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INVESTIGATING THE CHALLENGES AND OPPORTUNITIES OF IMPLEMENTING EMERGING TECHNOLOGIES IN THE FIELD OF EDUCATION AND THEIR IMPACT ON STRATEGIC LEADERSHIP

Christopher Dordi[1*], Prof. Dr. Ansari Ebrahim[2]

[1]Banasthali Vidyapith Email - Christopher.Dordi@Outlook.Com*
[2]Supervisor Ansari.Ebrahim@Excellanzeducation.Org

Corresponding Author:
Email id: Christopher.Dordi@Outlook.Com

Abstract- *Emerging technologies (ET), such as artificial intelligence, virtual reality, and augmented reality, have the potential to transform the field of education. However, the implementation of these technologies poses significant challenges to educational institutions and their leaders. The primary objective of this research is to identify the most significant barriers and advantages of adopting new technologies in education, as well as to determine how strategic leadership (SL) can effectively leverage technology to enhance student outcomes. The study employed a quantitative research design, and data were collected from 445 participants using a questionnaire. The SPSS tool was utilized to analyze the collected data. The findings of this study suggest that while ET in education offers significant opportunities, such as improving student engagement (SE), accessibility, and learning outcomes, there are also significant challenges associated with their implementation. These include lack of funding, inadequate infrastructure, resistance to change, and insufficient professional development opportunities. Moreover, the results indicate that SL plays a vital role in successful technology adoption in education. Leaders who possess the necessary skills and knowledge to integrate technology into the curriculum, provide adequate training for teachers and staff, and allocate sufficient resources are more likely to achieve positive outcomes.*

Keywords: *Strategic Leadership, Emerging Technology, Adaptive Learning Programs, Innovative Development, Learning Experience, Student Engagement*

1. INTRODUCTION

In recent years, ET has been transforming the field of education, providing new opportunities for teaching and learning [1] [2] [3]. From artificial intelligence to virtual and augmented reality, technology is changing the way we approach education, and it is becoming increasingly clear that educational institutions must adapt to remain competitive and effective. However, this transformation is not without its encounters. The purpose of this paper is to explore the challenges and opportunities of implementing ET in the field of education and their impact on SL. We will explore the benefits of these technologies, such as "increased access to education and more personalized learning experiences, as well as the challenges, including the cost of implementation and the need for ongoing training and support for educators". The integration of ET into education has the potential to revolutionize how we approach teaching and learning [4] [5] [6] [7]. With the use of artificial intelligence and machine learning, educational institutions can provide more personalized learning experiences for students. Students can benefit from adaptive learning programs that adjust to their learning style, pace, and level of understanding. This approach allows for more efficient use of time and resources, as students can focus on the areas that require the most attention.

Virtual and augmented reality can also provide a more immersive learning experience, allowing students to visualize and interact with concepts and ideas in innovative and appealing ways [8] [9] [10] [11] [12] [13]. For example, students can explore historical sites or science labs without leaving the classroom, making education more accessible to students who might not have had the opportunity to travel or experience these environments in person. Despite the benefits, the integration of ET into education also poses significant challenges. One of the main obstacles is the cost of implementation. Many schools and educational institutions operate on tight budgets, and the cost of purchasing and maintaining these technologies can be prohibitive. Additionally, educators must be trained and supported to effectively integrate these technologies into their teaching practice. The rapid pace of technological change means that unending professional expansion is crucial to guarantee educators can stay up to date with the latest developments [14] [15]. Furthermore, the implementation of ET requires a strategic approach to leadership. Educational leaders must be proactive in identifying the technologies that will have the most significant impact on their students and school culture. They must also be willing to invest in the necessary resources and provide ongoing support to educators to confirm the efficacious implementation of these technologies. The contribution of this paper is,

- To identify the challenges and opportunities of implementing ET in education, informing successful technology adoption strategies.
- To highpoint the importance of SL in maximizing the benefits of ET in education, providing insights into enhancing student outcomes and organizational performance.

The paper is structured into six sections: Section 2 provides a comprehensive review of the literature on the integration of ET in education. Section 3 outlines the research problem and research questions that the investigation aims to address along with the hypotheses that will be tested to answer the research questions. Section 4 provides the results of the investigation and their discussion. Section 5 completes the research.

2. LITERATURE REVIEW

Cortes and Herrmann, 2021 [16] suggested a structure to guide subsequent studies on this serious subject and describe how prevailing theories rely on discretionary or architectural mechanisms to elucidate strategic leaders' influence on innovation. The present investigation that links strategic leaders to specific phases of the innovation process is also examined. The involvement of the internal and external environments in mediating these relationships has been mentioned, as well as "an overview and critique of theoretical and methodological issues". The paper has proposed several research avenues and discusses how specific framework recommendations can subsidize a comprehensive understanding of strategic leaders' inspiration for innovation.

