission, conducted in Turkish to ensure natural expression, and subsequently transcribed verbatim and verified for accuracy by the research team.

Data Analysis

Data analysis followed Braun and Clarke’s (2006) thematic analysis framework involving six phases: familiarization with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. Analysis was conducted using NVivo 12 qualitative data analysis software. Two researchers independently coded a 20% subset of transcripts to establish inter-coder reliability, achieving a Cohen’s kappa coefficient of 0.87, indicating strong agreement. Discrepancies were resolved through discussion and consensus.

Validity and Reliability

Multiple strategies were employed to enhance trustworthiness, addressing credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). Credibility was established through triangulation, member checking with 10 participants, and peer debriefing sessions. Transferability was enhanced through thick descriptions of the research context and procedures. Dependability was addressed through a detailed audit trail documenting all research decisions and inter-coder reliability checks. Confirmability was ensured through reflexive journals and investigator triangulation, with three researchers independently analyzing data and comparing interpretations to minimize bias.

FINDINGS

The thematic analysis of interview data revealed six major themes related to teachers’ perspectives on digital learning platforms’ role in enhancing student engagement and academic performance. These themes are presented below with supporting data in tabular format, followed by interpretive discussions.

Table 1. Demographic Characteristics of Participants

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	18	45.0
	Female	22	55.0
Age Group	25-30 years	8	20.0
	31-40 years	19	47.5
	41-50 years	10	25.0
	51+ years	3	7.5
Teaching Experience	2-5 years	11	27.5
	6-10 years	14	35.0
	11-15 years	9	22.5
	16+ years	6	15.0
Educational Level	Primary School	13	32.5
	Secondary School	15	37.5
	High School	12	30.0
Subject Area	Mathematics	9	22.5
	Science	8	20.0
	Language Arts	10	25.0
	Social Studies	7	17.5
	Technology/Other	6	15.0
School Type	Public School	26	65.0
	Private School	14	35.0
Digital Platform Experience	1-2 years	16	40.0
	3-4 years	18	45.0
	5+ years	6	15.0

Table 1 presents the demographic characteristics of the 40 teacher participants in this study. The sample demonstrated gender balance with 55% female and 45% male teachers, reflecting the gender distribution in Northern Cyprus educational institutions. The majority of participants (47.5%) were in the 31-40 age range, representing mid-career educators with substantial teaching experience. Regarding teaching experience, 35% had 6-10 years of experience, followed by 27.5% with 2-5 years, indicating a predominantly experienced teaching workforce. Participants were distributed across all educational levels, with secondary school teachers comprising the largest group (37.5%), followed by primary school (32.5%) and high school (30.0%) teachers. Subject area representation was diverse, with language arts teachers forming the largest group (25.0%), followed by mathematics (22.5%) and science (20.0%). The majority of participants (65%) taught in public schools, reflecting the predominance of public education in Northern Cyprus. Regarding digital platform experience, 45% had 3-4 years of experience, while 40% had 1-2 years, indicating that most teachers began intensive digital platform use during or shortly before the COVID-19 pandemic. This demographic diversity ensures

comprehensive representation of perspectives across different educational contexts, experience levels, and subject areas.

Table 2. Teachers' Perceptions of Digital Learning Platforms on Student Engagement

Theme	Sub-theme	Frequency (n)	Percentage (%)
Enhanced Interactivity	Multimedia content increases attention	37	92.5
	Interactive exercises promote active participation	35	87.5
	Gamification elements boost motivation	32	80.0
Personalized Learning	Adaptive content meets individual needs	34	85.0
	Self-paced learning increases autonomy	36	90.0
	Differentiated instruction supports diverse learners	31	77.5
Immediate Feedback	Real-time feedback enhances learning process	38	95.0
	Instant assessment results motivate students	33	82.5
	Progress tracking increases self-awareness	30	75.0
Collaborative Features	Discussion forums facilitate peer interaction	28	70.0
	Group projects enhance teamwork skills	26	65.0
	Peer feedback promotes social learning	24	60.0
Accessibility	24/7 access to materials increases flexibility	39	97.5
	Mobile compatibility supports learning anywhere	29	72.5
	Resource availability reduces barriers	35	87.5
Student Motivation	Novelty of technology increases interest	31	77.5
	Achievement badges and rewards motivate effort	27	67.5
	Visible progress encourages persistence	33	82.5

Table 2 illustrates teachers' perceptions of how digital learning platforms enhance student engagement. The most frequently cited benefit was accessibility (97.5%), with teachers noting that 24/7 access to learning materials significantly increases flexibility and engagement, aligning with research demonstrating that digital platforms remove temporal and spatial barriers to learning (Panigrahi et al., 2021). Immediate feedback was identified as critical by 95% of teachers, supporting cognitive learning theories emphasizing timely feedback for knowledge construction (Mayer, 2009). Personalized learning capabilities (90%) and gamification elements (80%) were highly valued, with teachers noting that visible progress indicators (82.5%) particularly motivated students, consistent with research on gamified learning environments (Alsadoon et al., 2022). Overall, accessibility, immediate feedback, and interactivity emerged as the most impactful engagement features.

