Study On Students' Perception Towards The Use Of Ar/Vr Technologies In Higher Education

Varunan[1], Pradeep Malik[2]

[1]Research Scholar, School of Liberal Studies-Pandit Deendayal Energy University, Knowledge Corridor, Raisan Village, PDPU Rd, Gandhinagar, Gujarat 382007, Email: varunan.kphd19@sls.pdpu.ac.in
[2]Professor and Head, Department of languages, Literature and Aesthetics, School of Liberal Studies-Pandit Deendayal Energy University, Knowledge Corridor, Raisan Village, PDPU Rd, Gandhinagar, Gujarat 382007, Email: Pradeep.malik@sls.pdpu.ac.in

Received: 18.04.2024 Revised : 19.05.2024 Accepted: 20.05.2024

ABSTRACT
Smart, new digital technologies that have an impact on a variety of environments and sectors involve virtual reality and augmented reality. The transition from traditional to digital or blended learning methods and tools is one of the most significant breakthroughs in higher education. For all relevant stakeholders, adopting and using these immersive tools presents a number of difficulties. The study's goals included learning how students perceive the use of augmented reality and virtual reality technologies as well as learning what influences how these tools are applied in higher education. The research was constructed on the theoretical underpinnings of the Technology Approval Model to achieve this goal (TAM). A study model was empirically tested within students of higher educational institutions in Bengaluru, Karnataka. 294 students made up the sample group, and data were gathered using an online survey. SPSS 23 was used in analysing data. Findings from multiple regression and ANOVA analysis show that perceived usefulness, confidence, and awareness, as well as perceived ease of use, has a greater impact on students' perceptions and are key predictors of whether and how often they will embrace and use these immersive technologies. These results support the development of TAM theory and successful application of interactive technologies in higher education. The results of the research will aid higher education institution leaders and management in concentrating on creating infrastructure, educating instructors, and developing creative pedagogy for incorporating immersive augmented and virtual reality technologies into curricula.

Keywords: Augmented reality, Virtual reality, Student perception, TAM, Higher education

INTRODUCTION

Although the study fields of augmented and virtual reality (VR/AR) have been researched for decades, the recent advent of ongoing development in technology that are accessible to a wide range of customer markets has once again sparked substantial research endeavours in these areas. The only distinction between AR and VR as digital tools is the level of engagement. While VR immerses the user in different locations, AR enables users to engage within their present environments (Yung & Khoo-Lattimore, 2019). According to Akçayr & Akçayr (2017), Virtual items are projected onto the actual world using an AR technology. Then, it appears that these virtual items are situated in the same space as real objects. Virtual reality (VR) is a technology which allows users to analyse computer-simulated environments and immerses themself in a digital interactive portrayal of locations or conditions (Hunter, 2016). This improves their ability to successfully complete tasks and fulfil responsibilities for a variety of uses (Khoo-Lattimore, 2019).Scholarly researches indicates that AR and VR are effective teaching methods that are completely consistent with the current drive for digital and blended instruction (Boulton et al., 2018). Numerous studies have demonstrated benefits of using VR and AR in academic achievement (Chen, 2016). Merchant (2014) demonstrated in their study the benefits of implementing augmented reality (AR) in the classroom, including learning advances, motivation, and student involvement. Numerous studies regarding VR and AR have revealed enhancements in students' academic results, drive, collaboration, and cognitive and psychomotor abilities (Harris, Kristan, & Denise Reid, 2005). Since VR and AR improves decision-making while engaging with environments virtually, allowing explorations, comprehending complex ideas, developing new experiences, and experiential learning, it is claimed that technological innovations urge students to become engaged and active participants in learning.

Jorge Martn-Gutiérrez, et al. (2017) go into detail on four key benefits of utilizing VR/AR educational technology: Integrating VR and AR in higher educational context can boost learner involvement and motivation. When examining three - dimensional images, students engage in immersive interactions that improve their learning. VR/AR enables a creative method of teaching. Students are allowed to openly engage including both other students and virtual elements. As a result, students can investigate, study, and receive input, which leads to a learning opportunity. Costs for VR/AR are going down, making them more widely available. Smartphones, laptops, and gaming consoles now have easier access to VR/AR technology due to recent technical advancements. Students can now easily access shared Virtual contents without the need for complicated hardware through popular online sites like YouTube. Furthermore, special needs students can engage with virtual objects as well as other students as well as have simpler access to virtual environments (Michelle R. Kandalaft et al., 2013). Compared to traditional learning tools, VR and AR encourage more engagement. With the aid of VR/AR, students can engage with various learning concepts while feeling more involved thanks to the use of headgear, haptic gloves, and motion detectors. Through this unique engagement, students can interact with real-world scenarios, things that they would not otherwise have access to (Mercè Bernaus, Annie Wilson, Robert C. Gardner, and Bernaus, 2009). In the recent past, there has been a lot of researches on understanding the student attitude ad motivation towards these immersive technologies. This study's goal is to analyse views, attitudes, and drive of learners with regard to using AR/VR technologies in the classroom. Some scholars contend that student perspective is essential to the process of instruction and learning.

