Effects of Technology on Student Learning Outcomes in Higher Education

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Abstract

Introduction: Aim of this research is to analyse the impacts of technology on the learning outcomes of students engaged in higher education. Usage of advanced technology in higher education has increased engagement of learners. Availability of concrete information through technical applications has allowed students to carry out their educational assignments in an easier manner.

Literature Review: Socrative is the other tool used by teachers in creating educational games for their students engaged in higher education. Google classroom has been found as one of the widely used technical applications used by teachers in higher education. This application has played a vital role in carrying out educational activities during the global pandemic period. Usage of advanced technical applications can allow teachers to improve the grading procedure in education. Lack of privacy and security in the online learning platforms has been found as one of the major challenges for students engaged in higher studies.

Methodology: The research has collected quantitative information from primary sources and the primary quantitative information has been collected by carrying out a sample survey. Random and convenience sampling was followed in selecting the respondents for the sample survey and 50 respondents have been chosen for this process. In this research, SPSS has been used as a tool for data analysis and this tool has allowed the study to statistically represent the facts and findings.

Findings: For hypothesis 1, the value of regression is 0.224 for the sum of squares and the value of regression is the same for mean square. Along with these, the value of residual is 51.156 for sum of squares and mean square its value is 1.066. For hypothesis 2, the residual value is 51.368 and 1 for sum of squares and df respectively. In addition, for mean square the residual value has been found as 1.070. For hypothesis 3, the regression value is 0.835 for mean square. The residual values have been found as 50.545 and 48 respectively for sum of squares and df respectively. For hypothesis 4, the regression values are 0.395 and 1 for sum of squares and df respectively. Along with these, for mean square the value of regression has been found as 0.395.

Discussion: Advancement in technology has allowed learners to access valuable educational information in an easier way. Findings of the previous literature have shown that advanced technical applications have allowed learners to obtain education information at a faster pace. I t has been found that advanced technical applications have been used by the educational institutions during the global pandemic period to carry out their services

Conclusion: Using advanced technology; students are able to share educational resources among their peers. Privacy and security of student's information must be given a high priority by educators in carrying out their teaching services by using advanced technical applications.

Keywords: Advanced technology, Learning outcomes, Higher education, Students , Educators, Technical applications

INTRODUCTION

Advanced technical applications have played a vital role in personalising the learning experiences of individuals engaged in higher studies. As per the view of Halili (2019), advanced technical applications have allowed learners engaged in higher studies to easily access educational information. Along with this, educational information can be accessed at a faster pace using advanced technical tools. The availability of concrete information through technical applications has allowed students to carry out their educational assignments in an easier manner. In this modern era, advanced technical tools have played an important role in enhancing students' academic grades. The establishment of educational hypotheses can be done by students in an effective manner by using advanced technical tools used in education. Authentic information needs to be collected by students for their assignments to prevent academic misconduct and in order to collect authentic and relevant information; advanced technical tools have played an important role. As mentioned by Shahzad et al. (2021), the usage of advanced technical applications has increased the scope of distance learning for students. Educational documents can be shared in an easier manner by using advanced technology by learners engaged in higher studies. Virtual learning can be considered as one of the main advantages of the advancement of technology which has played a crucial role in carrying out educational procedures during the global pandemic period in the recent past.

