Impact of Digital Education on Learning Behavior of Undergraduates

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Present study examines the impact digital education on learning behaviour of undergraduates in terms of Perceived Ease of Use, Perceived Usefulness, Psychological Wellbeing and E-classroom interaction. The background of the study is the point in Madhya Pradesh in response to the COVID-19 virtual educational environment. To measure the learning behaviour indicators used in the present study, a survey was conducted on the total of 385 undergraduates taking digital education. The data were analyses using the structural equation modelling. Results showed that the digital education has positive impact on all the learning behaviour predictors used in the present study. The findings showed that psychological wellbeing and e-classroom interaction were improved with the experiences and time. Results suggest that satisfaction with digital education can be further improved by developing e-classes that are easy to use, focusing on the features that are frequently used by the undergraduates. In addition, educational institutes provide training and advice to increase students' psychological wellbeing.

Keywords: digital education, learning behaviour (Perceived Ease of Use (PEoU), Perceived Usefulness (PU), Psychological Well-being and E-Classroom Interaction

INTRODUCTION

Change is constant and inevitable; therefore, anything in this world tends to be obsolete with every new advancement or development, and intelligence lies in the ability to adapt to change (Sundarasen et al., 2020). Digital Learning is primarily referred to as the use of technology and network communication for teaching and learning (Profit, 2019). It is one such fastest growing trend in the educational uses of technology (Brockman et al., 2020). Digital class is a system where students can learn subjects, discuss issues with fellow students, clarify doubts with instructors and share material and check academic progress with help of internet-oriented technologies (Barber & King, 2016). The role played by the instructor and learners have importance as their perception and attitude are important for the teaching learning process (Philip & Gavrilova Aguilar, 2021).

The pandemic has disrupted teaching in a variety of educational institutions. Fortunately, current technology enabled electronic learning (e-learning) to be the core method of teaching the curriculum during the COVID-19 pandemic (Huynh & Nguyen, 2019).

E-learning is defined as using information technology to improve the quality of education. Currently, digital teaching is commonly used in the training of undergraduates (Surahman & Sujarwanto, 2021). Digital learning could be a platform that makes the process of education more student-centered, creative, and flexible (Alt & Raichel, 2020). Digital delivery of courses is cost-effective and easily accessible especially when delivering curriculum to students in rural and remote areas of India (Ahmed & Roche, 2021). Educational colleges have implemented numerous creative strategies to combat the crisis, using various software/apps such as Kahoot, Google Meet, Google Classroom, Zoom, and Microsoft Teams to take online courses and assessment (Alawadhi & Abu-Ayyash, 2021). The virtual classes were initiated not only to complete the course but also to stay in constant contact with the learners and infuse confidence in students during the COVID-19 pandemic (Khalil et al., 2020).

The success of digital-learning depends on many factors like infrastructural accessibility, usage of appropriate methods for teaching learning, adequate course content, student teacher interaction and various methods of assessment. Above all it is important that learners develop a positive attitude for the digital education and its perceived ease of use (Qaisar et al., 2020). Digital classes at times have its own challenges like poor internet access, insufficient digital skills, lack of digital awareness etc. Some benefits such as time flexibility can also be a limitation, especially for students who have difficulties with self-discipline (Chocarro et al., 2021). In spite of all the challenges, digital education emerged as a rightful substitute accelerated by the pandemic. The learning loss was minimized with the adoption of online teaching learning in the higher education institutes. But at the same time online assessment is a key concern in the digital education framework.

Theoretical Background Technology Acceptance Model

TAM is recognized as the best model for understanding the acceptance of technology. It is presented as a concise and useful theoretical framework for investing hoe perceived ease of use and perceived usefulness of digital learning affect its acceptance (Hardy, 2020) As a result, these two concepts were used in the present study to explain the learner's intentions to use digital learning. Davis defines perceived ease of use which affect the acceptance and adoption of particular technology or system (Teo & Noyes, 2014). Perceived usefulness is defines as the degree to which an individual believes that using a particular system would enhance the performance. Perceived ease of use is preceding variable of perceived usefulness. TAM is the most widely used model for information technology acceptance research, it has been frequently applied in different studies (Lazar et al., 2020). Present study used the same model to study the perceived ease of use and perceived usefulness with respect to the digital education acceptance during Pandemic.

