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Evaluation of the Impact of the Use of Digital Skills on the Substantial Increase in Learning through the Neutrosophic PEST-SWOT approach

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Abstract. The research focuses on measuring the influence of the use of digital skills on learning, a major issue in current education. The fundamental issue addressed is how digital skills can greatly influence the educational process and the academic success of learners. In the contemporary environment, characterized by rapid technological growth and the increasing integration of digital instruments into the educational sphere, this challenge becomes especially essential. Despite the extensive use of digital technologies, there is a dearth of a comprehensive examination of how these skills influence learning from a multidimensional point of view that incorporates both intrinsic possibilities and risks. The research addresses this gap in the current literature by employing an integrated strategy that combines PEST and SWOT approaches with the neutrosophic methodology. Process, however, also bring with them dangers and constraints that need to be managed. The contribution of the study is twofold: first, it provides a methodological framework for assessing the impact of digital skills on learning. The study also provides a deeper and more complex examination of economic, social and cultural factors. Technical variables, as well as the weaknesses, opportunities and risks associated with the application of digital skills and talents. The findings demonstrate that digital skills have a positive impact on learning, driving engagement and personalization of education without digital technologies on education; Secondly, it offers practical recommendations to optimize the use of these tools in the classroom, ensuring a balance between their benefits and challenges. This study enhances knowledge in the area of digital education and gives practical suggestions for the proper deployment of technology in educational contexts.

Keywords: Digital Skills, SWOT Analysis, PEST Analysis, PEST-SWOT Neutrosophic Analysis, Education, neutrosophic PEST-SWOT

1. Introduction

In the digital age, the integration of digital skills in education has become more vital, altering the way students engage with material and gain knowledge. Assessing the influence of these abilities on learning is vital to understanding how they might increase academic achievement and better prepare students for the future. Current studies emphasizes that the efficient use of digital technology may in-

crease accessibility, customization and motivation in learning [1]. However, most research have concentrated on the technical execution of these technologies without digging into how they affect learning from an integrative viewpoint. Historically, education has gone through numerous phases of technological revolution, from the usage of printed books to the advent of computers and, more recently, online learning platforms. These advancements have permitted a steady evolution in educational techniques and have spurred the need for a more complete study of how digital technologies effect learning [2]. Despite gains, there remains a large gap in knowing how digital abilities affect academic success and what circumstances increase or restrict their effect. The primary issue that this research tackles is the absence of a detailed investigation of the true influence of digital skills on learning. Despite the expanding deployment of digital tools in education, the issue remains: how do these skills effect the large rise in learning in diverse educational contexts? This research tries to address this gap by offering a complete evaluation that covers both technical and contextual components of digital skills usage.

To answer this topic, the research adopts a new methodological approach that merges the PEST and SWOT frameworks with the neutrosophic technique. This method provides for a deeper and more complex examination of political, economic, social and technical (PEST) aspects and strengths, weaknesses, opportunities and threats (SWOT) connected to the application of digital skills in learning [3,4]. The combination of these methodologies gives a full understanding of how digital skills might influence academic achievement and what the accompanying difficulties and possibilities are. The major purpose of this research is to analyze the influence of the application of digital skills on enhancing learning utilizing the neutrosophic PEST-SWOT technique. In particular, the purpose is to assess how these characteristics affects the efficiency of digital technologies and what are the best methods to optimize their advantages in the educational environment. Additionally, the research tries to identify limitations that may restrict the good influence of digital skills on learning. In summary, this research not only gives a greater knowledge of the influence of digital skills on learning but also offers practical suggestions based on a rigorous examination. The project intends to contribute to the advancement of educational practices and the optimization of the use of digital technology in the classroom, offering useful tools and information for educators and those responsible for educational policy.

2 Related Works.

2.1. Digital Skills.

Digital skills have become a vital pillar of modern existence, playing a critical part in practically all facets of our everyday lives. In the digital age, it is about not only being able to operate electronic gadgets but also rather learning a sophisticated set of abilities that enable us to engage, create and collaborate successfully in an increasingly linked environment. This transition has led to a reconsideration of the abilities we deem vital and has produced major discussion over what digital skills are genuinely required for success in the 21st century. First, it is vital to realize that digital skills are not a monolithic thing, but rather a spectrum of competencies that span from simple usage of technical tools to complex software creation and awareness of cybersecurity. At a basic level, these abilities include the capacity to utilize devices such as computers and cellphones, access the Internet, and use office software. However, as we progress up the skill level, the complexity grows substantially. Skills like as programming, data analysis and digital project management come into play here, needing a deeper and more technical grasp of technology tools and procedures. The significance of these abilities is clear in a work market that is digitalizing at a fast rate. Statistics demonstrate that the need for workers with sophisticated digital skills is always growing, indicating the need to adapt to a work environment that increasingly requires technical

knowledge and analytical ability [5]. This tendency not only influences technology areas, but also extends to traditionally non-technological fields, such as education, health and commerce. Consequently, the capacity to learn and utilize digital skills has become a decisive factor for employability and professional progress.