The availability of wide choices of educational resources is one of the main positive aspects of digital learning in higher education. As opined by Bond et al. (2020), it has been found that the usage of advanced technology in higher education has increased the engagement of learners. Presentation of lessons can be done by educators in an attractive manner by using advanced technology in their services and this in turn can increase the engagement and participation of students. Administration tasks of educational institutions can be made efficient by using advanced technical tools. At the same time, the record-keeping procedure of student's data has become easier for tutors due to the increasing usage of advanced technical tools.
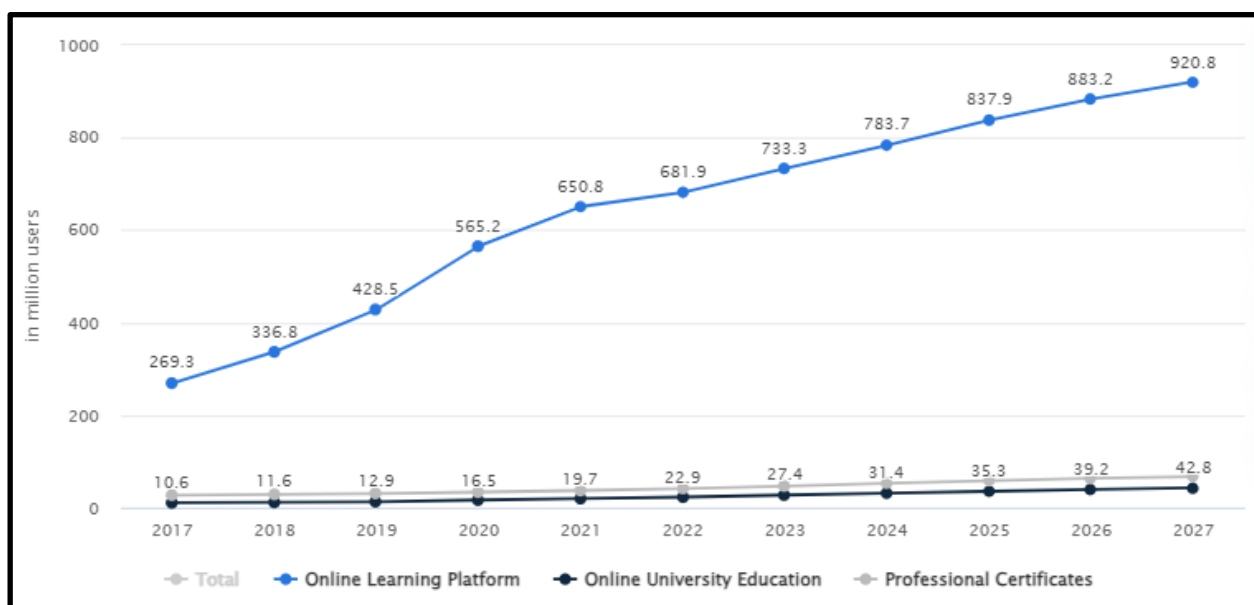

Figure 1: Usage of online education services
(Source: Statista, 2023)

The above graph reflects the users of online educational services in the world. It has been found that the number of individuals using online learning platforms was 428.5 million in 2019 and this increased to 565.2 million in 2020 (Statista, 2023). A further increase was observed in 2021 and in this year the number of users was 650.8 million. In 2022, the number

of online learning platform users was 681.9 million (Statista, 2023). An increasing number of online learning platform users reflect an increasing usage of advanced technical devices in higher education countries.

Research aim and objectives

Aim

The main aim of this research is to analyse the impacts of technology on the learning outcomes of students engaged in higher education.

Objectives

The main objectives of this research are as follows

RO1: To identify the technical applications used in higher education

RO2: To analyse the impacts of advanced technologies on learning outcomes of students engaged in higher education

RO3: To identify the challenges faced by students in adopting advanced technology in their learning

RO4: To recommend strategies for effectively utilising technical devices by students in their higher education

Research questions

RQ1: What are the technical applications used in higher education?

RQ2: What are the impacts of advanced technologies on the learning outcomes of students engaged in higher education?

RQ3: What are the challenges faced by students in adopting advanced technology in their learning?

RQ4: What can be the most fruitful strategies for effectively utilising technical devices by students in their higher education?

