Impact of Smart Classrooms in Teaching Learning Effectiveness in Higher Education: A Quantitative Investigation

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Abstract

In the higher education system of India, smart classrooms have changed the way teachers teach and students learn. The technologically advanced learning spaces have multimedia tools, internet access, and engaging screens that spur interest in students' lessons. Teachers can offer information to students in varied ways using digital tools and engaging software. The real-time group discussion and sharing of ideas in class create an atmosphere where students can actively participate in the classroom activities. Such an environment encourages students to become independent learners, as they can access the learning materials at any time and place. Smart classes also make teachers more successful by giving them tools for video lectures, quick feedback, and automated tests. This not only makes routine jobs easier, but it also makes it easier for teachers to tailor lessons to each student and keep better track of their progress. Overall, smart classes have changed traditional lecture-based methods into more dynamic, engaging, and student-centered learning spaces. This has helped Indian college students think critically, be creative, and work together. Study survey was conducted among 201 people (teachers and students) with different streams in higher education to know the factors that determines the impact of Smart Classrooms in teaching learning effectiveness in higher education. It is found that Enhanced Engagement, Personalized Learning, Access to Resources and Collaborative Learning are the factors that determines the impact of Smart Classrooms in teaching learning effectiveness in higher education.

Keywords: Smart classes, Higher education, Multimedia tools, Internet access, Engaging screens, Student-centered learning, Technological advancement, Interactive teaching.

Introduction

Smart classes have made a big difference in how well students and teachers learn in India's higher education system. The latest technology in these classes has changed the way standard lessons are taught by making talks more interesting and participatory. They give students a way to study that is different from the norm. This helps them learn how to use technology and improve their digital literacy. Programmes like the Digital India movement and the National Education Policy 2020 have pushed for smart classes. These programmes aim to integrate

technology into education and close the digital gap. However, all schools must gain from technology, especially those that are government or government-aided. Smart classes are being used in almost all schools, which is good news. Today, smart classes have become increasingly important in the higher education system of India. Naidu et al. (2017) looked into how learning analytics could enhance the way teaching and learning occur within smart classes. With data-driven insights, teachers may personalize lessons based on students' learning needs to offer a more customized and thus effective learning experience. This also makes students more involved and helps them remember and understand what they are learning. Smart technologies will also make real-time feedback possible, which allows teachers to quickly locate and rectify any problems in the classroom, thereby helping to enhance teaching and learning.

Palanivel (2020) strives to discuss the idea of new technologies in smart education, citing how important they are in changing traditional classroom working. Together with virtual reality, augmented reality, and intriguing video materials, smart classrooms go beyond conventional methods of teaching. Such interactive and engaging learning experiences keep students interested and get them to participate and remember what they have learned. Smart classes enable teachers to enhance the classroom learning experience with the help of a wide range of pedagogical resources and encourage collaborative learning. Such a flexible and effective approach to teaching and learning within the confines of Indian universities improves the quality of education.

Saini and Goel (2019) looked at how smart classrooms change teaching and learning in more ways than one. From interactive whiteboards to mobile learning apps, smart classrooms have many tools that make learning fun and active. Such tools enable the teachers to reach more students, including those from far-off places, and then give them better lessons. The multimedia materials and involving learning tools, on the other hand, also induct students into being engaged, thinking critically, and solving problems. Hence, smart classes are making teaching and learning more effective, and they provide skills that will be essential for any student in a world undergoing rapid digitization and changing higher education in India. Smart classes had a tremendous impact on the effectiveness of teaching and learning in India's higher education system. According to Kaur et al. (2022), especially in higher education settings, smart classrooms could be viewed as an essential tool in enhancing the effectiveness of teaching and learning. Leaning will be focused on different advantages that are brought about by application of smart classroom tools, e.g., higher student participation, better academic achievements and personalized learning among many others.

Literature Review

Murugesan and Deepa (2019) explored smart classroom teaching into high school science grades, and they offered us useful information on various ways through which technology could be beneficial in improving the learning environment. This showed us that we must are proactive in our approach and use "smart classroom technologies" to improve student learning, especially in STEM subjects. Teachers become capable of using digital content, interactive tools, and real-time feedback systems to develop student-centered learning environments that will improve the engagement of all students and create a deeper comprehension of science concepts. Chatterjee et al. (2023) analyzed the difficulties of implementing smart schooling in the Indian educational system that uses information and communication technologies. This requires a multi faceted solution ranging from content development to teacher retraining construction and favorable policies. By means of smart learning technologies with virtual classes, mobile learning apps and on-line testing programs, India could overcome the obstacles of education and guarantee the provision of quality learning for all.