Despite their relevance, there is a large disparity in the availability and access to chances to acquire these abilities. Inequalities in access to technology and digital education remain, especially influencing underprivileged people and places with fewer resources [6]. This inequality provides a significant challenge: ensuring that all persons, regardless of their socioeconomic background, have the required chances to learn and perfect digital skills. Without bridging this divide, we risk continuing and deepening existing inequities, creating a digitally fractured society. In the educational area, the efficient integration of digital skills in the curriculum continues to be a matter of controversy. Many school systems have started to include these capabilities into their curriculum, although the implementation and quality of digital education vary greatly. Teaching digital skills should not just concentrate on the technical usage of technologies, but also on building a critical knowledge of how these tools effect society and daily life [7]. Critical digital literacy is essential to prepare students not only to use technology effectively but also to navigate a complex and often confusing digital landscape. Furthermore, digital skills are not restricted to technical competence; they also involve soft skills such as problem-solving, critical thinking, and the capacity to cooperate in virtual spaces. These interpersonal skills are increasingly valued in a work environment that is characterized by online collaboration and remote communication [8]. The ability to work effectively in geographically dispersed teams, manage conflicts on digital platforms, and use collaborative tools is critical to success in the contemporary labor market.

The impact of digital skills also extends to personal lives, influencing the way we interact with the world. From managing our finances to the way, we access information and services, digital skills play an increasingly vital part in daily life. This pervasiveness of technology in our daily lives reinforces the need for strong digital literacy that allows people to make the most of the opportunities available and protect themselves from the associated risks. The discussion about the need for digital skills also raises issues about the future of labor and education. Automation and artificial intelligence are rapidly transforming the job landscape, creating new opportunities but also displacing some traditional jobs [9]. In this setting, digital skills are emerging as a fundamental prerequisite to adapt to changes and remain relevant in a continuously developing work market. Finally, public policies and educational strategies must adapt to this changing reality. Governments and educational institutions must collaborate to design and implement programs that not only teach basic digital skills but also prepare people for future challenges. This involves investing in technological infrastructure, training educators and ensuring that all individuals have access to learning and development opportunities in the digital sphere.

Digital skills are more than a collection of technical competencies; they are an integral part of modern life that influences our ability to fully participate in 21st century society and economy. As we move towards an increasingly digitalized future, we must address inequalities in access, integrate digital education effectively and prepare people to meet the challenges and opportunities that technology offers us. This holistic and equitable approach is essential to building a more inclusive society prepared for the digital future.

2.2. SWOT Analysis.

SWOT analysis is a vital method to assess the position of an organization or project, by evaluating both its internal qualities (Weaknesses and Strengths) and external elements (Threats and Opportunities) in an orderly matrix. This process is divided into four key stages: the evaluation of the external environment, the internal analysis, the construction of the SWOT matrix and, finally, the formulation of strategies

to follow. An organization's ability to survive and thrive is closely linked to its environment, which offers both opportunities and challenges. These factors are the crucial components of the external analysis. Internally, the strengths and weaknesses of a company are strongly tied to its internal management. Each of these four elements can be classified as positive or negative. Opportunities, which are favorable factors in the environment, can be exploited to promote growth, while threats, which represent external risks, must be managed with specific strategies to mitigate them. Internally, weaknesses are negative aspects that need to be addressed through effective management, while strengths are positive characteristics that must be leveraged and enhanced. The SWOT analysis examines aspects such as the availability of financial resources, personnel, assets, product quality, organizational structure and consumer perception. The findings of this study are grouped in a matrix and assessed by specialists, whose combined judgment offers a clear image of the most suited plans and tactics for the organization or project[9].

Here are the technical elements that make up each of these categories[10]:

1. Strengths

Positive Internal Features :

Resources and Capabilities: Human, financial, technological, and physical resources that provide a competitive advantage. This includes highly qualified personnel, advanced technology, and a solid customer base.

Key Competencies: Special skills and capabilities that allow the organization to perform better than the competition, such as efficient processes, innovations or effective methodologies.

Reputation and Brand: Positive market perception, brand recognition, and a strong reputation that may attract customers and talent.

Relationship Network: Strategic alliances, contact networks, and partnerships with suppliers and partners that give assistance and benefits in the market.

2. Weaknesses

Negative Internal Features:

Resource Limitations: A scarcity of financial, technical, or human resources that restricts the organization's capacity to run effectively or invest in opportunities.

Capability Gaps: Areas in which the organization has gaps, such as lack of expertise in important areas, technology inadequacies, or inefficient procedures.

Reputation difficulties: Negative market views, poor customer satisfaction, or quality difficulties that might affect the organization's image.