Research hypothesis

The research is based on the following hypothesis

H1: There is a positive relationship between technological advancement and learning outcomes of students engaged in higher studies

H2: A lot of students have faced challenges in adopting advanced technical tools used in higher studies

H3: In the upcoming period, usage of technical applications is going to increase among students engaged in higher studies

H4: Improvement in the technological infrastructure of countries is vital for enhancing the learning outcomes of students engaged in higher education

LITERATURE REVIEW

Technical applications used in higher education

Google Classroom has been found as one of the widely used technical applications used by teachers in higher education. This application has played a vital role in carrying out educational activities during the global pandemic period. Edmodo is one of the popular technical tools used by educators for communicating with their students with accuracy. As depicted by Ali (2020), the creation of online collaborative groups can be done by educators in their teaching by using Edmodo. This tool allows teachers to efficiently share educational materials with their students in an easier way. Socrative is the other tool used by teachers in creating educational games for their students engaged in higher education. Project is the other technical application used by educators for creating multimedia presentations. Interactive maps, online quizzes, and educational videos can be created by teachers for their students by using this tool which can enhance the learning experiences of students to a great extent. As demonstrated by Zawacki-Richter et al. (2019), Thinglink is a technical application used by teachers to create interactive learning resources for students such as attractive images, videos, or audio clips. Usage of TED-Ed has been identified among a huge segment of educators for improving the learning outcomes of their students engaged in higher studies.

Usage of this application has led to an increase in collaboration between teachers and their students. As opined by Iglesias-Pradas et al. (2021), cK-12 can be marked as one of the most effective technical applications which can be utilised by teachers for efficiently distributing educational resources among their students. EduClipper is another useful technical application for higher education and this can be used by students for exploring educational materials. Improvement in research techniques can be done by students in an easier way by using this tool. Digital records of students' achievements can be kept by educators in an effective manner by using this tool.

Impacts of advanced technologies on learning outcomes of students engaged in higher education

Enhancement of the learning capabilities of students can be marked as the other positive impact of advanced technology on higher education. As mentioned by Chernikova et al. (2020), in providing additional tutoring to learners engaged in higher studies, advanced technical applications play an important role. In addition, the increasing trend of using virtual educational courses is a reflection of the increasing application of advanced technology in higher education. On the other hand, the usage of advanced technical applications has made the teaching procedure easier in higher education. Advancement technology has made the educational communication procedure easier outside classrooms. It has been found that the advancement of technology has enabled teachers to provide educational instructions to learners in an easier way. At the same time, the usage of advanced technical devices has enabled learners to engage in higher studies to enhance their communication skills. Along with these, using technical applications in teaching, educators can have a higher understanding of the issues faced by their students in adopting lessons. As suggested by Radianti et al. (2020), usage of advanced technical devices in education, educators can make the learning process of students enjoyable. It has been observed that the digital learning procedure can play a vital role in improving the mental well-being of students.

Improvement has been made by teachers in the lesson planning for the learners engaged in higher studies. In addition, by using advanced technical devices, educators are able to track the attendance of their students in an easier way. As illustrated by Castro (2019), the usage of advanced technical applications can allow teachers to improve the grading procedure in education. The usage of technical devices in higher education has allowed educators to provide instant feedback to students in an easier way. The usage of technical applications has played an important role in improving the digital literacy of learners engaged in higher studies.

Challenges faced by students in adopting advanced technology in their learning

Lack of efficiency in handling technical applications can be marked as one of the main challenges faced by a lot of students engaged in higher education. As stated by Oliveira et al. (2021), it has been found that poor network infrastructure is one of the main obstacles for students in carrying out digital learning. A huge segment of students from underdeveloped countries has faced this issue in their higher education. Along with these, lack of privacy and security in the online learning platforms has been found as one of the major challenges for students engaged in higher studies. Monotony can be marked as one of the negative aspects of online learning procedure for students and it has been found that offline learning procedure is still preferred by a huge segment of students. Resistance of students to changes has been identified as the main factor responsible for the issues faced by them in adopting advanced technical tools in their higher education.