LITERATURE REVIEW

VR/AR Technology in Higher Education

In all areas of education, there has been an overall rise of institutions employing AR and VR to improve learning. Building infrastructure and dispersing funds are being done by schools and colleges to incorporate technological advances into their curricula. In order to accomplish the desired learning results, AR/VR technology must be carefully matched with the curriculum. This is not an inexpensive endeavour. A number of theories have been used to describe how technological advancements are accepted in education, including innovation diffusion theory. (Straub, 2009). Important adoption variables for virtual labs include acceptance of technology, relative benefit, desire to use, and technology readiness (Achuthan et al., 2020). Technology trialability enables user to experience and explore with technology first-hand, which explains why it is favourably correlated with innovation adoption rates (Rogers, 1995). Therefore, in order for an instructor to be willing to incorporate VR and AR into their instruction, they must be able to use them themselves. Given the wide variety of methods that can be used with VR and AR technology, this is particularly significant (Grivokostopoulos et al., 2020). Technology like VR and AR by itself cannot guarantee effective learning results (Reeves & Crippen, 2020). Infrastructure, student receptivity to technological change, and instructor awareness are a few variables that go into producing successful educational outcomes. Data from long-term investigations on technology adoption in entire higher education institutions, as well as optimal designs and costs for VR and AR teaching tools, are lacking. Due to the lack of knowledge, it is challenging for educational establishments to decide on VR and AR technology and also to defend significant investments in centralised learning. AR/VR promotes student engagement and deeper understanding, which leads to more efficient learning. By utilizing VR devices, teachers can make learning engaging and immersive while presenting challenging concepts to students in a controlled environment. Liu and Xiao (2008) developed a paradigm for the relationship between learner perception and AR and VR technology. They developed this approach in light of reasoned action theory (Fishbein & Ajzen, 1975). They employed methodologies such as factor analysis, relationship analysis, hypothesis testing, and experimental evaluation of them using the Tam and innovation diffusion model proposed by David (1988). The research found that there was a favourable correlation between all of the traits thought to be connected to student perception.

Factors that influence the students' perception for AR/VR technology use

Researchers are starting to become more interested in using VR and AR in learning. To begin with, millennial students today are interested in VR and AR. The reality that younger generation are spending more of their time online and some of them practically exist in virtual worlds is just one of their many characteristics (Hu-Au and Lee, 2017). Researches have established, VR has numerous potential advantages for instruction and learning process. Clark (2006) asserts that learning may become more interesting and enjoyable with the help of VR and AR., which would subsequently boost student drive and focus. Additionally, instructors can introduce contexts and locations into the classroom using VR and augmented reality, which are otherwise inaccessible or impractical. According to earlier research, pupils had favourable opinions of their use as instructional tools. Students' perceptions of the utility, amusement, attitudes, and behavioural intentions to use virtual environments were found to be important (Singh & Lee, 2009). According to Huang, Backman, & Backman (2010), flow experience significantly and favourably influences learners' perspectives toward virtual learning (Deale, 2013). Students had positive attitudes toward the use of virtual environments to train in communication and interpersonal skills as well as tourism-related knowledge (Hsu, 2012). Related to this, VR in the hospitality industry gives pupils engaging learning chances and lets them collaborate on group tasks. Similar to this, Schafer (2017) examined use of immersive images in tourist education and discovered that students thought the experience increased their engagement and helped them comprehend the material more thoroughly.

According to Barak, Watted, and Haick (2016), The hedonism motivating factors links the pleasure and satisfaction of students' digital learning experiences to their effectiveness and efficiency. More specifically, enjoyment defines the degree to which a person gets pleasure when they employ technology in learning (Heijden, 2004). Such a motivation is linked to students' perceptions of the advantages of task facilitation through active learning. This research demonstrates that students who truly have an innate motivation to learn are more likely to think that technologies of AR and VR are beneficial and to plan to incorporate them into the curriculum. The first assertion made by this research is that hedonic motivation is indeed a factor affecting students' perception.

H1: Hedonic motivation (HM) has a significant impact on perception of students in using AR/VR technology in higher education.