Sullivan, *et al.* 2018 [17] proposed Industrial ecology (IE) as a method for providing the required concepts and methods. The objective of this article is to investigate the relevance of IE and business strategy for the SDGs, as well as to demonstrate how commercial organizations can make positive contributions to the SDGs whilst also gaining a competitive advantage. Textual analysis software is employed in economic analysis to overcome the "fields of industrial ecology, business strategy, and sustainable development".

Teece, 2019 [18] established a complex and subtle strategic management method for comprehending how companies are "created, organized, and grow, as well as how those who innovate and compete, based on economic principles". The theoretical foundation known as 'dynamic capabilities' has indeed been presented, and comparisons are made between "dynamic capabilities and other approaches to firm theory, such as transaction cost economics and agency theory". The application of functionality does have the potential to provide a rich and detailed conceptual knowledge of the nature of the commercial company and its management, which itself is coherent with developmental and cognitive economics.

Ullah, *et al.* 2022 [19] In SPSS, regression analysis has been carried out by employing the Andrew Hayes Process macros. The study's population has been restricted to a single city, where the majority of the industries have been located. The research contributes significantly to our understanding of the relationship between KS and IP by highlighting the significance of encouraging EC in organizations. There has been a dearth of studies in this setting, as the recent theoretical model has not been considered previously in the setting of emerging economies at large, and very few investigations have been carried out in the instance of developed nations with completely different institutional setups.

Pilcicki, *et al.* 2021 [20] investigated the significance of constraints in virtual collaboration and whether they can add value to the creative process. The research has enabled the advancement of human-centered IT artifacts and IS research. It has made available CSS developers and users with two practical insights: first, developers should strategically design

and incorporate constraints into new technologies, and second, teams should intentionally apply constraints in their virtual collaboration.

Bhaskar, *et al.* 2021 [21] acknowledged the research questions on the description of blockchain technology in education, the technique used to investigate the technology, and the outcomes of its use in education systems. The results reveal blockchain technology's potential benefits, barriers, and current applications in education. The investigation has established a "foundation for educational institutions, policymakers, and researchers to investigate additional areas where blockchain technology may be utilized to achieve maximum its potential".

Lindqvist and Pettersson, 2019 [22] The objective of this research would have been to look into how school leaders interpret digitalization and the digital competencies required to direct digitalization in Swedish schools. The investigators collected data from 32 school leaders by inquiring open-ended research questions in critical reflection journals and conducting interviews. Following the findings, school leaders see digitalization as a complex concept encompassing a technical, pedagogical, administrative, and critical step in helping to improve at all levels of the school organization. The study highlighted the importance of delivering school leaders with time, resources, and professional development to successfully and effectively manage digitalization efforts in schools.

Vasiliev, 2021 [23] The practical and theoretical connection between academic excellence and competitiveness in university education has been researched. The study discovered several variables that received the highest ratings from all respondents, which would include "graduate salary growth, the total count of foreign students, the amount of extra-budgetary income, and the number of publications in indexed databases". The investigation additionally discovered extremely conservative numbers of the eminence of state participation in maintaining "university competitiveness and academic excellence".

Krasnostanova, *et al.* 2021 [24] established recommendations for having to manage the groundbreaking development of the region. The research methodology often includes theoretical and legal material analysis and synthesis, in addition to statistical data analysis. Statistical indicators designed to reflect the innovative development of the Odesa region and other Black Sea region regions were evaluated. The article described regional strategic management and innovative development conceptual frameworks, in addition to regional strategic management and innovative development tools.

Correani, *et al.* 2020 [25] intended to tackle the disconnect between both strategy formulation and implementation that businesses face throughout the digital transformation. The researchers concluded that a structured approach to strategy formulation and implementation has been considered necessary for successful digital transformation. The proposed framework could indeed assist businesses in implementing a digital transformation strategy and innovating their business model.

2.1 PROBLEM STATEMENT

ET has been speedily changing various industries, and the education sector is no exception. The integration of ET in the field of education has created new opportunities for enhancing the learning experience and has also presented several challenges for educators and educational leaders [26]. While there is a growing interest in the use of ET in education, there is limited research on the challenges and opportunities associated with their implementation and their impact on SL [27] [28]. This study aims to investigate the challenges and opportunities of implementing ET in the field of education and their impact on SL. The research questions will explore the ET being implemented in education, the associated challenges, and how they can be addressed. The study will also investigate the opportunities presented by ET and how they can be leveraged to enhance the learning experience. The study will further examine how the implementation of ET in education affects SL, and what implications this may have for educational leaders. The findings of this study are expected to contribute to the existing body of knowledge on ET in education, specifically on their challenges and opportunities and their impact on SL. The study can also provide educational leaders with insights into the best ways to implement ET to enhance the learning experience while addressing associated challenges. Ultimately, the study can inform the development of effective strategies for integrating ET into education and maximizing their potential for improving the quality of education.