Strategies for effectively utilising technical devices by students in their higher education

In order to overcome the identified challenges, educational institutions must be focused on providing training to their students for efficiently handling the technical applications used in learning. As stated by Tokareva et al. (2019), frequent and clear communication with students can allow students to identify the challenges faced by them in adopting the advanced technologies used by the educational institution. The creation of group tables can be another effective strategy for teachers to increase collaboration among their students in digital learning. Along with these, in classrooms, educators need to ensure the usage of technical applications approved by their University. Internet filters can be used by teachers to prevent students from accessing risky web pages and this in turn can allow them to protect students' personal information. At the same time, strict guidelines need to be determined by educational institutions for ethically handling the technical applications used for educational purposes. As per the view of Tuah & Naing (2021), potential risks of using technical applications need to be conveyed by teachers to their students with a high priority. On the other hand, digital distraction policies need to be introduced by educators to prevent excessive usage of technical applications within educational activities. In addition, the usage of technical applications and non-technical educational procedures needs to be balanced by educators in their services.

METHODOLOGY

The research has collected quantitative information from primary sources and the primary quantitative information has been collected by carrying out a sample survey. As per the view of Pandey & Pandey (2021), the usage of primary data can increase the authenticity of research. At the same time, carrying out sample surveys, quantitative data collection can be done by researchers at a faster pace, and due to this reason, the research has collected data through a sample survey. 3

demographic questions were designed for the respondents of the sample survey and along with these, 10 questions were designed on the basis of research objectives. Likert scale was followed by the study in designing the questionnaire and the questionnaire was sent to the personal email addresses of the selected respondents. The sample survey was carried out among educators engaged in reputed colleges and Universities of the country. Random and convenience sampling was followed in selecting the respondents for the sample survey and 50 respondents have been chosen for this process. As commented by Mishra & Alok (2022), simple random sampling can be marked as effective in preventing biases in research. In this research, SPSS has been used as a tool for data analysis and this tool has allowed the study to statistically represent the facts and findings.

The collection of up-to-date information was one of the main reasons for choosing the primary data collection method for this research. As demonstrated by Snyder (2019), the collection of quantitative data can allow researchers to determine a larger sample size. In addition, in the primary data collection procedure, researchers can have a higher control over their studies and this was the other reason for collecting primary quantitative data. One of the main positive aspects of primary data is its objective nature and due to this reason, the research has collected primary data.

FINDINGS AND ANALYSIS

1. What is your gender?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	• Female	26	52.0	52.0	52.0
	• Male	24	48.0	48.0	100.0
	Total	50	100.0	100.0	

Figure 2: Gender of the survey respondents
(Source: SPSS)

From the calculation of the above table, it has been found that the number of females and males is 26 and 24 respectively among the total respondents.

2. What is your age bracket?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	• 30-39 Years old	41	82.0	82.0	82.0
	• 40-49 Years old	6	12.0	12.0	94.0
	• 50-59 Years old	1	2.0	2.0	96.0
	• Below 30 Years	2	4.0	4.0	100.0
	Total	50	100.0	100.0	

Figure 3: Age group of the survey respondents
(Source: SPSS)

From the calculation of the above table, it has been found that the number of respondents from the age bracket 30-39 years is 41. At the same time, the numbers of respondents from the age bracket 40-49 years and 50-59 years are 6 and 1 respectively. The number of respondents from the age bracket 0-30 years is 2.

3. How long have you been with the institution ?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	• 1-3 years	23	46.0	46.0	46.0
	• 3-5 years	19	38.0	38.0	84.0
	• 5-10 years	4	8.0	8.0	92.0
	• Less than 1 year	4	8.0	8.0	100.0
	Total	50	100.0	100.0	

Figure 4: Engagement period of the respondents with their present institution
(Source: SPSS)