The probability that students will use AR and VR technology for informational objectives is referred to in this research as behavioural intention. The connection between behavioural intention and real use is substantial (Nunkoo & Ramkissoon, 2013). The overall impression that students have of participating in digital and blended learning is referred to as attitude. A positive attitude toward a behaviour produces a powerful desire to act in that way (Ajzen, 1991). Researchers have shown that the concepts attitude towards technology and intentions of behaviour are closely related (Escobar-Rodriguez & Monge-Lozano, 2012). The desire to use AR learning objects can have a beneficial and substantial impact on how well students perform academically when using AR educational materials. In their research, Sun et al. (2015) discovered that involvement is a key component of learning in their study of the impacts of assimilation and engagement in a Taiwanese setting. Engagement and promotion emphasis have a favourable influence on the user's perception of efficacy. Examined was the efficiency of an online situation game-based learning program for instructional objectives (Chan et al. 2020). The other concern relates to variables that impacts how often students use technology-enhanced learning opportunities. In contrast to perceived usefulness and fun, which were found to be major variables, ease of use had little bearing on students' attitudes toward and intentions to employ these tools for learning (Singh & Lee,2009). In accordance with study by Ali, Kumar, and Hussain (2016), each factor they examined had an impact on students' approval and involvement of computer-supported interactive classes based on UTAUT2 framework. Taiwanese colleges looked into the adoption of virtual network systems as computer game-based teaching (Chiao et al., 2018). All factors that were examined were found to directly affect students' behavioural intentions for using them.

H2: Attitude towards technology has a significant impact on perception of students in using AR/VR technology in higher education.

H3: Behavioural intention has a significant impact on perception of students in using AR/VR technology in higher education.

Having confidence and awareness when using AR and VR technology is defined as having conviction in one's abilities and knowledge to adequately create the intended results (Bandura, 1986). Because it affects outcome of students' and takes priority over other cognitive tasks, it is crucial for academic learning (Geitz et al. 2016). Self-efficacy is belief that an individual can effectively do and finish a job on their own. Later, the concept was expanded to imply that an individual is more likely to participate in a task if they feel they can accomplish it, and the opposite is also true. Self-efficacy was defined in the light of AR/VR technology as "confidence in one's ability to carry out particular learning tasks using an e-learning system." (Wang CH, Shannon DM, Ross ME, 2013).

H4: Confidence and Awareness has a significant impact on perception of students in using AR/VR technology in higher education.

The extent to which an individual believes that using a specific technology purport to be simple and requires little effort is known as perceived simplicity of use (Venkatesh, 2000). The user's assessment of whether using a particular technology is desirable is reflected in their attitude toward technology. The probability that someone will use a technology is determined by their behavioural desire to use (Fishbein & Ajzen, 1975; Ajzen, 1991). Numerous investigations have supported the associations between usefulness, ease of use, and attitude (Wojciechowski & Cellary, 2013). Students will have positive views on AR/VR functionalities if they think that using them will improve their performance and that employing

them is simple, clear and uncomplicated (Perceived Usefulness). This research thus supports hypotheses 5 and 6:
H5: Perceived usefulness has a significant impact on perception of students in using AR/VR technology in higher education.
H6: Perceived ease of use has a significant impact on perception of students in using AR/VR technology in higher education.

RESEARCH OBJECTIVES AND FRAMEWORK
A framework was established using the literature studies to better understand the independent and dependent factors and their interactions. The exploratory research will be built upon the depiction below, which was developed after a thorough literature analysis.
Student perception is dependent component of the model, and AR ad VR technology related variables are the independent variable. The theory argues that a range of internal and exterior factors impact students' perceptions of AR/VR immersive technology use in higher education. The study's theoretical foundation is shown in Figure 1.

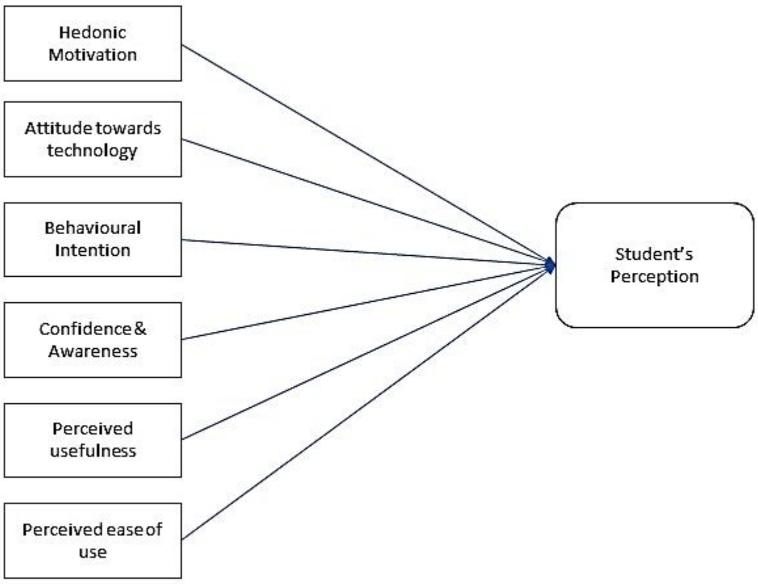

Figure 1. Framework for the study

The study's main goals are to:
1. Identify how students perceive AR/VR technology
2. Examine variables linked to AR/VR technology in higher education that have a major impact on students' perception
3. Analyze demographic characteristics of respondents