3. RESEARCH METHODOLOGY

The objective of this investigation is to understand the challenges and opportunities associated with the implementation of ET in education, and how they can impact SL. It aims to develop recommendations for education leaders on how to effectively leverage ET to improve student outcomes and achieve strategic objectives. A structured questionnaire will be used to collect primary data through a random sampling technique.

3.1 Data Collection

The study will employ a quantitative method of data collection by designing and administering a structured survey questionnaire to a randomly selected sample, to investigate the challenges and opportunities of implementing ET in education and their impact on SL.

3.2 Research Objectives

The objectives of the research were shown below:

- To determine the level of emerging technology adoption in education institutions and their impact on SE.
- To examine the relationship between ET and AP in education.
- To investigate the combined effect of SE and AP on the effectiveness of SL in education.

- To identify the factors that can hinder or facilitate the adoption of ET in education institutions and their impact on SE and AP.
- To provide recommendations for education leaders on how to leverage ET to improve SE and AP, and how to effectively incorporate them into their SL plans.

3.3 Research Hypotheses

Hypothesis 1: There is no significant positive relationship between ET and SE.
Hypothesis 2: There is no significant positive relationship between ET and AP.
Hypothesis 3: There is no significant positive relationship between SL and SE.
Hypothesis 4: There is no significant positive relationship between SL and AP.
Hypothesis 5: There is a significant positive relationship between SL and the combined effect of SE and AP.

3.4 Research Framework

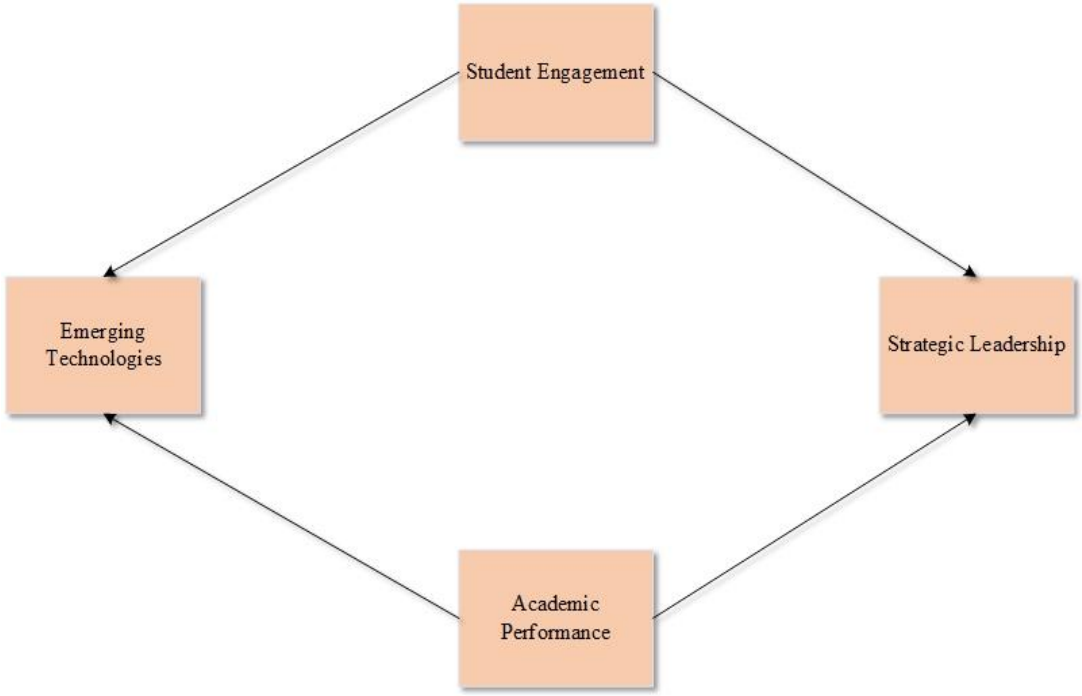

Figure 1: Framework of the research

The research framework consisting of SE, AP, SL, and ET has been shown in figure 1.

4. RESULTS AND DISCUSSION

4.1 Frequency Table

Table 1: Table on Frequency and Percentage

Factors	Frequency	Percent
Age		
20-30	126	28.3
31-40	161	36.2
41-50	115	25.8
above 50	43	9.7
Gender		
Male	126	28.3
Female	319	71.7
Qualification		
Teacher	316	71.0
Staff	129	29.0
How comfortable are you with using ET in your teaching or learning?		
3	32	7.2
4	196	44.0
5	217	48.8
How much do you think ET can improve the learning experience for students?		
2	3	0.7
3	18	4.0