Reliance on Suppliers or Clients: Risks associated with excessive reliance on specific suppliers, clients, or markets, which may undermine stability and adaptability.

3. Opportunities

Positive External Factors:

Market Trends: Changes in the market that give new possibilities, such as expansion in a certain industry, increasing demand goods or services, or new consumer wants.

Technological Advances: Technological advances that may be utilized to enhance operations, produce new products, or enter new markets.

Regulatory Changes: New laws or government policies that may give competitive benefits, such as subsidies, tax incentives, or regulatory changes that assist business.

Collaborations and Alliances: Opportunities to develop strategic alliances with other firms, extend distribution networks, or enter new markets.

4. Threats

Negative External Factors:

Competition: The existence of strong rivals that may affect market share, cut prices, or provide new goods or services that threaten the business.

Economic Changes: Unfavorable economic circumstances, such as recessions, swings in exchange rates, or inflation that may influence financial stability.

Technical Risks: Threats connected to technical obsolescence, cybersecurity, or fast technological progress that may surpass the organization's capacity to respond.

Regulatory Issues: Changes in regulation that may impose new limitations, raise compliance costs, or create obstacles to market entrance.

Application of SWOT Analysis

Data Collection: Gather useful information about the company and its surroundings, both internal and external.

Evaluation: Analyze and categorize the obtained data into the four SWOT categories.

Strategy Development: Use information from the analysis to design plans that optimize strengths, reduce weaknesses, exploit opportunities, and mitigate dangers.

Implementation and Monitoring: Implement the stated strategy and regularly monitor the SWOT elements to make modifications as required.

SWOT analysis gives a complete picture of the internal and external aspects that might impact the performance of a business, helping to design educated and successful plans.

PEST Analysis

PEST analysis focuses on examining the external elements that impact an organization, breaking them down into four essential components: Political, Economic, Social, and Technological. This method gives a knowledge of how government rules, economic situations, sociocultural trends, and technical developments impact an organization. For example, political considerations may include environmental legislation, antitrust rules, and government stability. Economic factors cover the elements that affect the market, such as interest rates and currency changes. Regarding sociocultural aspects, consumer tastes and behaviors are evaluated, whereas technical factors concentrate on the creation and implementation of new technological advancements. The PEST-SWOT technique combines PEST analysis with SWOT in two key phases. The first step comprises a detailed review of external issues under the political, economic, social and technical aspects. The second stage applies the concepts of SWOT analysis to assess the internal aspects of the firm. By merging these two methodologies, a full and thorough perspective of the company environment is achieved. This enables for the exact identification of external possibilities and threats, as well as internal strengths and weaknesses, helping the design of more effective and comprehensive plans for the growth and sustainability of the firm[9,10].

The technological pieces that make up each of these criteria are outlined below[11]:

1. Political

Regulations and Legislation: Laws and regulations that may influence the functioning of the company, such as labor standards, environmental rules, tax laws and trade policies.

Political Stability: The degree of political stability or instability in the country or region that can influence the predictability of the business environment.

Government Policies: Government initiatives, subsidies, incentives or support programs that may affect the organization's operations and strategies.

International Relations: Treaties, trade agreements and diplomatic relations that may affect international trade and investments.

2. Economical

Macroeconomic Conditions: Factors such as economic growth, inflation rates, interest rates and business cycles that affect the overall economy.

Fiscal and Monetary Policy: Government decisions on taxes and monetary policies that can influence the availability of resources and the cost of capital.

Exchange Rate: Fluctuations in the value of the local currency compared to foreign currencies, which affect international operations and costs.

Income Level and Wealth Distribution: Factors that affect the purchasing power of consumers and the demand for products and services.

3. Social

Demographics: Data about the population, including age, gender, family structure, and regional distribution, that may affect the target market and customer wants.

Cultural Attitudes and Behaviors: Values, beliefs and behaviors that determine customer preferences and acceptance of goods or services.

Degree of Education and Training: The degree of education and skills of the workforce, which might affect the availability of talent and competitiveness in the market.

Societal Trends: Changes in societal attitudes, such as worries about sustainability, diversity and equality, which might influence market expectations.

4. Technological

Technological Innovations: Advances and advances in technology that may give new possibilities or bring risks to the company.

Technology Infrastructure: Availability and quality of technology infrastructures, such as communication networks, computer systems and digital platforms.

Technology acceptance: The rate of acceptance and application of new technologies by consumers and industry, which may affect competitiveness and efficiency.

Research and Development (R&D): Level of investment in research and development that may generate innovation and ongoing improvement of goods and processes.

These technical parts of PEST analysis assist detect and analyze external issues that might affect an organization's operation and strategy, allowing for better informed and adaptable planning.

Basic concepts about neutrosophic.

Unlike traditional PEST-SWOT methods, in this work the evaluations are carried out based on Triangular Neutrosophic Numbers of Single Value. Below are the fundamental explanations on this topic.