Perceived Usefulness is an important antecedent of behavior such as learners' behavior. According to TAM the intentional behavior of learners to use digital education is influenced by the perception of the usefulness of the technology. Perceived usefulness can be interpreted as a subjective probability that illustrates whether the learner will adopt certain technologies under teaching learning process. Perceived ease of use variable is derived from the TAM. TAM is a way to predict behavioral intention of learner to adopt digital education (Taufiq et al., 2019). Learners' attitude and behavioral intention to use of digital education on the PU and PEoU. Perceived ease of use is the degree to which a Lerner believes that using a particular system will be free of efforts. PEoU has positive influence on leaner's adoption behavior toward digital education (Camilleri & Camilleri, 2020).

E-Classes are n number of plus points but sometimes they create a lot of difficulties. These difficulties and problems associated with the leaner's behavior such as feeling boring and unengaging (Kang et al., 2007). Digital Learning has so much of the time and flexibility that learners never find the time to do. Personal Attention is also a huge issue facing in digital learning that why learners expressed no interaction. Students feel lack of connections with the peer and teachers. The students' evaluation by means of assessment is a critical and imperative domain of the pedagogical process in the institutes of Higher Education especially so in the format of Digitalized education. However, it was the legitimacy of on-line

evaluations as compared to the face-to-face system which posed major concerns for all educational establishments as the pupil were exposed to a plethora of prohibited devices that could be used easily for their interest (Ali & Dmour, 2021) making it impossible for the educators to measure the actual learning of the pupil. The digitalized routines and the fundamental education for children ought to be recognized as a crucial matter of interest by the information management research. It is apparent that online education will stand the test of time and, teaching- learning will evolve into blended education only if the obstacles underwent during the pandemic are meticulously studied and converted into prospects of success (Adedoyin &Soykan, 2020).

Apart from aforesaid parameters on digital education psychological well-being of the learners cannot be ignored (Joshi et al., 2021). Psychological well-being is a multifaceted construct: it is influenced by several aspects. Research findings on the relationship between digital technology use and psychological well-being have been mixed (Kardas et al., 2019). This pandemic carries not only the risk of the life of the peoples but also psychological stress for people throughout the world. Continuous isolation and digital learning makes learners exhausted and affect mental health of the learners. Various studies were carried out and explained that learners are psychologically affected by the forced digital learning during pandemic

Objectives of the Study

- To study the impact of Digital Education on perceived usefulness among learners of higher education.
- To study the impact of Digital Education on perceived use of ease among learners of higher education.
- To study the impact of Digital Education on E-Classroom Interactions among learners of higher education
- To study the impact of Digital Education on psychological wellbeing among learners of higher education.

Rationale of the Study

The responsibility of designing a better world through equanimous educational methodologies is the responsibility of academicians and policy makers. The impact of Digital Education needs to be study from the perspective of specific pedagogy so that it doesn't just become a substitute for conventional learning but is able to complement conventional learning even post pandemic. The various stakeholders of education should welcome, adapt and adopt themselves to the shift from conventional classroom practices to a digital learning and teaching environment. Discarding the old and accepting the new widens the existing horizons and promises a brighter future. Efficient policymaking requires exploration of novel developments and merging them with traditional agencies of established systems. Keeping that in mind the research has been designed to dig into the mindset of learners regarding their acceptance, adaptability, affordability and expertise regarding Digital trends in education in terms of learning behavior. The present study delves the impact of Digital Education on the learners behavior.

METHODOLOGY

Structural Equation Modelling (SEM) which is a set of techniques for exploring the relationships between the constructs. A version of the same, Partial Least Squares (PLS) regression enables the testing for a small sample and leads to the prediction of indicators. It allows putting forwards hypothesis for the constructs with the impact on the particular aspects of the model. The data was collected from the undergraduates of the higher education institutes through Google survey forms using simple random sampling. The form contained two sections. The first section contained four items about the respondents and the second section contained 24 items pertaining to the variables. Multistage random sampling technique was adopted to draw a representative sample from the overall research population for conducting the survey. Multistage random sampling design is ideal for studies analogous to the current one where the required sample is scattered over a large geographical area having a nested relationship at multiple levels.