4	217	48.8
5	207	46.5
How much potential do you think ET has for transforming education?		
2	1	0.2
3	19	4.3
4	219	49.2
5	206	46.3
How much do you think ET can bridge the achievement gap in education?		
3	27	6.1
4	201	45.2
5	217	48.8
How important do you think it is to provide training or professional development for educators to effectively use ET in education?		
3	35	7.9
4	194	43.6
5	216	48.5
How concerned are you about the ethical implications of using ET in education?		
3	19	4.3
4	230	51.7
5	196	44.0
How much do you think ET can help address the current challenges in education, such as SE and retention?		
2	2	.4
3	17	3.8
4	212	47.6
5	214	48.1
How accessible do you think ET is to students and educators from low-income backgrounds or in rural areas?		
3	21	4.7
4	196	44.0
5	228	51.2
How much have you faced challenges when trying to implement ET in education?		
3	25	5.6
4	197	44.3
5	223	50.1
What kind of impact do you think ET can have on SL in education?		
2	1	.2
3	17	3.8
4	227	51.0
5	200	44.9
How engaged do you think your students are in your classroom?		
2	2	.4
3	18	4.0
4	228	51.2
5	197	44.3
How effective do you think your teaching strategies are in keeping your students engaged?		
3	28	6.3
4	202	45.4
5	215	48.3
How often do you use technology to enhance SE in your classroom?		
3	30	6.7
4	191	42.9
5	224	50.3
How often do you use collaborative learning strategies to promote SE?		
3	18	4.0
4	238	53.5
5	189	42.5
How often do you provide opportunities for students to give feedback on their learning experiences?		
2	3	.7
3	17	3.8
4	217	48.8
5	208	46.7

How often do you incorporate real-world examples and applications into your lessons to increase SE?		
3	23	5.2
4	201	45.2
5	221	49.7
How often do you provide opportunities for student-led discussions and activities to increase SE?		
3	21	4.7
4	230	51.7
5	194	43.6
How often do you provide opportunities for student-led discussions and activities to increase SE?		
3	21	4.7
4	230	51.7
5	194	43.6
How often do you use gamification techniques (such as quizzes, badges, or rewards) to increase SE?		
3	34	7.6
4	205	46.1
5	206	46.3
How often do you provide opportunities for students to work on projects that relate to their interests to increase SE?		
3	39	8.8
4	189	42.5
5	217	48.8
How effective do you think your school's or district's policies and programs are in promoting SE?		
3	16	3.6
4	229	51.5
5	200	44.9
How satisfied are you with your students' overall AP?		
2	2	.4
3	16	3.6
4	210	47.2
5	217	48.8
How confident are you in your ability to identify and address learning gaps in your students?		
3	21	4.7
4	186	41.8
5	238	53.5
How effective do you think your teaching strategies are in improving your students' AP?		
3	24	5.4
4	207	46.5
5	214	48.1
How often do you provide personalized feedback to your students to help them improve their AP?		
2	3	.7
3	16	3.6
4	224	50.3
5	202	45.4
how often do you use data to inform your instructional decisions and improve your students' AP?		
2	2	.4
3	18	4.0
4	234	52.6
5	191	42.9
How often do you collaborate with other teachers to identify and address learning gaps and improve your students' AP?		
3	30	6.7
4	198	44.5
5	217	48.8
How often do you provide opportunities for your students to receive extra help or support outside of class to improve their AP?		
3	24	5.4
4	180	40.4
5	241	54.2
How often do you involve parents or guardians in discussions about their child's AP?		
3	16	3.6
4	242	54.4
5	187	42.0

How often do you incorporate formative assessment strategies (such as quizzes, exit tickets, or think-pair-share) into your lessons to monitor and improve your students' AP?		
3	22	4.9
4	185	41.6
5	238	53.5
How effective do you think your school's or district's policies and programs are in improving students' AP?		
3	20	4.5
4	230	51.7
5	195	43.8
How well do you think the leadership in your school or district communicates its vision and goals to staff and stakeholders?		
3	36	8.1
4	196	44.0
5	213	47.9
How well do you think the leadership in your school or district involves staff and stakeholders in decision-making processes?		
3	43	9.7
4	186	41.8
5	216	48.5
How well do you think the leadership in your school or district supports the professional growth and development of staff?		
3	18	4.0
4	230	51.7
5	197	44.3
How well do you think the leadership in your school or district allocates resources to support teaching and learning?		
2	2	.4
3	16	3.6
4	211	47.4
5	216	48.5
How well do you think the leadership in your school or district promotes a positive and inclusive school culture?		
3	21	4.7
4	181	40.7
5	243	54.6
How well do you think the leadership in your school or district responds to challenges and adapts to changes in the education landscape?		
3	23	5.2
4	208	46.7
5	214	48.1
How well do you think the leadership in your school or district promotes innovation and experimentation in teaching and learning?		
2	5	1.1
3	15	3.4
4	219	49.2
5	206	46.3
How well do you think the leadership in your school or district fosters collaboration and teamwork among staff?		
2	2	.4
3	20	4.5
4	238	53.5
5	185	41.6
How well do you think the leadership in your school or district manages conflicts and challenges among staff and stakeholders?		
3	31	7.0
4	195	43.8
5	219	49.2
How well do you think the leadership in your school or district ensures that policies and practices are equitable and inclusive for all students and staff?		
3	24	5.4
4	177	39.8
5	244	54.8

The scale rate ranges between 1-5

The frequency and percentage of individuals are displayed in Table 1. According to the demographics of the survey, the majority of the participants were female, and the largest age group was 31-40. Additionally, most participants were teachers rather than staff. When it comes to the comfort and potential of ET in teaching and learning, participants generally believe that ET has the potential to improve the learning experience for students and that it can transform education by bridging the achievement gap and addressing current challenges such as SE and retention. Participants also consider it important to provide training or professional development for educators to use ET effectively.