Definition 1 ([12]) : The neutrosophic set Nis characterized by three membership functions, which are the truth membership function T_A, the indeterminacy membership functionI_A and membership function to falsehood F_A, where Uis the Universe of Discourse and $\forall x \in U$, $T_A(x), I_A(x), F_A(x) \subseteq]\bar{}_A 0, 1^+[$, and $\bar{}_A 0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3^+$.

See that by definition, $T_A(x), I_A(x)$and $F_A(x)$are standard or non-standard real subsets of $]\bar{}_A 0, 1^+[$and, therefore, $T_A(x), I_A(x)$and $F_A(x)$can be subintervals of $[0, 1]$. $\bar{}_A 0$and1^+ They belong to the set of hyperreal numbers.

Definition 2 ([13]) : The single-valued neutrosophic set $F_A: U \to [0, 1]$(SVN N) Ais U, $T_A: U \to [0, 1]$where $A = \{< x, T_A(x), I_A(x), F_A(x) > : x \in U\}$and $I_A: U \to [0, 1]$. $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$.

The single-valued neutrosophic number (SVN N) is symbolized by

$N = (t, i, f)$, such that $0 \leq t, i, f \leq 1$and $0 \leq t + i + f \leq 3$.

Definition 3 ([14]) : The single- $\tilde{a} = \langle(a_1, a_2. a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}}\rangle$valued triangular neutrosophic number , , is a neutrosophic set in $\mathbb{R}$, whose membership functions of truth, indeterminacy and falsity are defined as follows:

$$T_{\tilde{a}}(x) = \begin{cases} \alpha_{\tilde{a}}\left(\frac{x-a_1}{a_2-a_1}\right), a_1 \le x \le a_2 \\ \alpha_{\tilde{a}}, x = a_2 \\ \alpha_{\tilde{a}}\left(\frac{a_3-x}{a_3-a_2}\right), a_2 < x \le a_3 \\ 0, \text{otherwise} \end{cases} \quad (1)$$

$$I_{\tilde{a}}(x) = \begin{cases} \frac{(a_2-x+\beta_{\tilde{a}}(x-a_1))}{a_2-a_1}, a_1 \le x \le a_2 \\ \beta_{\tilde{a}}, x = a_2 \\ \frac{(x-a_2+\beta_{\tilde{a}}(a_3-x))}{a_3-a_2}, a_2 < x \le a_3 \\ 1, \text{otherwise} \end{cases} \quad (2)$$

$$F_{\tilde{a}}(x) = \begin{cases} \frac{(a_2-x+\gamma_{\tilde{a}}(x-a_1))}{a_2-a_1}, a_1 \le x \le a_2 \\ \gamma_{\tilde{a}}, x = a_2 \\ \frac{(x-a_2+\gamma_{\tilde{a}}(a_3-x))}{a_3-a_2}, a_2 < x \le a_3 \\ 1, \text{otherwise} \end{cases} \quad (3)$$

Where$\alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \in [0,1]$,$a_1,\ a_2, a_3 \in \mathbb{R}$ and $a_1 \le a_2 \le a_3$.

Definition 4 ([15]): Given$\tilde{a} = \langle(a_1, a_2, a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}}\rangle$ and$\tilde{b} = \langle(b_1, b_2, b_3); \alpha_{\tilde{b}}, \beta_{\tilde{b}}, \gamma_{\tilde{b}}\rangle$ two triangular neutrosophic numbers of a single value andλ any non-zero number on the real line. Then, the following operations are defined:

1. Addition: $\tilde{a} + \tilde{b} = \langle(a_1 + b_1, a_2 + b_2, a_3 + b_3); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle$,

2. Subtraction: $\tilde{a} - \tilde{b} = \langle(a_1 - b_3, a_2 - b_2, a_3 - b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle$,

3. Investment: $\tilde{a}^{-1} = \langle({a_3}^{-1}, {a_2}^{-1}, {a_1}^{-1}); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}}\rangle$, where $a_1, a_2, a_3 \neq 0$.

4. Multiplication by a scalar number:

$$\lambda\tilde{a} = \begin{cases} \langle(\lambda a_1, \lambda a_2, \lambda a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}}\rangle, \lambda > 0 \\ \langle(\lambda a_3, \lambda a_2, \lambda a_1); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}}\rangle, \lambda < 0 \end{cases}$$

5. Division of two triangular neutrosophic numbers:

$$\frac{\tilde{a}}{\tilde{b}} = \begin{cases} \left\langle \left(\frac{a_1}{b_3}, \frac{a_2}{b_2}, \frac{a_3}{b_1}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \right\rangle, a_3 > 0 \text{ and } b_3 > 0 \\ \left\langle \left(\frac{a_3}{b_3}, \frac{a_2}{b_2}, \frac{a_1}{b_1}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \right\rangle, a_3 < 0 \text{ and } b_3 > 0 \\ \left\langle \left(\frac{a_3}{b_1}, \frac{a_2}{b_2}, \frac{a_1}{b_3}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \right\rangle, a_3 < 0 \text{ and } b_3 < 0 \end{cases}$$