The technique denotes the process of repeated random selection of respondents by employing the same or varied sampling techniques at each stage of the sampling design. For the present study, the research population was filtered based on a three-stage sampling plan, involving area and simple random sampling techniques for determining the respondents for the survey.

Stage 1 – Area Sampling

The state of Madhya Pradesh was divided district-wise into five Zones– North, South, East, West and Centre – based on the geographical location of its districts. One district from each zone was chosen at random (Indore, Jabalpur, Bhopal, khandwa and Gwalior). As a result, out of the 52 districts of Madhya Pradesh, 5 districts were included for the study.

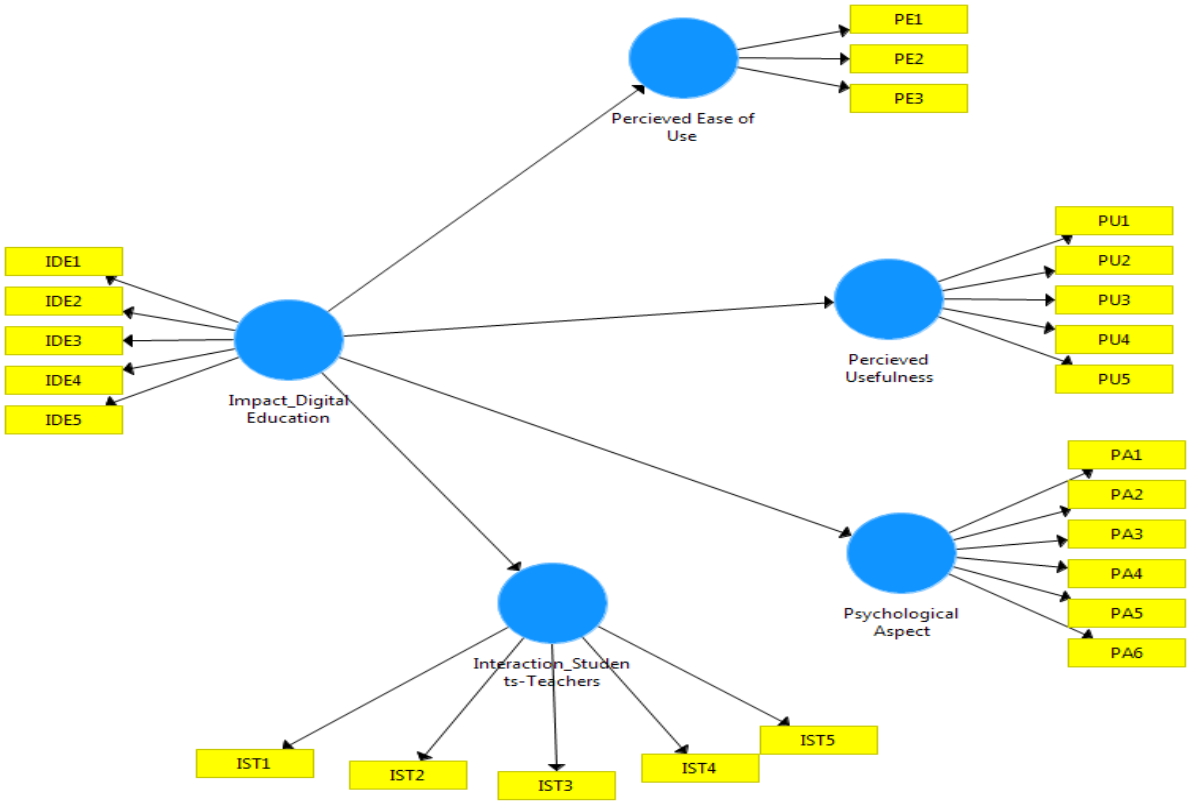
Stage 2 – Simple Random

For each of the selected districts, a database was created compiling the details of all the colleges. Random number generator was used to select per colleges from each of the databases. In this manner, a total of four colleges were selected from every district.