Interestingly, concerns about the ethical implications of using ET in education were relatively low. This could suggest that educators have not fully explored or considered the potential ethical implications of using ET in the classroom. However, it is worth noting that the majority of participants believe that ET is accessible to students and educators from low-income backgrounds or in rural areas. While participants have faced challenges when trying to implement ET in education, it is not considered a major concern. This could indicate that educators are becoming increasingly familiar with using ET in the classroom and are developing strategies to overcome any challenges that may arise.

Student Engagement

- Most participants believe that their students are engaged in the classroom (95.5% rated 4 or 5).
- Participants think that their teaching strategies are effective in keeping students engaged (93.7% rated 4 or 5).
- Participants frequently use technology to enhance SE (92.9% rated 4 or 5) and provide opportunities for student-led discussions and activities (95.3% rated 4 or 5).
- Providing opportunities for students to work on projects that relate to their interests is also considered important (93.6% rated 4 or 5).
- The effectiveness of school or district policies and programs in promoting SE is rated relatively high (96.4% rated 4 or 5).

Academic Performance

- Most participants are satisfied with their students' overall AP (96% rated 4 or 5).
- Participants are confident in their ability to identify and address learning gaps in their students (98.2% rated 3 or higher).
- Participants think that their teaching strategies are effective in improving their students' AP (94.6% rated 4 or 5).
- Providing personalized feedback to students is considered important (95.7% rated 4 or 5).
- Using data to inform instructional decisions and improve students' AP is also considered important (94.2% rated 4 or 5).

4.2 Descriptive statistics

Table 2: Statistics on the Respondents

Factors	**Mean**	**Std. Deviation**
Age	2.17	.950
Gender	1.72	.451
Qualification	1.29	.454
How comfortable are you with using ET in your teaching or learning?	4.42	.623
How much do you think ET can improve the learning experience for students?	4.41	.604
How much potential do you think ET has for transforming education?	4.42	.585
How much do you think ET can bridge the achievement gap in education?	4.43	.606
How important do you think it is to provide training or professional development for educators to effectively use ET in education?	4.41	.632
How concerned are you about the ethical implications of using ET in education?	4.40	.571
How much do you think ET can help address the current challenges in education, such as SE and retention?	4.43	.591
How accessible do you think ET is to students and educators from low-income backgrounds or in rural areas?	4.47	.586
How much have you faced challenges when trying to implement ET in education?	4.44	.600
What kind of impact do you think ET can have on SL in education?	4.41	.576
How engaged do you think your students are in your classroom?	4.39	.589
How effective do you think your teaching strategies are in keeping your students engaged?	4.42	.609
How often do you use technology to enhance SE in your classroom?	4.44	.618
How often do you use collaborative learning strategies to promote SE?	4.38	.564
How often do you provide opportunities for students to give feedback on their learning experiences?	4.42	.600
How often do you incorporate real-world examples and applications into your lessons to increase SE?	4.44	.593
How often do you provide opportunities for student-led discussions and activities to increase SE?	4.39	.577

How often do you use gamification techniques (such as quizzes, badges, or rewards) to increase SE?	4.39	.625
How often do you provide opportunities for students to work on projects that relate to their interests to increase SE?	4.40	.645
How effective do you think your school's or district's policies and programs are in promoting SE?	4.41	.561
How satisfied are you with your students' overall AP?	4.44	.589
How confident are you in your ability to identify and address learning gaps in your students?	4.49	.587
How effective do you think your teaching strategies are in improving your students' AP?	4.43	.594
How often do you provide personalized feedback to your students to help them improve their AP?	4.40	.595
How often do you use data to inform your instructional decisions and improve your students' AP?	4.38	.587
How often do you collaborate with other teachers to identify and address learning gaps and improve your students' AP?	4.42	.616
How often do you provide opportunities for your students to receive extra help or support outside of class to improve their AP?	4.49	.599
How often do you involve parents or guardians in discussions about their child's AP?	4.38	.556
How often do you incorporate formative assessment strategies (such as quizzes, exit tickets, or think-pair-share) into your lessons to monitor and improve your students' AP?	4.49	.591
How effective do you think your school's or district's policies and programs are in improving students' academic performance?	4.39	.574
How well do you think the leadership in your school or district communicates its vision and goals to staff and stakeholders?	4.40	.634
How well do you think the leadership in your school or district involves staff and stakeholders in decision-making processes?	4.39	.657
How well do you think the leadership in your school or district supports the professional growth and development of staff?	4.40	.568
How well do you think the leadership in your school or district allocates resources to support teaching and learning?	4.44	.588
How well do you think the leadership in your school or district promotes a positive and inclusive school culture?	4.50	.588
How well do you think the leadership in your school or district responds to challenges and adapts to changes in the education landscape?	4.43	.591
How well do you think the leadership in your school or district promotes innovation and experimentation in teaching and learning?	4.41	.614
How well do you think the leadership in your school or district fosters collaboration and teamwork among staff?	4.36	.590
How well do you think the leadership in your school or district manages conflicts and challenges among staff and stakeholders?	4.42	.620
How well do you think the leadership in your school or district ensures that policies and practices are equitable and inclusive for all students and staff?	4.49	.599