6. Multiplication of two triangular neutrosophic numbers :

$$\tilde{a}\tilde{b} = \begin{cases} \langle (a_1 b_1, a_2 b_2, a_3 b_3); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, \ a_3 > 0 \text{ and } b_3 > 0 \\ \langle (a_1 b_3, a_2 b_2, a_3 b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, a_3 < 0 \text{ and } b_3 > 0 \\ \langle (a_3 b_3, a_2 b_2, a_1 b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, a_3 < 0 \text{ and } b_3 < 0 \end{cases}$$

Where,∧ It's a norm∨ It is a conorm t[16, 17, 18].

2. Results and Discussion.

Key Factors in the Use of Digital Skills to Increase Learning.

Enabling Digital Education Policies (P1): Government policies that support the use of digital technology in education enable the integration of digital skills in learning.

Educational Technology Grants (P2): Funding for the procurement of digital tools and digital skills training may speed the deployment and effective use of technology.

Educated Teaching Staff (F1): A teaching team effectively educated in the use of digital technology may increase the quality of learning and the adoption of digital tools.

Access to Advanced Digital technologies (F2): The availability of new digital technologies helps students to explore and learn in a more interactive and customized manner.

High Student enthusiasm (F4): Students' interest and enthusiasm in adopting digital technology may lead to higher commitment and engagement in learning.

Expansion of Digital Skills Training Programs (O1): The construction of training and training programs in digital skills equips students and instructors with the essential capabilities to make the most of technology.

Creation of New Educational Digital Tools (O3): Innovation in the creation of digital tools may give new chances to enhance the quality and efficacy of learning.

Access to Online Learning Platforms (T2): Online platforms give access to a broad variety of educational materials and support flexible and remote learning.

Obstacles Requiring Attention and Consideration

Teacher reluctance to Technology (D1): The lack of acceptance or reluctance of certain instructors to incorporating technology into their teaching techniques might restrict the beneficial effect of digital skills.

Insufficient Technological Infrastructure (D2): Lack of proper infrastructure, such as computers, networks and maintenance might hinder the efficient use of digital technologies.

Lack of Resources for ongoing Training (D3): The lack of resources for ongoing training in digital skills for instructors might lead to ineffective deployment of technology.

Gaps in Digital Skills among Students (D4): Differences in digital skills among students may cause disparities in access and usage of digital resources.

Cybersecurity and Privacy Risks (A1): Data protection and internet security are critical to avoid vulnerabilities and secure student information.

Inequality in Access to Technology (A2): Differences in access to gadgets and internet connections between students from various socioeconomic backgrounds may produce discrepancies in learning.

Rapid Obsolescence of Digital Tools (A3): The pace with which digital technologies progress may lead instructional tools to soon become outdated, needing regular upgrades.

Changes in Government policy (A4): Alterations in educational policy or government financing may influence the continuation and extension of digital efforts in education.

These characteristics and barriers give a complete picture of the important aspects that affect the application and efficacy of digital skills in learning, as well as the issues that must be addressed to optimize the beneficial impact.

The research focuses on analyzing how the usage of digital skills effects the rise in learning in an educational institution. To achieve this, specialists were contacted and specialized literature was studied. The elements highlighted for the SWOT and PEST study include the following:

Identified Factors

1. PEST Analysis:

Political:

P1: Favorable digital educational policy.

P2: Government funding for educational technologies.

P3: Regulations on student data protection.

P4: Changes in educational legislation.

Economic:

E1: Budget for digital skills training.

E2: Cost of deployment of digital tools.

E3: Economic advantages of boosting educational efficiency.

E4: Investment in technology infrastructure.

Social:

S1: Students' attitude towards the usage of technology.

S2: Level of digital literacy of pupils.

S3: Digital participation in various socioeconomic categories.

S4: Parents' perspective on digital learning.

Technological:

T1: Availability of modern instructional software.

T2: Access to online learning systems.

T3: Training of teaching personnel in digital technologies.

T4: Advances in adaptive learning technology.

2. SWOT Analysis:

Strengths:

F1: Teaching personnel skilled in educational technology.

F2: Access to powerful digital tools.

F3: Innovative teaching approaches.

F4: High motivation of pupils for the use of technology.

Weaknesses:

D1: Resistance of certain instructors to technology.

D2: Insufficient technical infrastructure.

D3: Lack of resources for continual training.

D4: Gaps in digital abilities among pupils.