From the above calculation, it has been found that 23 respondents are engaged in their present institution for 1-3 years. At the same time, 19 respondents were engaged in their present institution for 3-5 years. In addition, 4 respondents are engaged in their present organisation for 5-10 years.
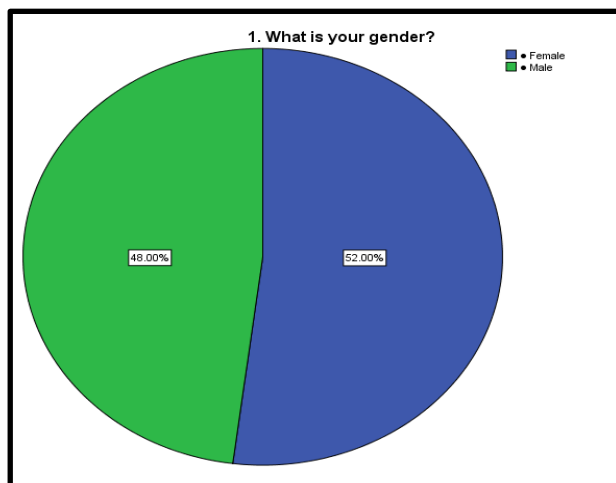

Figure 5: Diagrammatic representation of respondents' gender
(Source: SPSS)

From the calculation of the above table, it has been found that the share of females and males is 52% and 48% respectively among the total respondents.
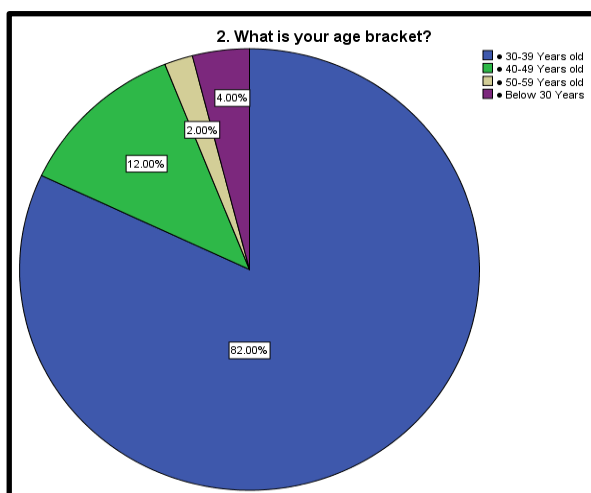

Figure 6: Diagrammatic representation of respondents' age bracket
(Source: SPSS)

From the above, it can be observed that the share of respondents from the age bracket 30-39 years is 82%. Along with this, the shares of respondents from the age bracket 40-49 years and 50-59 years are 12% and 2% respectively. The share of respondents from the age bracket 0-30 years is 4%.
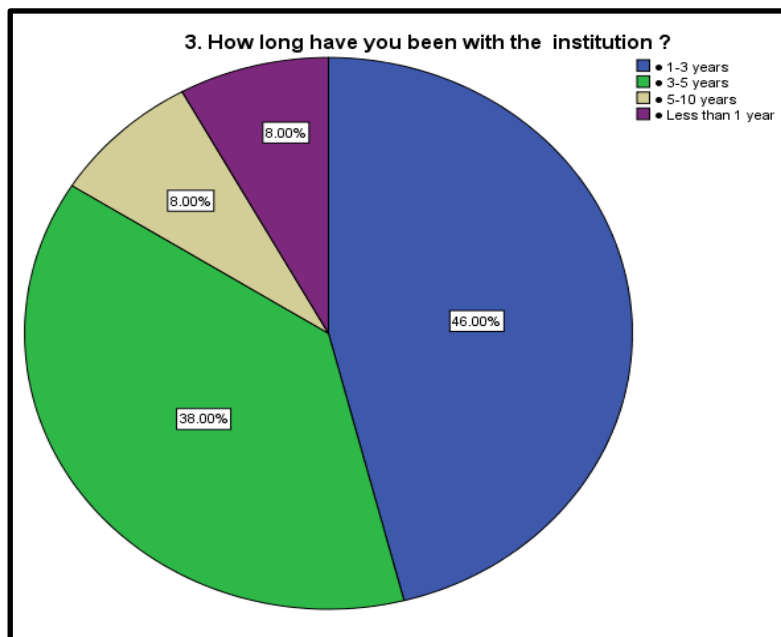
Figure 7: Engagement period of the respondents with their present institution
(Source: SPSS)