RESEARCH METHODOLOGY
A well-crafted, well-organized online questionnaire was used to gather primary data. This study used a sample gathered from college students in Bengaluru, Karnataka, studying in the arts, sciences, engineering, architecture, and design colleges through a convenient sampling method which is heterogeneous, comprising of respondents from different geographic regions, educational levels, age groups, and courses. To improve the study's exterior validity, this was performed. Online survey was circulated for data collection. The participants were also informed of the privacy of responses and their names. The total number of surveys collected was 335. 294 data were discovered following a screening for missing or insufficient entries.

Measures
The questionnaire was made using the Likert Scale, and analysis was done. Age, gender, course, graduation was all taken into account in a separate section. Six independent variables were used in the research, along with 30 assertions about the participants' perceptions of usefulness, usability, hedonic motivation, attitude towards technology, confidence and awareness and behavioral intention. The

dependent component is assumed to be student perception. The TAM and earlier works, including those by Venkatesh et al. (2012); Huang (2015); Mehta (2019) were used to develop measurement scale and items, which were then customized for the unique circumstances surrounding this research (Chiao et al., 2018). For each measurement, validity and reliability tests were conducted. Highly influential received a rating of 5, very influential received a rating of 4, somewhat influential received a rating of 3, slightly influential received a rating of 2, and not at all influential received a rating of 1. The dependability study was used to calculate Cronbach's Alpha consistency. According to the research, the reliability coefficient, or Cronbach's alpha, which measures how reliable all factors are, was 0.838.

DATA ANALYSIS AND RESULTS

The data is analysed using the software SPSS 23. Frequency and percentage analysis was used to examine the participant's socioeconomic characteristics. It was feasible to identify the components that affects the perception of students in using AR and VR technology in institutions of higher education by using ANOVA, and multiple regression. Descriptive statistics are employed in socio-demographic research.

The socio-demographic profile of the participants is as below: In that 56.8% are male and 43.2% are female among the age groups 49.3 % are among 18–21-year group, 35.3 % are among 21 to 23 age group, remaining are 25.4%. Among 33 % of students are in under graduation, 67% are in post-graduation courses. 30% of students were from architecture and design field, 59.8% were from engineering areas and 11.2% were from arts and science background. Most of the students 43.2% who use AR/ VR technology, use it for gaming, 17.6% use it for shopping, 39.2% uses for educational activities. 67.3% have said hybrid or blended learning as preferred mode, Online or MOOCs were 21.3% and 11.4% have preferred traditional classroom.

Table 1. Respondents' socio demographic characteristics

		n= 294	%
Gender	Male	167	56.8
	Female	127	43.2
Age	18-21	145	49.3
	21-23	104	35.3
	24 and above	45	15.4
Graduation	UG	96	33
	PG	198	67
Specialization	Architecture & Design	85	30
	Engineering	176	59.8
	Arts & Sciences	33	11.2
Purpose for using AR/VR technology	Gaming	127	43.2
	Shopping	52	17.6
	Education	115	39.2
Preferred mode of learning	Hybrid or blended	198	67.3
	Online, MOOCs	62	21.3
	Traditional classroom	34	11.4

Factor Analysis

Some factors were eliminated after factor analysis and multiple regression because they were insignificant to the research. As can be seen in Table 2, KMO and Bartlett's test were used to evaluate selection process. Sample appropriateness, as defined by KMO, should be higher than 0.5; nevertheless, the research reveals that in this case, it is 0.842. The information is therefore very significant.