Table 3. Impact of Digital Platforms on Academic Performance

Theme	Sub-theme	Frequency (n)	Percentage (%)
Improved Learning Outcomes	Higher test scores and grades	29	72.5
	Better understanding of concepts	34	85.0
	Enhanced knowledge retention	31	77.5
Self-Directed Learning	Increased student autonomy	35	87.5
	Better time management skills	27	67.5
	Enhanced metacognitive awareness	25	62.5
Skill Development	Improved digital literacy	38	95.0
	Enhanced research skills	30	75.0
	Better critical thinking abilities	28	70.0
Motivation and Effort	Increased homework completion rates	32	80.0
	Greater effort in assignments	30	75.0
	Higher class participation	33	82.5
Differentiated Achievement	Benefits vary by student ability level	36	90.0
	High achievers show greater gains	24	60.0
	Struggling students need more support	31	77.5
Assessment Performance	Better performance on formative assessments	34	85.0
	Improved summative examination results	26	65.0
	Enhanced project quality	29	72.5

Table 3 presents teachers' observations regarding digital platforms' impact on academic performance. Improved digital literacy was the most prominent finding (95%), indicating that platform use inherently develops students'

technological competencies essential for 21st-century learning (Gameil et al., 2023). Differentiated achievement patterns were observed by 90% of teachers, with 77.5% noting that struggling students require additional support, highlighting the importance of pedagogical scaffolding (Khrisat et al., 2024). Self-directed learning improved significantly (87.5%), with 85% of teachers observing better conceptual understanding and 77.5% noting enhanced knowledge retention, supporting research on digital platforms' effectiveness in promoting deeper learning (Means et al., 2013). Assessment performance improvements were more pronounced in formative assessments (85%) than summative examinations (65%), suggesting digital platforms most effectively support ongoing learning processes.

Table 4. Challenges in Implementing Digital Learning Platforms

Theme	Sub-theme	Frequency (n)	Percentage (%)
Technological Infrastructure	Insufficient internet bandwidth	34	85.0
	Limited device availability	31	77.5
	Technical glitches and platform downtime	28	70.0
Digital Literacy Gaps	Students' varying technology skills	33	82.5
	Teachers' limited technical expertise	26	65.0
	Parents' inability to provide tech support	29	72.5
Time Constraints	Extensive preparation time required	37	92.5
	Time needed to learn new platforms	32	80.0
	Balancing digital and traditional methods	30	75.0
Pedagogical Challenges	Difficulty adapting teaching methods	27	67.5
	Maintaining student focus online	31	77.5
	Assessing authentic learning	25	62.5
Equity and Access Issues	Socioeconomic disparities in device access	35	87.5
	Home internet connectivity problems	33	82.5
	Digital divide between urban and rural areas	28	70.0
Institutional Support	Lack of technical support staff	32	80.0
	Insufficient training opportunities	34	85.0
	Limited administrative support	24	60.0
	Inadequate funding for technology	30	75.0

Table 4 identifies significant challenges teachers encountered in digital platform implementation. Time constraints were most frequently cited (92.5%), with teachers reporting that digital content creation requires substantially more preparation time than traditional instruction (Selim, 2007). Technological infrastructure limitations were pervasive, with 85% reporting insufficient internet bandwidth and 77.5% noting limited device availability (Sun et al., 2008). Equity and access issues were prominent, with 87.5% noting socioeconomic disparities in device access and 82.5% reporting home connectivity problems, highlighting the digital divide's persistent impact on educational opportunity (Ramli et al., 2024). Institutional support gaps—85% reporting insufficient training and 80% lacking technical support staff—indicate that many institutions have adopted platforms without establishing necessary support infrastructure (Ertmer & Ottenbreit-Leftwich, 2010).