Stage 3 – Simple Random

For each of the selected college, a database compiling the list of the students associated with that particular college was created. Once again random sampling technique was used to identify the respondents. In this manner, 20 databases were created (One data base from each college) and around 682 students were approached for the survey from which the researcher was able to collect 400 valid responses having a total sample size well above the minimum sample size – 385 (Raosoft) – needed for the present study.

FIGURE 1
CONCEPTUAL FRAMEWORK



Development of Research Hypothesis

Perceived Usefulness: Perceived Usefulness of digital education is the most important elements in the present study. Perceived is the degree to which a user of a particular system believes that it would improve the study performance as compared to the alternative methods. It influenced the decision of a user on whether to accept or reject the digital technology in education. I the context of digital education, to which colleges have had to switch because of the pandemic, the authors have to formulated the hypothesis.

Hypothesis 1 (H1): *Digital Education has a positive impact on perceived usefulness among learners of higher education*

Perceived Ease of Use: Perceived Ease of Use (PEU) of e-learning is considered as the degree to which a person using the system without any efforts. It is the predictors of users' attitude towards the digital education. When users' perceptions of the ease of use and the usefulness of the technology are positive, they will embrace new technology without any problems. Despite the possible contradictions, the authors have set a hypothesis for the students' PEU of digital education tools.

Hypothesis 2 (H2): *Digital Education has a positive impact on perceived use of ease among learners of higher education.*

Interactive E-Classroom: Interactive online learning entails going beyond the passive one-way nodes of reading, listening, and watching static content. It includes pulling out the exact content you want and manipulating it rather than just waiting for information and digesting it. Hypothesis about the Interactive E-Classroom was put forward in this research

Hypothesis 3 (H3): *Digital Education has a positive impact on E-Classroom Interactions among learners of higher education*

Psychological Wellbeing: This involves students learning to recognize and regulate emotions. develop empathy for others and understand relationships.

Hypothesis 4 (H4): *Digital Education has a positive impact on psychological wellbeing among learners of higher education.*

The process of evaluation of results of the partial least squares structural equation modelling (PLS-SEM) involves two steps. In step 1, the examination of reflective and formative measurement models is conducted. This is a necessary part of the evaluation because it provides support for the measurement quality. When quality is confirmed, the structural model evaluation is conducted in step 2. While in step 1, the measurement theory is examined, step 2 covers the structural theory that involves testing the proposed hypotheses and that addresses the relationships among the latent variables. Our model contains only reflective measures.

TABLE 1
CONSTRUCT RELIABILITY AND VALIDITY

Constructs	Cronbach's Alpha	rho_A	Composite Reliability
ImpactDigital Education	0.904	0.905	0.929
Interaction: Students-Teachers	0.920	0.926	0.939
Perceived Ease of Use	0.891	0.891	0.932
Perceived Usefulness	0.908	0.910	0.931
Psychological Aspect	0.721	0.785	0.842

At this stage, we start by examining the indicator loadings. Loadings above 0.70 indicate that the construct explains more than 50% of the indicator's variance, demonstrating that the indicator exhibits a satisfactory degree of reliability. The constructs' internal consistency reliability was assessed. For the composite reliability criterion, higher values indicate higher levels of reliability. Results between 0.70 and 0.95 represent "satisfactory to good" reliability levels.

Cronbach's alpha measures internal consistency reliability that assumes the same thresholds. Results between 0.70 and 0.95 represent "satisfactory to good" reliability levels.

TABLE 2
PLS-SEM ASSESSMENT RESULTS OF MEASUREMENT MODELS

Latent Variable	Indicators	Convergent Validity	
		Loadings	AVE
		>0.70	>0.50
IDE	IDE1	0.851	0.722
	IDE2	0.875	
	IDE3	0.870	
	IDE4	0.794	
	IDE5	0.858	
IST	IST1	0.871	0.756
	IST2	0.881	
	IST3	0.863	
	IST4	0.846	
	IST5	0.885	
PA	PA2	0.831	0.645
	PA5	0.913	
	PA6	0.640	
PEU	PEU1	0.910	0.822
	PEU2	0.921	
	PEU3	0.888	
PU	PU1	0.853	0.645
	PU2	0.844	
	PU3	0.851	
	PU4	0.835	
	PU5	0.890	

Convergent validity was calculated, which is the extent to which a construct converges in its indicators by explaining the items' variance. Convergent validity is assessed by the average variance extracted (AVE) across all items associated with a particular construct and is also referred to as communality. An acceptable threshold for the AVE is 0.50 or higher.