Table 2 responds to a survey on various aspects of education, including the use of ET, SE, academic performance, and school leadership. The mean values for each factor indicate the overall level of agreement or disagreement among respondents. The highest mean values are for questions related to the use of ET in education, with means ranging from 4.39 to 4.47, indicating a generally positive attitude towards the potential benefits of technology in education. The lowest mean value is for the use of collaborative learning strategies to promote SE, with a mean of 4.38, indicating that respondents may not use this strategy as frequently as other engagement techniques. In terms of academic performance, respondents generally feel confident in their ability to identify and address learning gaps in their students, with a mean of 4.49. Respondents also feel that personalized feedback and collaboration with other teachers can be effective strategies for improving academic performance, with means ranging from 4.38 to 4.49.

Regarding school leadership, respondents feel that their school or district supports a positive and inclusive school culture, with a mean of 4.50. Respondents also feel that leadership promotes policies and practices that are equitable and inclusive for all students and staff, with a mean of 4.49. However, the means for other leadership factors, such as “fostering collaboration and managing conflicts among staff, are somewhat lower, ranging from 4.36 to 4.42”. Overall, the data suggest that respondents generally have a positive attitude towards the potential benefits of ET in education, believe in the effectiveness of certain engagement and academic performance strategies, and feel that their school or district

promotes a positive and inclusive school culture. However, there may be some areas where respondents feel less confident or less satisfied with school leadership, such as fostering collaboration among staff.

4.3 Regression Co-Efficient tables

Table 3: Regression Co-Efficient on SE

Model		UC		SC	t	Sig.
		B	Std. Error	Beta		
1	ET	4.445	0.200		22.235	0.000
	SE	-0.005	0.045	-0.005	-0.112	0.911

"UC=Unstandardized Coefficients, SC=Standardized Coefficients"

Table 3 provides the results of a regression analysis with two predictors: ET and SE. The UC indicates that for every one-unit increase in ET, the outcome variable is predicted to increase by 4.445 units, holding all other variables constant. For every one-unit increase in SE, the outcome variable is predicted to decrease by 0.005 units, holding all other variables constant. The SC or beta values indicate the relative importance of the predictors. The beta value for ET is much larger than that of SE, indicating that ET has a stronger impact on the outcome variable than SE. Both predictors have non-zero t-values, indicating that they are statistically significant predictors of the outcome variable. However, the p-value for SE is high, indicating that the relationship between SE and the outcome variable may not be practically significant, even though it is statistically significant.

Table 4: Regression Co-Efficient on AP

Model		UC		SC	t	Sig.
		B	Std. Error	Beta		
1	ET	4.672	0.195		23.922	0.000
	AP	-0.056	0.044	-0.061	-1.280	0.201

Table 4 provides the results of a regression analysis with two predictors: ET and AP. The UC indicates that for every one-unit increase in ET, the outcome variable is predicted to increase by 4.672 units, holding all other variables constant. For every one-unit increase in AP, the outcome variable is predicted to decrease by 0.056 units, holding all other variables constant. The SC or beta values indicate the relative importance of the predictors. The beta value for ET is larger than that of AP, indicating that ET has a stronger impact on the outcome variable than AP. The beta value for AP is negative, suggesting that higher values of AP are associated with lower values of the outcome variable. ET and AP both have non-zero t-values, but the p-value for AP is high (0.201), which indicates that it is not statistically significant at the conventional level of 0.05. This means that we cannot conclude that AP is a significant predictor of the outcome variable, and the relationship between AP and the outcome variable may not be practically meaningful.

Table 5: Regression Co-Efficient on SE and AP

Model		UC		SC	t	Sig.
		B	Std. Error	Beta		
1	SL	4.453	0.294		15.151	0.000
	AP	0.006	0.046	0.006	0.135	0.893
	SE	-0.013	0.047	-0.013	-0.269	0.788

Table 5 presents the results of a regression analysis with three predictors: SL, AP, and SE. The UC indicates that for every one-unit increase in SL, the outcome variable is predicted to increase by 4.453 units, holding all other variables constant. For every one-unit increase in AP, the outcome variable is predicted to increase by 0.006 units, holding all other variables constant. For every one-unit increase in SE, the outcome variable is predicted to decrease by 0.013 units, holding all other variables constant. The SC or beta values suggest that SL has the largest impact on the outcome variable, with a beta value of 1.0. This means that SL is the most important predictor of the outcome variable. AP and SE have beta values close to zero, indicating that their impact on the outcome variable is minimal. The t-values for all three predictors are non-zero, but only SL has a p-value less than 0.05, indicating that it is a statistically significant predictor of the outcome variable. On the other hand, AP and SE have p-values greater than 0.05, indicating that they are not statistically significant predictors of the outcome variable.