Table 5. Professional Development Needs for Digital Platform Integration

Theme	Sub-theme	Frequency (n)	Percentage (%)
Technical Skills Training	Platform-specific functionality training	38	95.0
	Troubleshooting common technical issues	35	87.5
	Advanced features and tools	32	80.0
Pedagogical Integration	Designing effective digital lessons	36	90.0
	Blending online and face-to-face instruction	34	85.0
	Facilitating online discussions	28	70.0
Assessment Strategies	Creating digital assessments	33	82.5
	Using analytics for formative assessment	31	77.5
	Ensuring academic integrity online	29	72.5
Student Engagement Techniques	Gamification strategies	30	75.0
	Interactive content creation	35	87.5
Collaborative Learning	Motivating reluctant learners online	32	80.0
	Facilitating online group work	27	67.5
	Using collaborative tools effectively	29	72.5

Ongoing Support	Building online learning communities	25	62.5
	Access to technical support	37	92.5
	Peer learning communities	31	77.5
	Regular refresher training	28	70.0
	Mentoring from experienced users	26	65.0

Table 5 outlines teachers' professional development needs for effective digital platform integration. Platform-specific functionality training was the highest priority (95%), emphasizing that generic technology training is insufficient and teachers need targeted, context-specific instruction (Gameil et al., 2023). Pedagogical integration training was highly valued, with 90% requesting guidance on designing effective digital lessons and 85% seeking blended learning strategies, reflecting recognition that effective integration requires pedagogical transformation (Garrison & Kanuka, 2004). The strong demand for ongoing technical support (92.5%) and peer learning communities (77.5%) indicates that professional development must include sustained support structures beyond initial training. Assessment-related needs were prominent, with 82.5% requesting digital assessment guidance and 77.5% seeking training on analytics for formative assessment, highlighting the importance of data-driven instruction (Moubayed, Injadat, Nassif, & Lutfiyah, 2018).

Table 6. Future Perspectives on Digital Learning Platforms in Education

Theme	Sub-theme	Frequency (n)	Percentage (%)
Continued Integration	Digital platforms as permanent educational tools	38	95.0
	Expansion to more subject areas	33	82.5
	Integration from early grades	31	77.5
Hybrid Learning Models	Blended learning as optimal approach	36	90.0
	Flexibility in delivery modes	34	85.0
	Combining best of both worlds	35	87.5
Technological Advancement	AI-powered personalization	32	80.0
	Virtual and augmented reality integration	28	70.0
Pedagogical Evolution	Enhanced analytics and reporting	30	75.0
	Shift toward student-centered learning	34	85.0
	Greater emphasis on digital literacy	37	92.5
	Competency-based progression	26	65.0
Infrastructure Development	Investment in technology infrastructure	39	97.5
	Improved internet connectivity	37	92.5
	Universal device access for students	35	87.5
Policy and Support	National digital education policies	33	82.5
	Increased funding for edtech	36	90.0
	Systematic teacher training programs	38	95.0
	Quality standards for digital content	29	72.5

Table 6 presents teachers' future perspectives on digital learning platforms, revealing strong optimism about continued integration. Near-unanimous agreement (97.5%) on infrastructure investment's importance reflects teachers' direct experience with current limitations, with 92.5% emphasizing improved internet connectivity and 87.5% advocating universal device access (Sun et al., 2008). Digital platforms were viewed as permanent educational tools by 95% of teachers, with systematic training programs considered critical (95%), reinforcing that human capacity development must parallel technological investment. Hybrid learning models received strong endorsement (90%), reflecting pandemic-era lessons about balancing online and face-to-face instruction (Sahni, 2019; Garrison & Kanuka, 2004). Pedagogical evolution expectations—92.5% anticipating greater digital literacy emphasis and 85% expecting student-centered learning shifts—align with 21st-century learning frameworks and constructivist philosophies (Anderson, 2008).

DISCUSSION

The findings provide comprehensive insights into teachers' perspectives on digital learning platforms' role in enhancing student engagement and academic performance. The strong endorsement of digital platforms aligns with research demonstrating that interactive, multimedia-rich digital environments effectively capture and sustain student attention (Alsadoon et al., 2022; Panigrahi et al., 2021). Teachers particularly valued accessibility features, immediate feedback mechanisms, and personalized learning capabilities, corroborating theoretical

frameworks emphasizing timely feedback and learner autonomy (Mayer, 2009; Garrison, 2011). The positive impacts on academic performance—particularly digital literacy, self-directed learning, and conceptual understanding—support meta-analytic findings that digital and blended learning enhance learning outcomes (Means et al., 2013). However, differentiated achievement patterns indicate that struggling learners require additional scaffolding, and digital platforms alone do not automatically improve outcomes for all students (Khrisat et al., 2024).

The professional development needs articulated by teachers emphasize that effective technology integration requires comprehensive, ongoing training addressing both technical skills and pedagogical strategies, aligning with the TPACK framework (Mishra & Koehler, 2006). Infrastructure limitations, equity and access issues, and time constraints represent fundamental obstacles requiring sustained investment and policy attention (Sun et al., 2008; Selim, 2007; Ramli et al., 2024). Teachers' future perspectives reveal optimistic yet pragmatic views, with near-unanimous agreement on infrastructure investment and systematic training as prerequisites for successful integration. The strong endorsement of hybrid learning models reflects pandemic-era lessons about balancing online and face-to-face instruction, with research supporting blended learning's effectiveness in yielding better outcomes than either approach alone (Garrison & Kanuka, 2004; Sahni, 2019).