This level or higher indicates that, on average, the construct explains (more than) 50% of the variance of its items. The last step in reflective measurement is to assess discriminant validity. This analysis reveals to which extent a construct is empirically distinct from other constructs both in terms of how much it correlates with other constructs and how distinctly the indicators represent only this single construct.

TABLE 3
DISCRIMINANT VALIDITY

Constructs	Impact_Digital Education	Interaction_Students-Teachers	Perceived Ease of Use	Perceived Usefulness	Psychological Aspect (Well-Being)
Impact_Digital Education	**0.850**				
Interaction_Students-Teachers	0.697	**0.869**			
Percieved Ease of Use	0.729	0.776	**0.906**		
Percieved Usefulness	0.747	0.790	0.816	**0.855**	
Psychological Aspect	0.718	0.668	0.673	0.745	**0.803**

Discriminant validity assessment in PLS-SEM involves analyzing Henseler et al.'s (2015) heterotrait–monotrait ratio (HTMT) of correlations. The suggested threshold is a value of 0.90, when the path model included constructs that are conceptually very similar. Our model presents this concept.

The heterotrait–monotrait ratio of correlations is a new criterion to assess the discriminant validity in variance-based structural equation modelling, which is superior compared with the Fornell–Larcker criterion and (partial) cross-loadings.

RESULTS

The data for research were collected through a survey in Google Forms. The survey allowed collecting 385 responses. The structure of respondents is presented in Table 4.

TABLE 4
FREQUENCIES OF GENDER

Levels	Counts	% of Total	Cumulative %
Female	183	47.6 %	47.6 %
Male	202	52.4 %	100.0 %

Of the 385-total respondent from learners Community 47.6 % of respondents are females whereas 52.4 % of respondents were male teachers. The above table 4 showed the gender percentage, however the study does not statistically analysed on gender basis. Percentage of gender was only taken to check the equality percentage, since it was approximately equal in percentage, it was not statistically analyzed.

Next, the data were screened. There were no missing values since it was guaranteed by the structure of the survey. We excluded 18 answers because respondents marked the same answer for each question and the calculated variance was 0. Finally, 367data rows were used for calculation.

This sample size is sufficient for the PLS path model estimation.

After the pilot researcher found some items in the construct psychological aspect (wellbeing) were not connected with the study so PA1, PA3, and PA4 were taken as outlier items thus that will be not included in final analysis, PA6 is also beyond the threshold value (PA6= 0.64) but the investigator include this in the study, as it near to the threshold value 0.7, also it talks about the loneliness during digital classes which is the most important variable of the psychological wellbeing and Figure 2 shows the PLS-SEM results. The numbers on the path relationships represent the standardized regression coefficients, while the numbers displayed in the circles of the constructs represent the R 2 values.