Table 2. KMO and Bartlett's Test

Sampling Adequacy Test (KMO)		0.842
Bartlett Test	Chi- Square (Approx)	11363.783
	df	441
	Sig.	.000

The overall variation of the components using the extraction method is shown in table 3 below. The minimal load needed to incorporate each component was found by Hair (1992). Furthermore, it is advised that factors with loads of 0.30 or higher be considered important, those with loads of 0.40 or higher to be deemed more significant, as well as those with loads of 0.50 or higher to be highly significant. Nothing had been overlooked in this instance. The eigenvalue of Component 1's variance, which is 52.76%, is 14.54. The eigenvalue of Component 2's variance, which is 14.31%, is 4.83. The eigenvalue of Component 3's variance, which is 15.97%, is 3.32. The eigenvalue of Factor 4's variance, which is 14.82 percent, is 2.24. The eigenvalue of Component 5's variance, which is 1.22, is 17.21%. Component 6's eigenvalue is 1.11 and its variation is 11.41%. Frequently, the item's natural affection for a grouping is the determining element. The filling component increases with an item's stronger correlation to a given element. The findings of the research demonstrate that every one of six variables— hedonic motivation, perceived utility, perceived ease of use, attitude toward technology, trust and consciousness, and behavioural intention—was uniformly loaded to different elements. As a result, every one of the 28 factors that were included in the six distinct components is related to what the consumers need. For each figure in the table, the factor loading orders of magnitude have been increased by 100. Table 4 displays the component grid that has been rotated, and loadings of 0.60 or less are not recorded.

Table 3. Total Variance

Item	Initial Eigen Value			Extraction Sums of Squared Loadings		
	Total	Variance %	Cumulat%	Total	Variance %	Cumulat %
1	14.54	52.76	54.79	14.54	52.76	54.79
2	4.83	14.31	67.00	4.83	14.31	67.00
3	3.32	15.97	82.06	3.32	15.97	82.06
4	2.24	14.82	97.59	2.24	14.82	97.59
5	1.22	17.21	96.43	1.22	17.21	96.43
6	1.11	11.41	97.94	1.11	11.41	97.94
7	0.086	0.322	99.12			
8	0.076	0.172	99.26			
9	0.051	0.114	99.38			
10	0.042	0.103	99.52			
11	0.038	0.072	99.66			
12	0.017	0.069	99.72			
13	0.005	0.064	99.81			
14	0.004	0.059	99.91			

Table 4. Rotated Component Matrix

Factors with alpha value	F1	F2	F3	F4	F5	F6
Hedonic Motivation (0.815)						
HM1	0.93					
HM2	0.82					
HM3	0.81					
HM4	0.83					
HM5	0.82					
Attitude towards technology (0.857)						
ATT1		0.77				
ATT2		0.84				
ATT3		0.91				
ATT4		0.93				
ATT5		0.88				
Behavioural Intention (0.847)						
BI1			0.86			
BI2			0.85			
BI3			0.83			
BI4			0.93			
Confidence and Awareness (0.812)						
CA1				0.82		
CA2				0.91		
CA3				0.83		

CA4				0.87		
Perceived Usefulness (0.848)						
PU1					0.84	
PU2					0.75	
PU3					0.83	
PU4					0.87	
PU5					0.90	
Perceived Ease of Use (0.863)						
PEU1						0.74
PEU2						0.73
PEU3						0.82
PEU4						0.83
PEU5						0.80

Testing of Hypothesis

Regression was utilized for evaluating the study's premise after six factors were extracted from the component analysis. The results of the study on pupil perspective are shown in Tables 5 and 6. According to the study's results, these six independent variables accounted for 76.3 percent of the variation in students' views of AR and VR in higher educational institutions, with a F value of 64.958 significant and a p-value of 0.000. (Table 6 and 7). Therefore, it is evident that these six factors have a significant impact on perception of students toward use of AR and VR in higher education.

Table 5. Summary of Model

Model	R	R^2	Adjusted R^2	Std. error
1	0.872	0.782	0.763	0.48762598

IV: perceived usefulness, hedonic motivation, confidence and awareness, perceived ease of use, attitude towards technology, and behavioural intention

Table 6. ANOVA

Model	Sum of Square	df	Mean Square	F	Signif.
1					
Reg	113.067	7	18.189	64.958	.000 (a)
Residual	32.853	130	0.357		
Total	145.92	137			

The study's hypotheses centres on how specific, unrelated variables affect how students view AR/VR technology use in institutions of higher education. Testing above mentioned hypothesis leads to the accomplishment of study's objectives. Table 7 shows results of level of impact each independent variable will have on perception of students towards using technologies of AR/VR in higher educational institutions. All of the aforementioned hypotheses are important and significantly improve how people view pupils. This research has shown that perceptions of usefulness, confidence, and simplicity of use have the strongest impacts on students' perceptions.