Bharadwaj (2023) has assessed the onset of the "new era of online education" and its influence on the efficacy of teaching and learning, especially in the Indian higher education sector. Because online education is popular, the role of "smart classroom" is crucial for the purpose of ensuring students learn from home in a way that is enjoyable and meaningful. With "Smart Classrooms," students anywhere are really well-equipped to receive top quality instruction by combining digital media tools and giving an interactive platform for learning. It means freedom, convenience, and innovation. Teachers can fit into changing educational trends and cater to the needs of all students by using "smart classroom" and online learning. The move towards online learning is a big step towards

making education more open to everyone and making sure that all students have equal access to good learning options. This will change the way education works in India for the better. Singh (2022) developed a "conceptual framework on Smart Learning Environment" that was specifically designed for India's current and future school systems. Putting together educational ideas, new technologies, and learner-centered methods to make learning spaces that are active and practical. Native Indian teachers can change to their students' changing needs and use technology to make teaching and learning more effective by creating smart learning settings.

Lakshmypriya et al. (2021) discuss the "digital transformation in higher education" that occurred during the pandemic. They highlighted that teacher training is absolutely needed to create more effective learning situations enabled by digits. Institutions will ensure that education continues and the standards for teaching and learning are maintained, even in uncommon circumstances, by providing teachers with the knowledge and skills for using smart classroom tools well. The continuing professional development program needs to be put in place to make the best use of the benefits of smart classes in teaching and learning in Indian higher education settings.

Uskov et al. (2020) discussed how the application of smart technology-based methods towards education may change things. A smart classroom environment lets the teacher attract learners to such active and interesting environments that fit the needs and learning style of each student. This is a great place in the college atmosphere, where students come from various backgrounds and have a varied amount of basic information. With the help of learning data and new tools, smart classrooms make the learning process even more personalized. Real-time data and information available at their fingertips do allow teachers to tune lessons according to the needs and abilities of each student, hence resulting in better learning outcomes. New video, virtual reality, and dynamic tools could keep the students motivated and active. This helps to involve the students in the learning process, which, in turn, is likely to increase their engagement in it. That is, that student will be engaged in learning more, and new tools will enhance the capacity of that student to understand complex ideas.

Kwet and Prinsloo (2020) explored the smart classroom as the recently available area that has the capacity to completely redefine how higher education is taught and learned within the framework of the "smart university." They will discuss how smart classrooms can change things by promoting creativity, teamwork, and participation between students and teachers. Smart classrooms are integrating innovative tools and pedagogical practices that make the environment effective in learning at India's higher education colleges. Within the age of the "smart university," Di et al. (2019) looked into how "learner factors" can influence higher-order thinking within a "smart classroom environment." They emphasized how important it is to be conscious of the backgrounds and interests of each student in order for smart classroom activities to work better. Educators can develop higher-order thinking skills among students when they introduce novelty in teaching and learning experiences, provided they adapt lessons and technology based on learner differences, cognitive abilities, and preference for a learning style. This will ultimately make classes more effective in India's higher education system. Ansari and Tripathi (2017) assesed the effectiveness of "mobile learning apps" in Indian higher education, providing necessary information on how mobile technologies can enhance teaching and learning processes.. They noted that the usage of mobile learning apps makes it easier for the students to access educational materials and work with other peers through learning, and to have individually designed learning experiences at any time and from anywhere. Teachers will get around common learning blocks and encourage active participation, memory recall, and skill development through the use of mobile devices prevalent among students. In India's higher education situations, this changed the way teaching and learning were done, a new era of open and inclusive education.

Lall et al. (2020) explored the possibilities of smart classes as an innovation in the field of education that transforms teaching and learning methods in the modern times. On the other hand, they also discussed on 'smart classes' many benefits which include: more learner responses, improved memory and easier access to all learning materials. "Multi-learning classrooms" achieve this by making learners participants in the process, utilizing technology to make the space interactive and collaborative. The introduction of this new principle in modern India's education may bring the change necessary for the schools to create a culture of innovation and achievement in both public and private universities. College education schools that offer the future-forward approach to

schooling help to build a culture of innovation and success. It will ensure students develop the digital literacy they will need in an increasingly digital era. The provision of equal opportunities for the delivery of quality learning experiences to all students will be made possible through easy learning experiences to smart classrooms.

The changing nature of the education system is the basis for the National Education Policy (NEP) 2020, which highlights how technology could be used to enhance quality in teaching and learning. One of the major bases of the concept of "smart classrooms," where technology supports dynamic learning spaces filled with digital tools and resources for encouraging personalized and interactive learning, is how technology could be used. National Education Plan 2020 (NEP 2020) would offer a smart classroom to all levels of schools for easy transformation from traditional teaching practices to modern ones. Using infrastructure for information and communication technology (ICT), the smart classes provide full and interesting learning, fitting different learning styles and tastes. However, integrating smart classrooms successfully faces several challenges, as Kaur and Ahuja (2023) describe. The challenges include problems with infrastructure, like slow internet connections and the lack of digital infrastructure in rural areas, as well as problems with teaching training and understanding how to use technology. Additionally, parties used to traditional teaching methods may not want to change, so a concerted effort is needed to raise knowledge and build capacity for adopting smart classroom tools. Although there are problems, the NEP 2020 lays out a plan for getting around them and using the revolutionary power of smart classes in higher education.