4.3 ANOVA Tables

Table 6: ANOVA test

Factors		**SS**	**df**	**MS**	**F**	**Sig.**
SE * ET	BG	0.207	10	0.021	0.557	0.848
	WG	16.152	434	0.037		
	Total	16.359	444			
AP * ET	BG	0.319	10	0.032	0.817	0.612
	WG	16.937	434	0.039		
	Total	17.256	444			

SE * SL	BG	0.708	10	0.071	1.963	0.036
	WG	15.651	434	0.036		
	Total	16.359	444			
AP * SL	BG	0.261	10	0.026	0.668	0.755
	WG	16.994	434	0.039		
	Total	17.256	444			

"SS=Sum of Squares, MS=Mean Square"

Table 6 presents the results of a four-way ANOVA analysis, examining the effects of SE, AP, ET, and SL. For the SE * ET interaction, the between-groups SS is 0.207, the df is 10, the MS is 0.021, the F-value is 0.557, and the significance level (p-value) is 0.848. This indicates that there is no significant interaction effect between SE and ET on the outcome variable. For the AP * ET interaction, the between-groups SS is 0.319, the df is 10, the MS is 0.032, the F-value is 0.817, and the significance level (p-value) is 0.612. This also indicates that there is no significant interaction effect between AP and ET on the outcome variable. For the SE * SL interaction, the between-groups SS is 0.708, the df is 10, the MS is 0.071, the F-value is 1.963, and the significance level (p-value) is 0.036. This suggests that there is a significant interaction effect between SE and SL on the outcome variable. For the AP * SL interaction, the between-groups SS is 0.261, the df is 10, the MS is 0.026, the F-value is 0.668, and the significance level (p-value) is 0.755. This also indicates that there is no significant interaction effect between AP and SL on the outcome variable. Overall, these results suggest that the interaction between SE and SL has a significant effect while the other three interactions do not.

4.4 Measures of Association

Table 7: Measures of Association between ET and SL

	Eta	**Eta Squared**
SE * ET	0.113	0.013
AP * ET	0.136	0.018
SE * SL	0.208	0.043
AP * SL	0.123	0.015

Table 7 demonstrates the measures of association between ET and SL. The Eta Squared values indicate the effect size of each factor or the proportion of variance in the dependent variable that is explained by each factor. In this case, the largest effect size is for the interaction between SE and SL, with an Eta Squared value of 0.043, indicating a moderate effect size. The other three factors have smaller effect sizes, with Eta Squared values ranging from 0.013 to 0.018, indicating small to moderate effect sizes. Overall, the results suggest that both SE and Academic Performance, when combined with ET and SL, have a small to moderate impact on the dependent variable, while the interaction between SE and SL has a larger impact. However, it is important to note that the significance level for the interaction between SE and SL is only marginally significant ($p = 0.036$).

5. CONCLUSION

In conclusion, the study investigated the challenges and opportunities of implementing ET in education and their impact on SL. The results suggest that respondents have a positive attitude towards the potential benefits of ET in education and believe in certain engagement and academic performance strategies. However, respondents may feel less confident in school leadership's ability to foster collaboration among staff. The interaction between SE and SL has a significant effect on the dependent variable, while the other three interactions do not. SE and academic performance, combined with ET and SL, have a small to moderate impact on the dependent variable. The study highlights the need for a collaborative school culture and effective SL to ensure success. Further research is needed to explore these relationships in more detail and identify additional factors that may impact the implementation of ET in education.

References

[1] Engelbrecht, J., Llinares, S. and Borba, M.C., 2020. Transformation of the mathematics classroom with the internet. *Zdm*, *52*, pp.825-841.

[2] Vargo, D., Zhu, L., Benwell, B. and Yan, Z., 2021. Digital technology use during COVID-19 pandemic: A rapid review. *Human Behavior and Emerging Technologies*, *3*(1), pp.13-24.

[3] Abad-Segura, E., González-Zamar, M.D., Infante-Moro, J.C. and Ruipérez García, G., 2020. Sustainable management of digital transformation in higher education: Global research trends. *Sustainability*, *12*(5), p.2107.

[4] Oke, A. and Fernandes, F.A.P., 2020. Innovations in teaching and learning: Exploring the perceptions of the education sector on the 4th industrial revolution (4IR). *Journal of Open Innovation: Technology, Market, and Complexity*, *6*(2), p.31.