Table 7. Coefficient of Regression Model

Model 1	Unstd. coeff		Std.co-eff	t	Sig
	B	Std. err	beta		
(const)	-3.9889 E-	0.043		0.000	1.0
Factor 1	0.402	0.044	0.402	8.120	0
Factor 2	0.393	0.041	0.393	7.323	0
Factor 3	0.438	0.045	0.436	6.472	0
Factor 4	0.393	0.042	0.394	8.864	0
Factor 5	0. 379	0.043	0. 389	9.862	0
Factor 6	0.387	0.042	0.388	8.453	0

DISCUSSION AND CONCLUSION

According to the study, most students have favourable perceptions towards use of technologies like VR and AR in classroom. Learners think that by utilizing VR and AR in the classroom, learners will have the ability to better comprehend the concepts being taught and will learn more effectively. This result is in line with the facts in. They listed benefits like concentration, enhanced memory, drive, and a sense of being in the "real world," as well as time travel, which was proven during the study's literature review (Freina, Laura, and Michela O, 2015). In conclusion, students recognized that using VR and AR have many beneficial effects that were outlined in the literature, despite the fact that technologies are all still comparatively unknown and the majority of learners do not keep up with new technological developments in higher education. In this article, a sampling of students' opinions regarding use of AR and VR technology as tools was taken and analysed. The findings indicate that while most students have optimistic hopes for these new tools. It is crucial to note that all six of the study's variables— hedonic motivation, perceived usefulness, perceived ease of use, confidence, awareness, attitude towards technology, and behavioural intention—have a big influence on how students view things. The TAM paradigm is supported by this study's results and is consistent with them. According to this study, views of utility, assurance, and ease of use have the biggest effects on students' perspectives. Therefore, it is crucial to inform learners about benefits of AR/VR technology in educational environments. Individuals must have the confidence in their ability to manage technology on their own, as well as the drive to make the process enjoyable and enjoyable. Despite this, the majority of worries revolved around VR/AR being primarily used for entertainment rather than learning. Because new technologies have the potential to be useful instruments for the educational process, instructors need to be instructed how to use them with confidence and effectiveness. It will be crucial for us to comprehend factors influencing favourable views of AR and VR in order to inspire instructors to use new technologies. Higher education institutions will be able to change teaching and the university as a whole to better serve their students' requirements if they can completely utilize these technologies. The developments of VR, AR, have the potential to significantly increase student success and happiness, from tailored programs and also more effective remote learning to better research possibilities and a more linked student life. Higher education will only benefit from allowing students to further closely experience their scholastic emphasis in these ways. The variety of options, when combined with the appropriate disciplines and classes, can assist institutions in meeting the expectations of students in a technologically advanced world. The adoption of VR/AR technology by higher education institutions needs to be considered, including what the future may look like and what kind of infrastructure and assistance it might need. The use of AR and VR in classroom is generally well received by students, and due to possible advantages of these tools, educators are eager to learn more about them.

Limitations and scope for further research

It is clear from the above that a wide range of decision-making situations must be investigated before broad conclusions can be made to guide the development of VR/AR technologies. This research has suggested a highly integrative model that can be used to examine relationships between the determinants' usefulness, simplicity of use, awareness and confidence, attitude, and motivation in order to better understand how students view AR/VR technology in higher education. More research is needed to investigate these problems using different populations before generalizations can be made. Furthermore, it is essential to go beyond the Bangalore area. The research of additional internal and external variables is also an option.

REFERENCES

[1] Achuthan, K., Nedungadi, P., Kolil, V., Diwakar, S., & Raman, R. (2020). Innovation adoption and diffusion of virtual laboratories. International Journal of Online and Biomedical Engineering, 16(9), 4–25.

[2] Ajzen, I. (1991). The theory of planned behavior: Some unresolved issues. Organizational Behavior and Human Decision Processes, 50(2), 179–211.

[3] Ali, F., Kumar, N. P., & Hussain, K. (2016). An assessment of students' acceptance and usage of Computer supported collaborative classrooms in hospitality and tourism schools. Journal of Hospitality, Leisure, Sports and Tourism Education, 18, 51–60. doi: 10.1016/j.jhlste.2016.03.002

[4] Barak, M., Watted, A., & Haick, H. (2016). Motivation to learn in massive open online courses: Examining aspects of language and social engagement. Computers & Education, 94, 49–60. doi: 10.1016/j.compedu.2015.11.010.