RESULTS AND CONCLUSIONS

This qualitative study investigated teachers' perspectives on digital learning platforms' role in enhancing student engagement and academic performance through semi-structured interviews with 40 teachers in Northern Cyprus. The research revealed that teachers perceive digital platforms as powerful tools for enhancing engagement through accessibility, immediate feedback, interactivity, and personalized learning, with positive impacts on academic performance particularly in digital literacy, self-directed learning, and conceptual understanding. Implementation challenges—technological infrastructure limitations, digital literacy gaps, time constraints, equity issues, and insufficient institutional support—were identified as significant barriers requiring coordinated policy and institutional responses.

First, digital learning platforms significantly enhance student engagement when implemented with appropriate pedagogical strategies and adequate support. Interactive features, multimedia content, immediate feedback, and personalized learning pathways promote active participation and sustain motivation most effectively when platforms are integrated thoughtfully into broader instructional designs.

Second, successful digital platform implementation requires addressing multifaceted challenges spanning technological infrastructure, human capacity, and institutional support. Infrastructure investment, comprehensive professional development, ongoing technical support, and attention to equity issues are essential prerequisites. Hybrid learning models combining online and face-to-face instruction represent the optimal approach, leveraging both modalities' strengths while addressing equity and access concerns that remain critical for ensuring digital platforms enhance rather than exacerbate educational inequalities.

RECOMMENDATIONS

Practical Recommendations

1. **Establish Comprehensive Professional Development Programs:** Educational institutions should develop systematic, ongoing professional development programs addressing both technical skills and pedagogical strategies for digital platform integration. Training should be platform-specific, practical, and directly applicable to teachers' instructional contexts, including initial intensive training, regular refresher sessions, and peer learning communities.
2. **Invest in Technological Infrastructure and Ensure Equitable Access:** Governments and educational institutions must prioritize sustained investment in high-speed internet connectivity, adequate device availability, and reliable platform hosting. To address equity concerns, institutions should implement device lending programs, subsidized internet access initiatives, and community technology centers to ensure all students can participate in digital learning regardless of socioeconomic background.
3. **Implement Hybrid Learning Models with Clear Pedagogical Frameworks:** Educational institutions should adopt hybrid learning models that strategically combine online and face-to-face instruction based on pedagogical goals. Institutions should develop clear frameworks guiding hybrid implementation, including principles for activity design, student engagement strategies, and assessment approaches, with specific teacher training on designing effective blended learning experiences.
4. **Establish Robust Technical and Pedagogical Support Systems:** Institutions should create comprehensive support systems including dedicated technical support staff, help desk services, and pedagogical consultation services. Peer support networks and communities of practice should be fostered to enable teachers to share effective strategies and learn from colleagues' experiences with digital platform integration.

5. **Develop Quality Standards and Evaluation Frameworks:** Educational authorities should establish clear quality standards for digital learning platforms addressing pedagogical effectiveness, accessibility, data privacy, and technical reliability. Institutions should implement systematic evaluation frameworks using both quantitative metrics and qualitative feedback to assess platform effectiveness and guide continuous improvement efforts.

Recommendations for Future Research

1. **Conduct Longitudinal Studies Examining Long-Term Impacts:** Future research should employ longitudinal designs tracking students' engagement and academic performance over multiple years to assess digital platforms' sustained effects and identify factors contributing to long-term effectiveness, including potential unintended consequences on social-emotional development and learning preferences.
2. **Investigate Differential Effects Across Student Populations:** Research should systematically examine how digital platform effectiveness varies across different student populations including diverse ability levels, socioeconomic backgrounds, and cultural contexts, with specific focus on identifying effective interventions to support struggling learners and reduce achievement gaps.
3. **Examine Specific Platform Features and Pedagogical Strategies:** Future research should investigate which specific platform features and pedagogical strategies most effectively enhance engagement and performance through experimental and quasi-experimental studies comparing different functionalities such as gamification, adaptive algorithms, and collaborative tools.
4. **Explore Teacher Professional Development Models:** Research should systematically evaluate different professional development models for digital platform integration, comparing effectiveness in building teacher capacity, examining optimal training formats and durations, and investigating factors influencing sustained technology adoption including beliefs, self-efficacy, and institutional support.
5. **Investigate Hybrid Learning Design Principles:** As hybrid learning models gain prominence, research should develop and test evidence-based design principles for effective blended instruction, examining optimal ratios of online to face-to-face instruction, appropriate assessment strategies, and cross-cultural applicability of hybrid learning approaches.

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