[5] Lawrence, J.E. and Tar, U.A., 2018. Factors that influence teachers' adoption and integration of ICT in teaching/learning process. *Educational Media International*, *55*(1), pp.79-105.

[6] Elmqaddem, N., 2019. Augmented reality and virtual reality in education. Myth or reality?. *International journal of emerging technologies in learning*, *14*(3).

[7] Burbules, N.C., Fan, G. and Repp, P., 2020. Five trends of education and technology in a sustainable future. *Geography and Sustainability*, *1*(2), pp.93-97.

[8] Papanastasiou, G., Drigas, A., Skianis, C., Lytras, M. and Papanastasiou, E., 2019. Virtual and augmented reality effects on K-12, higher and tertiary education students' twenty-first century skills. *Virtual Reality*, *23*, pp.425-436.
[9] Peterson, C.N., Tavana, S.Z., Akinleye, O.P., Johnson, W.H. and Berkmen, M.B., 2020. An idea to explore: Use of augmented reality for teaching three-dimensional biomolecular structures. *Biochemistry and Molecular Biology Education*, *48*(3), pp.276-282.
[10] Cai, S., Liu, C., Wang, T., Liu, E. and Liang, J.C., 2021. Effects of learning physics using Augmented Reality on students' self-efficacy and conceptions of learning. *British Journal of Educational Technology*, *52*(1), pp.235-251.
[11] Jesionkowska, J., Wild, F. and Deval, Y., 2020. Active learning augmented reality for STEAM education—A case study. *Education Sciences*, *10*(8), p.198.
[12] Kazanidis, I., Pellas, N. and Christopoulos, A., 2021. A learning analytics conceptual framework for augmented reality-supported educational case studies. *Multimodal Technologies and Interaction*, *5*(3), p.9.
[13] Remolar, I., Rebollo, C. and Fernández-Moyano, J.A., 2021. Learning history using virtual and augmented reality. *Computers*, *10*(11), p.146.
[14] Vanoostveen, R., Desjardins, F. and Bullock, S., 2019. Professional development learning environments (PDLEs) embedded in a collaborative online learning environment (COLE): Moving towards a new conception of online professional learning. *Education and information technologies*, *24*(2), pp.1863-1900.
[15] Litvinenko, V.S., 2020. Digital economy as a factor in the technological development of the mineral sector. *Natural Resources Research*, *29*(3), pp.1521-1541.
[16] Cortes, A.F. and Herrmann, P., 2021. Strategic leadership of innovation: a framework for future research. *International Journal of Management Reviews*, *23*(2), pp.224-243.
[17] Sullivan, K., Thomas, S. and Rosano, M., 2018. Using industrial ecology and strategic management concepts to pursue the Sustainable Development Goals. *journal of cleaner production*, *174*, pp.237-246.
[18] Teece, D.J., 2019. A capability theory of the firm: an economics and (strategic) management perspective. *New Zealand Economic Papers*, *53*(1), pp.1-43.
[19] Ullah, Y., Ullah, H. and Jan, S., 2022. The mediating role of employee creativity between knowledge sharing and innovative performance: Empirical evidence from manufacturing firms in emerging markets. *Management Research Review*, *45*(1), pp.86-100.
[20] Pilcicki, R., Siemon, D. and Lattemann, C., 2021. How Virtual Teams Collaborate Creatively under Communication Constraints. In *AMCIS*.
[21] Bhaskar, P., Tiwari, C.K. and Joshi, A., 2021. Blockchain in education management: present and future applications. *Interactive Technology and Smart Education*, *18*(1), pp.1-17.
[22] Håkansson Lindqvist, M. and Pettersson, F., 2019. Digitalization and school leadership: on the complexity of leading for digitalization in school. *The international journal of information and learning technology*, *36*(3), pp.218-230.
[23] Vasiliev, A., 2021. Competitiveness and Academic Excellence with Emerging Technologies: Methods for Assessing the Quality of University Education. *International Journal of Instruction*, *14*(4), pp.1013-1032.
[24] Krasnostanova, N., Yatskevych, I., Maidaniuk, S., Palamarchuk, V. and Pryvalova, N., 2021. Strategic management tools for innovative development of the region. *Studies of Applied Economics*, *39*(5).
[25] Correani, A., De Massis, A., Frattini, F., Petruzzelli, A.M. and Natalicchio, A., 2020. Implementing a digital strategy: Learning from the experience of three digital transformation projects. *California Management Review*, *62*(4), pp.37-56.
[26] Falloon, G., 2020. From digital literacy to digital competence: the teacher digital competency (TDC) framework. Educational Technology Research and Development, 68, pp.2449-2472.
[27] Manita, R., Elommal, N., Baudier, P. and Hikkerova, L., 2020. The digital transformation of external audit and its impact on corporate governance. Technological Forecasting and Social Change, 150, p.119751.
[28] Cole, R., Stevenson, M. and Aitken, J., 2019. Blockchain technology: implications for operations and supply chain management. Supply Chain Management: An International Journal, 24(4), pp.469-483.