From the above findings of the research, it has been found that 46% of the respondents are engaged in their present institution for 1-3 years. At the same time, 38% of the respondents are engaged in their present institution for 3-5 years. In addition, 8% of the respondents are engaged in their present organisation for 5-10 years.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
DV	50	3.00	7.00	3.8200	1.02400
IV1	50	2.00	7.00	3.5400	1.16426
IV2	50	2.00	8.00	3.4800	.88617
IV3	50	2.00	6.00	3.3400	.77222
IV4	50	2.00	4.00	3.1800	.59556
Valid N (listwise)	50				

Figure 8: Descriptive statistics table of the collected data
(Source: SPSS)

In the above table, the results of descriptive statistics for the collected dataset have been shown. The minimum and maximum values of the dependent variable have been found as 3 and 7 respectively. At the same time, the values of standard deviation and mean are 1.024 and 3.82 respectively. On the other hand, for the first independent variable, the minimum and maximum values are 2 and 7 respectively. In this case, the values of standard deviation and mean are 1.164 and 3.54 respectively. For the second independent variable, the minimum and maximum values are 2 and 8 respectively. In this case, the values of standard deviation and mean are 0.886 and 3.84 respectively. The minimum and maximum values of the third independent variable have been found as 2 and 6 respectively. For the third independent variable, the values of standard deviation and mean are 0.772 and 3.34 respectively. The minimum and maximum values of the fourth independent variable have been found as 2 and 4 respectively. The values of standard deviation and mean are 0.595 and 3.18 respectively.

Hypothesis 1

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.066	.004	-.016	1.03235

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.224	1	.224	.210	.648
	Residual	51.156	48	1.066		
	Total	51.380	49			

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.614	.472		7.664	.000
	IV1	.058	.127	.066	.459	.648

Figure 9: Linear regression analysis for Hypothesis 1
(Source: SPSS)

The above table shows the analysis of linear regression for the first independent variable. From the ANOVA table, it has been found that the value of regression is 0.224 for the sum of squares and the value of regression is the same for mean square. Along with these, the value of residual is 51.156 for the sum of squares, and the mean square value is 1.066. Calculation of the above table has reflected that the regression value is 0.648 for significance and this value is greater than 0.05. Therefore, it can be summarised that the first independent research variable is not significantly related to the dependent variable.

Hypothesis 2

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.015	.000	-.021	1.03449

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.012	1	.012	.011	.916
	Residual	51.368	48	1.070		
	Total	51.380	49			

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.881	.599		6.485	.000
	IV2	-.018	.167	-.015	-.106	.916

Figure 10: Linear regression analysis for Hypothesis 2
(Source: SPSS)

The above table shows the linear regression calculation between the second independent variable and the dependent variable. It has been observed that the regression value is 0.012 for the sum of squares and for df and mean values, these values are 1 and 0.012 respectively. At the same time, the residual value is 51.368 and 1 for the sum of squares and df respectively. In addition, for the mean square, the residual value has been found as 1.070. Calculation of the above table has reflected that the regression value is 0.916 for significance and this value is greater than 0.05. Therefore, it can be concluded that the second independent variable is not significantly related to the dependent variable.

Hypothesis 3

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.127	.016	-.004	1.02617

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.835	1	.835	.793	.378
	Residual	50.545	48	1.053		
	Total	51.380	49			

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.385	.650		6.741	.000
	IV3	-.169	.190	-.127	-.891	.378

Figure 11: Linear regression analysis for Hypothesis 3
(Source: SPSS)

The above table shows the linear regression calculation between the third independent variable and the dependent variable. Analysing the above findings it has been found that the regression values are 0.835 and 1 for the sum of squares and df respectively. Along with this, the regression value is 0.835 for the mean square. The residual values have been found as 50.545 and 48 respectively for the sum of squares and df respectively. For the mean square, the value of the residual is 1.053. Calculation of the above table has highlighted that the regression value is 0.378 for significance and this value is greater than 0.05. Therefore, it can be summarised that the third independent variable is not significantly related to the dependent variable.