[5] Bates, R., & Khasawneh, S. (2007). Self-efficacy and college students' perceptions and use of online learning systems. Computers in Human Behavior, 23(1), 175-191. doi: 10.1016/j.chb.2004.04.004

[6] Bernaus, Mercè, Annie, W., Robert, C., & Gardner. (2009). Teachers' motivation, classroom strategy use, students' motivation and second language achievement.
[7] Chen, Peng, & et, a. (2017). A review of using Augmented Reality in Education from 2011 to 2016. In Innovations in Smart Learning (pp. 13-18). Singapore: Springer.
[8] Chiao, H. M., Chen, Y. L., & Huang, W. H. (2018). Examining the usability of an online virtual tour-guiding platform for cultural tourism education. Journal of Hospitality, Leisure, Sports and Tourism Education, 23, 29–38. doi: 10.1016/j.jhlste.2018.05.002.
[9] Clark, D. (2006). Games and e-learning: Sunderland. Caspian Learning. Retrieved from http://ww.w.cedmaeurope.org/newsletter%20articles/misc/Games%20and%20
[10] Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340.
[11] Davis, F. D., Bagozzi , R., & Warshaw , P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. Management Science, 35(8), 982–1003.
[12] Deale, C. S. (2013). Incorporating second life into online hospitality and tourism education: A case study. Journal of Hospitality, Leisure, Sports and Tourism Education, 13, 154–160. doi: 10.1016/j.jhlste.2013.09.002
[13] DeTure, M. (2004). Cognitive Style and Self-Efficacy: Predicting Student Success in Online Distance Education. Retrieved from http://eric.ed.gov/?id=EJ683296
[14] DeWitt, D., Alias, N., Siraj , S., Yaakub , M. Y., Ayob , J., & Ishak , R. (2013). Procedia - Social; Behaviour Science (Vol. 103).
[15] Escobar-Rodriguez, T., & Monge-Lozano, P. (2012). The acceptance of Moodle technology by business administration students. Computer Education, 58(4), 1085–1093. doi: 10.1016/j.compedu.2011.11.012.
[16] Fishbein, M., Ajzen, I., Addison-Wesley, & Reading, M. A. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research.
[17] Fletcher, K. M. (2005). Self-efficacy as an evaluation measure for programs in support of online learning literacies for undergraduates. The Internet and Higher Education, 8(4), 307-322. doi: 10.1016/j.iheduc.2005.09.004
[18] Gebara, N. L. (2010). General self-efficacy and course satisfaction in online learning: A correlational study. (Doctoral dissertation). Columbia: University of Missouri. doi: http://www.editlib.org/p/121111
[19] Grivokostopoulos, F., Kovas, K., & Perikos, I. (2020). The effectiveness of embodied pedagogical agents and their impact on students learning in virtual worlds. Applied Sciences-Basel, 10(5), 14.
[20] Harris, Kristan, & Denise Reid. (2005). The influence of virtual reality play on children's motivation. Canadian Journal of Occupational Therapy, 72(1), 21-29.
[21] Holley, Debbie, Hobbs, M., & Menown, C. (2016). The Augmented Library: Motivating STEM Students. Networks 19.
[22] Howe, N., & Strauss, W. (2000). Millennials Rising: The Next Great Generation. Vintage Books.
[23] Hsu, L. (2012). Web 3D simulation-based application in tourism education: A case study with second life. Journal of Hospitality, Leisure, Sports and Tourism Education, 11(2), 113–124.
[24] Huang, Y. C., Backman, S. J., & Backman, K. F. (2010). Student attitude toward virtual learning in second life: A flow theory approach. Journal of Teaching in Travel & Tourism, 10(4), 312–334. doi:10.1080/15313220.2010.525425
[25] Hu-Au, E., & Lee, J. J. (2017). Virtual reality in education: a tool for learning in the experience age. International Journal Innovation in Education, 4(4), 215–226.
[26] Hwang, K., & Zo, H. (2016). Understanding users' continuance intention toward smartphone augmented reality applications. Information Development, 32(2), 345–367.
[27] Ibanez, M., & Delgado, C. (2018). Augmented reality for STEM learning: a systematic review. Computer Education, 123, 109–123.
[28] Jahnke, I., & Kroll, M. M. (2018). Exploring students' use of online sources in small groups with an augmented reality-based activity e group dynamics negatively affect identification of authentic online information. 4(6), 1–2.
[29] Joo, J., Martínez, F., García, J., & García, F. (2017). Augmented reality and pedestrian navigation through its implementation in m-learning and e-learning: evaluation of an educational program in Chile. Computer Education, 111, 1–17.
[30] Kandalaft, Michelle , R., & et, a. (2013). Virtual reality social cognition training for young adults with high-functioning autism. Journal of autism and developmental disorders, 43(1), 34-44.