FIGURE 2
REGRESSION WEIGHT

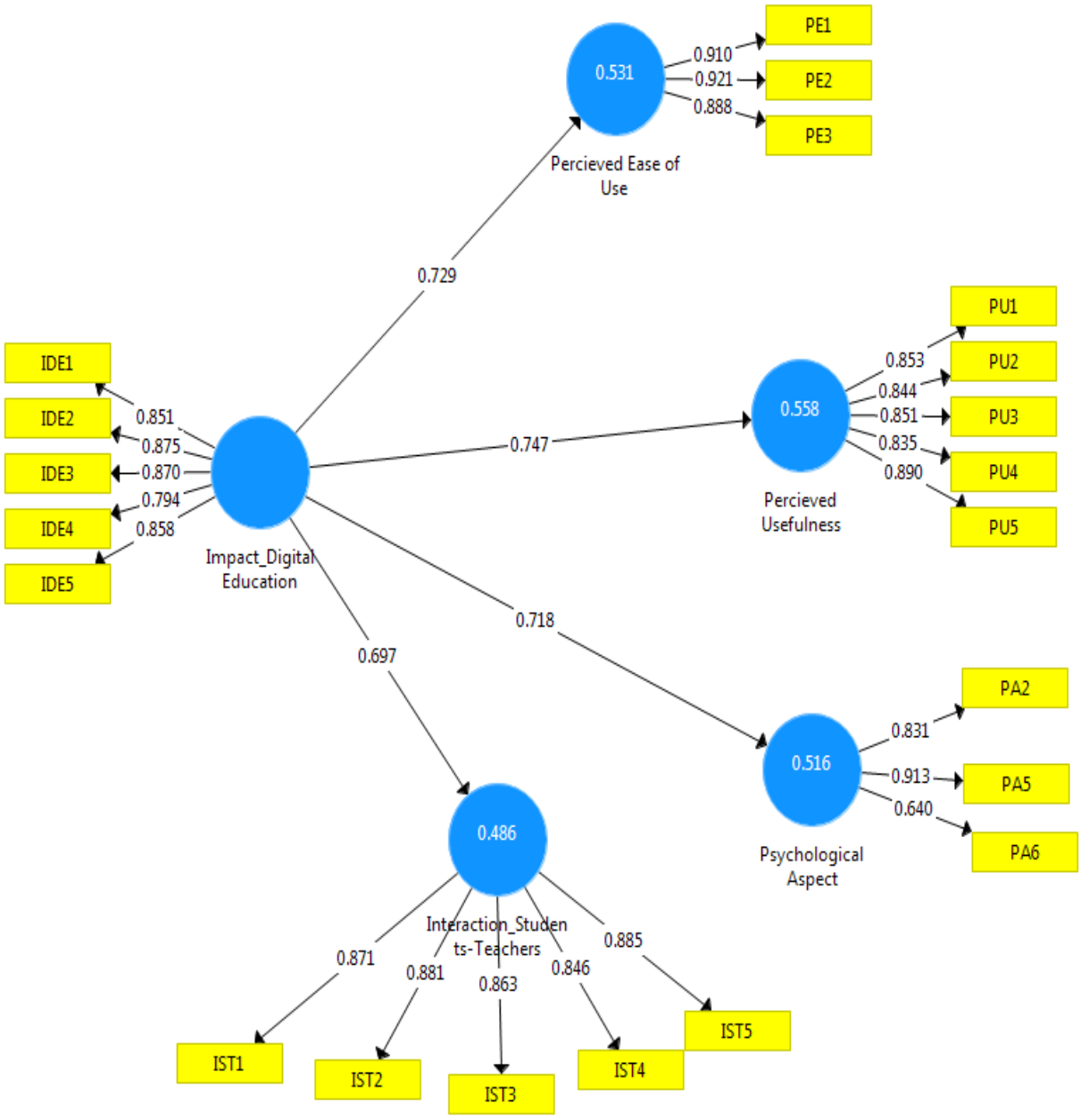


TABLE 5
PATH COEFFICIENT OF THE STRUCTURAL MODEL AND SIGNIFICANCE TESTING RESULTS

Constructs Connections	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Impact_Digital Education ->Interaction_Students-Teachers	0.697	0.699	0.059	11.918	**0.000**
Impact_DigitalEducation ->Percieved Ease of Use	0.729	0.728	0.053	13.625	**0.000**
Impact_Digital Education ->Percieved Usefulness	0.747	0.746	0.052	14.324	**0.000**
Impact_Digital Education -> Psychological Aspect	0.718	0.719	0.053	13.545	**0.000**

All the framed hypothesis was positively supported to the study, thus the interpretation of the result are: Digital Education has a positive impact on perceived usefulness among learners of higher education, Digital Education has a positive impact on perceived use of ease among learners of higher education., Digital Education has a positive impact on E-Classroom Interactions among learners of higher education and Digital Education has a positive impact on psychological wellbeing among learners of higher education.

DISCUSSION

The objective of the study was to study the impact of digital education on learning behaviour of undergraduates in terms of Perceived Ease of Use, Perceived Usefulness, Psychological Wellbeing and E-classroom interaction. According to the results digital education showed a statistically positive impact on the learning behaviour

Digital education had a positive impact on perceived ease of use. This represents the basic relationship proposed by TAM. Various studies reported that since perceived ease of use a have a positive relationship, it can be inferred that users perceive easy to use of new systems as more useful. Moreover, Caliser (2009) reported that if a new technology is easy to use and does not take long to learn, real users' efficiency increases: therefore, digital learning should be easy to use (Lee et al., 2020). These results suggest that the outcomes of digital education can be enhancing by making digital educational services easy to use.