Hypothesis 4

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.088	.008	-.013	1.03063

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.395	1	.395	.372	.545
	Residual	50.985	48	1.062		
	Total	51.380	49			

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.341	.800		4.178	.000
	IV4	.151	.247	.088	.610	.545

Figure 12: Linear regression analysis for Hypothesis 4
(Source: SPSS)

The above table shows the linear regression calculation between the fourth independent variable and the dependent variable. Analysing the recorded responses through SPSS, it has been observed that the regression values are 0.395 and 1 for the sum of squares and df respectively. Along with these, for the mean square, the value of regression has been found as 0.395. The residual values have been found as 50.985 and 48 respectively for the sum of squares and df. For mean squares, this value has been found as 1.062. Calculation of the above table has indicated that the regression value is 0.545 for significance and this value is greater than 0.05. Therefore, it can be summarised that the fourth independent variable is not significantly related to the dependent variable.

Correlations

		DV	IV1	IV2	IV3	IV4
DV	Pearson Correlation	1	.066	-.015	-.127	.088
	Sig. (2-tailed)		.648	.916	.378	.545
	N	50	50	50	50	50
IV1	Pearson Correlation	.066	1	.040	.155	.004
	Sig. (2-tailed)	.648		.781	.283	.977
	N	50	50	50	50	50
IV2	Pearson Correlation	-.015	.040	1	.353[*]	-.090
	Sig. (2-tailed)	.916	.781		.012	.536
	N	50	50	50	50	50
IV3	Pearson Correlation	-.127	.155	.353[*]	1	-.136
	Sig. (2-tailed)	.378	.283	.012		.347
	N	50	50	50	50	50
IV4	Pearson Correlation	.088	.004	-.090	-.136	1
	Sig. (2-tailed)	.545	.977	.536	.347	
	N	50	50	50	50	50

Figure 13: Correlation between dependent and independent variables
(Source: SPSS)

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Analysis of the correlation between the dependent and independent variables has been shown in the above table. The DV's value of Pearson correlation coefficient is 0.066 for the first independent variable and for the second independent variable this value has been found as -0.015 for the second and third independent variables, the values are -0.127 and 0.088 respectively. At the same time, for the first independent variable, the value of the Pearson correlation coefficient is 0.066 for DV. For the four independent variables, these values are 1, 0.040, 0.155, and 0.004 respectively. For the second independent variable, the value of the Pearson correlation coefficient is -0.015 for DV and for the independent variables, the values are 0.040, 1, 0.353, and -0.090 respectively.

DISCUSSION

Comparing the findings of this research with the key findings of previous literature it has been found that advancement in technologies has led to personalisation of learning experiences of students engaged in higher education. As opined by Yusuf (2021), it has been found that advancement in technology has allowed learners to access valuable educational information in an easier way. Findings of the previous literature have shown that advanced technical applications have allowed learners to obtain education information at a faster pace. Using advanced technology, educational hypotheses can be easily established by learners engaged in higher education. The findings of this study have shown that the majority of the respondents selected for the sample survey are engaged with their present educational institutions for 1-3 years. It has been found that advanced technical applications have been used by educational institutions during the global pandemic period to carry out their services (Müller & Mildenberger, 2021). However, a huge segment of learners have faced issues in adopting advanced technology in their learning. In order to avoid such issues, educational institutions must be focused on providing training to their teachers as well as students.

CONCLUSION

From the above discussion of this study, it can be concluded that advancement in technology has led to an improvement in the learning outcomes of students engaged in higher education. Along with this, using advanced technology; students are able to share educational resources among their peers. Privacy and security of student's information must be given a high priority by educators in carrying out their teaching services by using advanced technical applications. Improvement is needed in the technological infrastructure of countries to enhance the learning experiences of students in digital learning.

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