Opportunities:
O1: Expansion of training programs in digital skills.
O2: Collaborations with technological businesses.
O3: Development of innovative instructional digital technologies.
O4: Increased interest in online and remote education.
Threats:
A1: Cybersecurity and data privacy threats.
A2: Inequality in access to technology among pupils.
A3: Rapid obsolescence of digital tools.
A4: Changes in government policy that impact finance.
Neutrosophic Evaluation

Linguistic phrases were employed to analyze combinations of external and internal elements. The language words and their single-valued triangular neutrosophic values (SVTNN) are as follows:

Table 4. Linguistic terms for evaluations and their associated SVTNNs. See [14-17].

Term	SVTNN Associate
Very Low (VL)	〈 (0,0,1);0.00,1.00,1.00 〉
Low (L)	〈 (0,1,3);0.17,0.85,0.83 〉
Medium Low (MDL)	〈 (1,3,5);0.33,0.75,0.67 〉
Medium (M)	〈 (3,5,7);0.50,0.50,0.50 〉
Medium High (MDH)	〈 (5,7,9);0.67,0.25,0.33 〉
Height (H)	〈 (7,9,10);0.83,0.15,0.17 〉
Very High (VH)	〈 (9,10,10);0.00,1.00,1.00 〉

Combination Evaluation
The experts gave the following evaluations:

- **Opportunities + Strengths (SO):**

Opportunities	**O1**	**O2**	**O3**	**O4**
Strengths	F1	F2	F3	F4
Worth	h	V.H.	h	V.H.

- **Threats + Strengths (ST):**

Threats	**A1**	**A2**	**A3**	**A4**
Strengths	F1	F2	F3	F4
Worth	MDH	h	MDH	MDH

- **Weaknesses + Opportunities (WO):**

Weaknesses	**D1**	**D2**	**D3**	**D4**
Opportunities	O1	O2	O3	O4
Worth	CDM	CDM	CDM	CDM

- **Weaknesses + Threats (WT):**

Weaknesses	**D1**	**D2**	**D3**	**D4**
Threats	A1	A2	A3	A4
Worth	V.H.	h	h	MDH

Calculations

Specifically, there are the following sets:
$W = \{W_1, W_2\}$ denotes the set of Weaknesses,
$S = \{S_1, S_2, S_3\}$denotes the set of Strengths,
$T = \{T_1, T_2, T_3, T_4, T_5, T_6, T_7\}$denotes the set of Threats,
$O = \{O_1, O_2, O_3, O_4, O_5\}$denotes the set of Opportunities.

The steps are as follows:

1. Each expert was asked to evaluate the possible combinations between the elements of SO, ST, WO and WT. This evaluation is carried out in terms of how the development and implementation of a multi-platform mobile application in the gastronomic sector would have a socioeconomic impact.
2. Linguistic terms are replaced by the equivalent single-valued triangular neutrosophic numbers (SVTNN) in Table 4.

3. A single SVTNN is obtained by calculating the median of the SVTNNs of all experts for each pair of items.
4. The arithmetic mean of the SVTNN is calculated for each quadrant SO, ST, WO and WT.
5. The final result of each quadrant is converted to a crisp value using precision Equation 4. This converts them into values on a numerical scale out of 10 that allows the results to be compared.

$$A(\tilde{a}) = \frac{1}{8}[a_1 + a_2 + a_3](2 + \alpha_{\tilde{a}} - \beta_{\tilde{a}} + \gamma_{\tilde{a}}) \quad (4)$$

Step 1: Calculate the median of the SVTNN for each combination.
Step 2: Convert the neutrosophic values to sharp values using Equation 4.

- **For OS:**

Values for OS:

- ✓ O1 + F1: 〈 (7,9,10);0.67,0.25,0.33 〉
- ✓ O2 + F2: 〈 (9,10,10);0.00,1.00,1.00 〉
- ✓ O3 + F3: 〈 (7,9,10);0.67,0.25,0.33 〉
- ✓ O4 + F4: 〈 (9,10,10);0.00,1.00,1.00 〉

Average: 〈 (8,9.5,10);0.17,0.75,0.67 〉

Step 3: Convert to numerical scale (max 10):

Value =(8+9.5+10)/3=9.17

- **For ST:**

- ✓ A1 + F1: 〈 (5,7,9);0.67,0.25,0.33 〉
- ✓ A2 + F2: 〈 (7,9,10);0.83,0.15,0.17 〉
- ✓ A3 + F3: 〈 (5,7,9);0.67,0.25,0.33 〉
- ✓ A4 + F4: 〈 (5,7,9);0.67,0.25,0.33 〉

Average: 〈 (5.5,7,9);0.67,0.25,0.33 〉

Value= (5.5+7+9) /3=7.17

- **For WO:**

- ✓ D1 + O1: 〈 (1,3,5);0.33,0.75,0.67 〉
- ✓ D2 + O2: 〈 (1,3,5);0.33,0.75,0.67 〉
- ✓ D3 + O3: 〈 (1,3,5);0.33,0.75,0.67 〉

- ✓ D4 + O4: 〈 (1,3,5);0.33,0.75,0.67 〉

Average: 〈 (1,3,5);0.33,0.75,0.67 〉

Value =(1+3+5)/3=3.00

For WT:

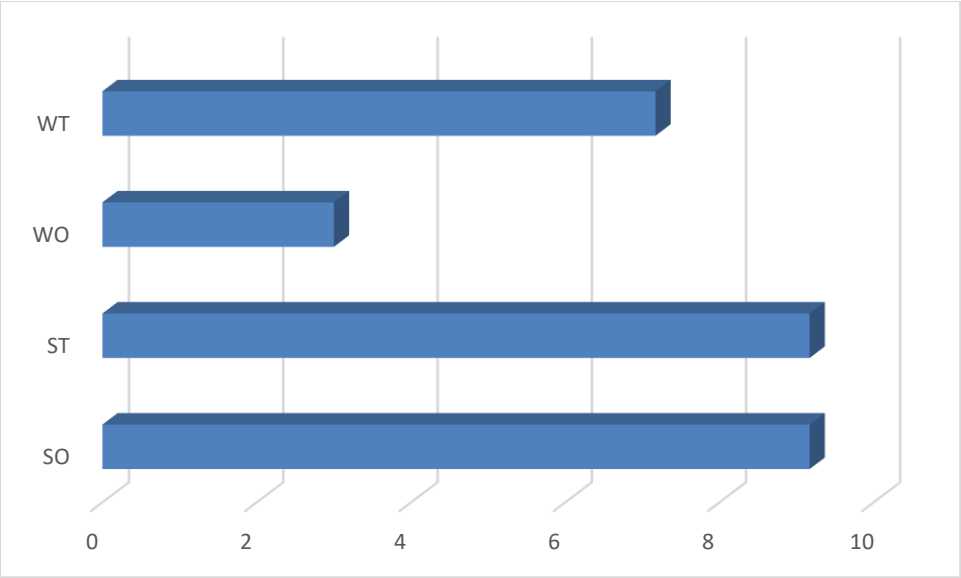
- ✓ D1 + A1: 〈 (5,7,9);0.67,0.25,0.33 〉
- ✓ D2 + A2: 〈 (7,9,10);0.83,0.15,0.17 〉
- ✓ D3 + A3: 〈 (5,7,9);0.67,0.25,0.33 〉
- ✓ D4 + A4: 〈 (5,7,9);0.67,0.25,0.33 〉

Average: 〈 (5.5,7,9);0.67,0.25,0.33 〉

Value =(5.5+7+9)/3=7.17

Results

- ➢ OS (Opportunities + Strengths): 9.17
- ➢ ST (Threats + Strengths): 7.17
- ➢ WO (Weaknesses + Opportunities): 3.00
- ➢ WT (Weaknesses + Threats): 7.17



Graph 1: Results.

The results suggest that the use of digital skills has a high potential for positive impact on learning (SO = 9.17), but also faces important challenges related to the identified weaknesses and threats (WO = 3.00, WT = 7.17). It is recommended to prioritize the improvement of technological infrastructure and continuous training to maximize the benefits of digital learning. Additionally, threats and weaknesses must be addressed to ensure effective and equitable implementation.

This analysis provides a solid basis for making strategic decisions about the integration of digital skills in the educational environment, considering both opportunities and strengths as well as weaknesses and threats.

Conclusion

This research has revealed that the usage of digital skills has tremendous potential to change and improve the learning process. The findings demonstrate that whereas digital skills may considerably increase educational efficiency, they also provide considerable obstacles relating to the highlighted weaknesses and dangers. Among these issues are the deficiency in technology infrastructure and the necessity for continual training for instructors, which might restrict the usefulness and reach of digital technologies in the educational sphere. The practical significance of these results is clear by stressing the need to prioritize improvement in the crucial areas discovered. It is vital to develop in the modernization of technology infrastructure and in the continual training of educational workers to ensure that the usage of digital skills translates into practical advantages for the learning process. Addressing these concerns will lead to a more equal and successful incorporation of digital technology in education. This research provides a vital addition to the area of digital education by presenting a complete examination of the variables influencing the implementation and usage of digital skills. By evaluating strengths, weaknesses, opportunities and dangers, it offers a strong platform for designing informed and successful strategies in integrating technology into the educational environment. Furthermore, it presents a complete viewpoint that might serve as a reference for future study in this field. However, the research had certain drawbacks. The examination focuses on a particular study of digital abilities and may not capture all the intricacies of their influence in varied educational environments. Furthermore, subjectivity in the identification and analysis of vulnerabilities and threats might affect the generality of the findings. For future study, it would be good to examine other approaches that complement the present analysis, such as longitudinal studies or comparative research in various educational environments. Expanding the scope of the research to varied individuals and circumstances might give a more thorough and generalizable insight on the impacts and limitations of applying digital skills in learning. The ongoing assessment and adaption of digital initiatives will be vital to enhance their efficacy and provide excellent education in the digital era.