[31] Kerlinger, F., & Lee, H. (2002). Investigacion del comportamiento. M etodos de investigacion en las ciencias sociales [Behavioral research. Research methods in the social sciences]. Mexico: McGraw-Hill.
[32] Lagunes-Domínguez, A., Torres-Gastelú, C., Angulo-Armenta, J., & Martínez-Olea, M. (2017). Prospectiva hacia el Aprendizaje Móvil en Estudiantes Universitarios (Vol. 10). Formación universitaria.
[33] Li, Y., Duan, Y., Fu , Z., & Alford , P. (2012). Br Journal Educatiom Technology (Vol. 43).
[34] Lopez-Bonilla, L., & Lopez-Bonilla, J. (2017). Explaining the discrepancy in the mediating role of attitude in the TAM. Br. Journal Education Technology, 48(4), 940–949.
[35] Martín-Gutiérrez, Jorge, & et, a. (2017). Virtual technologies trends in education. EURASIA Journal of Mathematics Science and Technology Education, 13(2), 469-486.
[36] Merchant, Zahira, & et, a. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. Computers & Education 70, 29-40.
[37] Nunkoo, R., & Ramkissoon, H. (2013). Travelers' e-purchase intent of tourism products and services. Journal of Hospitality Marketing & Management, 22(5), 505–529.
[38] Oriol, X., Miranda, R., Oyanedel, J. C., & Torres, J. (2017). Front Psychol (Vol. 8).
[39] Padilla-Meléndez, A., del Aguila-Obra, A. R., & Garrido-Moreno, A. (2013). Perceived playfulness, gender differences and technology acceptance model in a blended learning scenario. Computers & Education, 63, 306–317. doi: 10.1016/j.compedu.2012.12.014
[40] Pellas, N. (2014). The influence of computer self-efficacy, metacognitive self-regulation and self-esteem on student engagement in online learning programs: Evidence from the virtual world of Second Life. Computers in Human Behavior, 35, 157-170. doi: 10.1016/j.chb.2014.02.048
[41] Puzziferro, M. (2008). Online Technologies Self-Efficacy and Self-Regulated Learning as Predictors of Final Grade and Satisfaction in College-Level Online Courses. American Journal of Distance Education, 22(2), 72-89. doi:10.1080/08923640802039024
[42] Ray, Ananda Bibek, & Suman, D. (2016). Smartphone Based Virtual Reality Systems in Classroom Teaching—A Study on the Effects of Learning Outcome. 2016 IEEE Eighth International Conference. Technology for Education (T4E).
[43] Reeves, S. M., & Crippen, K. J. (2020). Virtual laboratories in undergraduate science and engineering courses: A systematic review. Journal of Science Education and Technology, 15. Retrieved 2009–2019
[44] Rogers, E. (1995). Diffusion of innovations. Free Press.
[45] Schaffer, V. (2017). Enhancing learning to diverse cohorts via immersive visualization. Journal of Hospitality, Leisure, Sports and Tourism Education, 21(Part A), 46–54. doi: 10.1016/j.jhlste.2017.07.001
[46] Shea, P., & Bidjerano, T. (2010). Learning presence: Towards a theory of self-efficacy, self-regulation, and the development of communities of inquiry in online and blended learning environments. Computers & Education, 55(4), 1721-1731. doi: 10.1016/j.compedu.2010.07.017
[47] Shen, D., Cho, M. H., Tsai, C. L., & Marra, R. (2013). Unpacking online learning experiences: Online learning self-efficacy and learning satisfaction. The Internet and Higher Education, 19, 10-17. doi: 10.1016/j.iheduc.2013.04.001
[48] Singh , N., & Lee , M. J. (2009). Exploring perceptions toward education in 3-D virtual environments. An introduction to "second life" Journal of Teaching in Travel & Tourism, 8(4), 315–327. doi:10.1080/15313220903047896.
[49] Straub, E. T. (2009). Understanding technology adoption: Theory and future directions for informal learning. Review of Educational Research, 79(2), 625–649.
[50] Van Der Heijden, H. (2004). User acceptance of hedonic information systems. MIS Quarterly, 28(4), 695–704.
[51] Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. Information Systems Research, 11(4), 342–365.
[52] Wadhera, M. (2016). The information age is over; welcome to the experience age. Tech Crunch. Retrieved from https.//techcrunch.com/2016/05/09/the-information-age-is-over- welcome-tothe-experience-age/
[53] Wang, C. H., Shannon, D. M., & Ross, M. E. (2013). Distance Education (Vol. 34).
[54] Wang, Y. (2017). Using augmented reality to support a software editing course for college students. Journal Computer Assisted Learning, 33, 532–546.

[55] Wojciechowski, R., & Cellary, W. (2013). Evaluation of learners' attitude toward learning in ARIES augmented reality environments. Computers & Education, 68, 570–585. doi: 10.1016/j.compedu.2013.02.014
[56] Yang, S. (2013). Understanding undergraduate students' adoption of mobile learning model: A perspective of the extended UTAUT2. Journal of Convergence Information Technology, 8(10), 969–979. doi: 10.4156/jcit.vol8.issue10.118.