Digital education had a positive impact on Perceived Usefulness of new learning change. The higher the perceived usefulness the higher the educational satisfaction (Ahilyavishwavidhyalay & Ahilyavishwavidhyalay, n.d.). Numerous previous studies have suggested that perceived usefulness for new technology have a positive impact on user satisfaction. Researchers have also found that perceived usefulness has a positive impact on user satisfaction in the information systems field, Landrum in 2004 suggested that perceived usefulness has a very strong influence on satisfaction, and in a study on information systems. Roca in 2006 applied an extended version of TAM to investigate the use intention of digital learning information technology and their results revealed that perceived ease of use and perceived usefulness are positively related to user satisfaction. Results show that educational satisfaction had a positive effect on acceptance intention. Research has shown that satisfaction regarding psychological wellbeing and e-classroom interaction, digital education are inter related. Accordingly, this study's finding that high educational satisfaction produces positive impact of digital education on learning behaviour.

CONCLUSIONS

The research described, this study was conducted in the period of the coronavirus pandemic, which has covered the whole world and has not left a single country uninvolved. All educational institutions were caught by surprise and had to throw all their efforts toward adjusting to the new reality as quickly as possible (Almahasees et al., 2021). The survey "caught" the students of colleges in the middle of the period of distance learning, to which they all had to switch. Such timing allowed getting the most state-of-the-art feedback from students as for the methods and tools used in the process and exploring their emotions while they were still experiencing them. The authors consider picturing such state-of-the-art students' attitude to be one of the contributions of this research (Diener, 2009).

The research, conducted in this paper, is based on a survey conducted among Undergraduates of Central India, when the entire education system shifted to digital because of the coronavirus outbreak. The survey has allowed for analysing the impact of Digital Education on learning behaviour in terms of Perceived ease of use, perceived usefulness, psychological wellbeing and e-classroom interaction. However, despite the positive opinions about digital education, the students would like to go back to traditional education. This research is a valuable contribution for policy-making in case the COVID-19 situation forces HEIs to continue working online. Nevertheless, this work has limitations since only Undergraduates of Central India was observed. Realization of comparative research would be reasonable to get a wider picture of the impact of pandemic on higher education.

Limitations and Future Directions

The results of this study should be interpreted in the context of some limitations which can be addressed in the future research. The study was conducted during pandemic crises, so it is not easily replicable. Also the results of the present study are influenced by the family mental health due to covid-19 suffering. It was conducted on undergraduates of central India. The gender ratio was approximately balanced in the present study; however it was not analyzed statistical for the control variable gender. The measures adopted by the different state, countries and universities have differed. These differences may make the results of this study difficult to extrapolate to other countries or universities. For this reason, while it is expected that some of the results may be of value beyond the pandemic situation, it will be necessary to validate their applicability on other context.

It can be concluded that various predictors of learning behavior was impacted by the digital education during pandemic (Profit, 2019). It is clear that digital education now from the pandemic created a alternate path in education world. With this Online degree programs now have the equal weightage and more and more universities now started with the same (Solberg, 2012). We should meet the needs by incorporating a range of digital education mean while we have taken care of learner's psychological health (Philip & Gavrilova Aguilar, 2021). Existing study cover only the four predictors of learning behavior but it has more scope to study as; learning behavior is very vast area and it directly involve with any kind of education. However, the educators need to be given the opportunity for further training in instructional design for digital teaching and learning. In the further studies, it would be useful to examine to what extent online assessment can be made more fruitful. Wide scope is there to study the positive thinking, performance expectancy, monotonous e-classroom etc (Badan & Igeria, 2018). Despite these limitations, the results of the present study offer valuable information on the learning behavior and digital education.

ACKNOWLEDGEMENT

This paper is largely an outcome of the Research Project sponsored by the Indian Council of Social Science Research (ICSSR).

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