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References

[1]. Yasir , M. Zafar, A. Anas , M. (2023). Implementation and execution of NEP-2020: a study conducted using neutrosophic PESTEL analysis. Journal of International Journal of Neutrosophic Sciences, 20 (2), 86-106.

[2]. AR Medina Gamero , "Computer skills: a challenge in the school context", Educação . Dutor (print), vol. 21, no. 6, p. 411-412, 2020.

[3]. L. Meroño , A. Calderón and JL Arias-Estero, "Digital pedagogy and collaborative learning : Effects nocontents two counts technologies and pedagogics and non-performance of learning

em originalis Tablets de formação de Teachers ", Revista de Psychodidactica , vol. 26, no. 1 pp. 53–61, 2021.

[4]. S. Moll, "The five pillars of education in digital competence and their objectives", EDUCAÇÃO 3.0. [A straight line]. Available at: https://www.educaciontrepuntocero.com/noticias/competencia-digital-docente/.

[5]. Luzardo Martínez, H. J., Molina Gutiérrez, T. de J., & Lizcano Chapeta, C. J. (2024). Método neutrosófico para la evaluación de los requerimientos de los estudiantes de Educación Superior para el éxito del aprendizaje en línea. Neutrosophic Computing and Machine Learning, 34, 175–183.

[6]. L. Saikkonen and M.-T. Kaarakainen , "Multidimensional analysis of teachers' digital computing skills: the importance of available resources," Computing and Education, vol. 168, no. 1 pp. 104206, 2021. [

[7]. M. San Nicolas, E. Fariña Vargas and M. Area Moreira, "Digital skills of teachers and students in the development of virtual learning. Sunset of the University of La Laguna", Revista História da Educação Latino- americana, vol. 14, no. 19, p. 227-245, 2012..

[8]. UNESCO, "Global Education Coalition to Fight COVID-19", 2020. [Online]. Available at: https://es.unesco.org/covid19/globaleducationcoalition.

[9]. UNESCO, "Guidelines for distance education during the coronavirus emergency", 2020. [Online]. Available at: https://news.un.org/es/story/2020/03/1471342.

[10]. Yusuf , M., Saiyed , R., & Sahala , J. (December 2022). SWOT analysis in the development of the relationship marketing program. In Proceedings of the International Conference on Economics and Business (Vol. 1, No. 2, pp. 573-588).

[11]. Longsheng , C., Shah , S.A.A., Solangi , Y.A., Ahmad, M., & Ali, S. (2022). A multi-criteria integrated SWOT analysis on the implementation of sustainable waste-to-energy in Pakistan. Renewable Energy, 195, 1438-1453.

[12]. Pupo, I. P., Pérez, P. Y. P., Vacacela, R. G., Bello, R., Santos, O., & Vázquez, M. Y. L. (2018). Extensions to Linguistic Summaries Indicators based on Neutrosophic Theory, Applications in Project Management Decisions. Neutrosophic Sets and Systems, 87.

[13]. Saqlain, M., Riaz, M., Saleem, M. A., & Yang, M. S. (2021). Distance and similarity measures for neutrosophic hypersoft set (NHSS) with construction of NHSS-TOPSIS and applications. Ieee Access, 9, 30803-30816. Benzaghta , M.A., Elwalda , A., Mousa , M.M., Erkan , I., and Rahman , M. (2021). Applications of SWOT analysis: An integrative review of the literature. Journal of Global Business Insights , 6(1), 54-72.

[14]. Ortega, R. G., Rodríguez, M., Vázquez, M. L., & Ricardo, J. E. (2019). Pestel analysis based on neutrosophic cognitive maps and neutrosophic numbers for the sinos river basin management. Neutrosophic Sets and Systems, 26(1), 16.Batista- Hernández, N., Vega, JAF, Cuzco, NEU and Merchán, MMF (2020). Neutrosophic Method for making decisions on procedure of tender for the acquisition of goods and services in public procurement. Neutrosophic Computing and Machine Learning, 11, 1-8

[15]. Yang, W., Cai, L., Edalatpanah, S. A., & Smarandache, F. (2020). Triangular single valued neutrosophic data envelopment analysis: application to hospital performance measurement. Symmetry, 12(4), 588.

[16]. Saha, A., Deli, I., & Broumi, S. (2020). Hesitant triangular neutrosophic numbers and their applications to MADM. Neutrosophic Sets and Systems, 35, 269-298.

[17]. Mathivadhana, E. (2024). Modified Non-Linear Triangular Neutrosophic Numbers: Theory and Applications in Integral Equation. Neutrosophic Sets and Systems, 72(1), 20.

[18]. Kumar, M., Singh, S. B., & Khati, A. (2024). Triangular neutrosophic set and its application to reliability analysis of gas turbine system. *International Journal of System Assurance Engineering and Management*, 1-14.

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