Shamim et al. (2022) placed cutting-edge methods, especially "quality education," for "smart classes teaching." Since they employ new teaching methods and cutting-edge technology, they said how important "smart classrooms" are towards making teaching and learning more effective. "Smart classrooms" give learners the chance to be more participative in learning and better understand subject concepts by using personalized learning experiences, virtual models, and engaging video materials. Shanwal (2017) analyzed the difference in the impact of "traditional and smart classrooms" upon "creativity" and "academic achievement." Different from what was available in conventional classrooms, smart classrooms offer learners a great platform with various sources of information, group learning platforms and interactive tools. These not in vain save time and boost creative spirit simultaneously. This illustrates the fact that an ideal classroom can help in altering those models of teaching and implementing them in the Indian higher education system.

Objective

1. To know the factors that determines different impact of Smart Classrooms in teaching learning effectiveness in higher education.

Methodology

Study survey was conducted among 201 people (teachers and students) with different streams in higher education to know the impact of Smart Classrooms in teaching learning effectiveness in higher education. "Random sampling method" and "Factor Analysis" were used to collect and analyze the data.

Findings

Table below is sharing respondent's general details. Total 201 people were surveyed in which male are 56.2% and 43.8% are female. Among them 30.8% are below 28 years of age, 40.3% are between 28-36 years of age and rest 28.9% are above 36 years of age. 20.4% are from science stream, 19.4% from arts, 25.9% from humanities, 23.4% from social science and rest 10.9% are from other streams in higher education.

Variables	Respondents	Percentage	
Gender			
Male	113	56.2	
Female	88	43.8	

Table 1 General Details

Total	201	100
Age (years)		
Below 28	62	30.8
28-36	81	40.3
Above 36	58	28.9
Total	2012	100
Stream		
Science	41	20.4
Arts	39	19.4
Humanities	52	25.9
Social science	47	23.4
Others	22	10.9
Total	201	100

Table 2 "KMO and Bartlett's Test"

"Kaiser-Meyer-Olkin Measu	.878	
"Partlett's Test of	Approx. Chi-Square	2638.092
Sphericity"	df	153
Spherienty	Sig.	.000

In the table above KMO value is 0.878 and the "Barlett's Test of Sphericity" is significant.

		"Initial Eigen v	alues"	"Rotation Sums of Squared Loadings"		
"Component"	%Ta4a 19	"% of	"Cumulative	tive "Total"	"% of	"Cumulative
	Total	Variance"	%"	Totai	Variance"	%"
1	7.670	42.609	42.609	3.857	21.425	21.425
2	2.251	12.507	55.116	3.638	20.212	41.637
3	1.971	10.949	66.065	2.932	16.289	57.926
4	1.453	8.072	74.137	2.918	16.211	74.137
5	.817	4.538	78.675			
6	.620	3.444	82.118			
7	.575	3.194	85.313			
8	.362	2.012	87.324			
9	.345	1.917	89.241			
10	.307	1.706	90.947			
11	.278	1.542	92.490			
12	.255	1.416	93.906			
13	.235	1.308	95.214			
14	.227	1.259	96.473			
15	.206	1.146	97.619			
16	.174	.965	98.584			
17	.151	.839	99.423			
18	.104	.577	100.000			

"Table 3 Total Variance Explained"

The "principal component analysis" method was applied to extract the factors and it was found that 18 variables form 4 Factors. The factors explained the variance of 21.425%, 20.212%, 16.289% and 16.211% respectively. The total variance explained is 74.137%.



The graph above depicts the Eigen values generated from the "Total Variance Explained table" for an elbow with 4 components.

"S.	"Statements"	"Factor	"Factor
No."	Statements	Loading"	Reliability"
	Enhanced Engagement		.917
1	Smart classrooms had increased student participation and interest in	856	
1	the subject matter	.850	
2	Captured students' attention more effectively than traditional	8/15	
2	methods	.0+0	
3	Visual aids, videos, and interactive presentations make learning	833	
5	more engaging	.055	
4	Improves student's active participate in activities	.823	
5	Smart classroom experiences ensured student's engagement and	783	
5	challenges at their level	.705	
	Personalized Learning		.900
6	Enable educators to tailor their teaching methods to individual	896	
0	learning styles and preferences	.890	
7	Allowed educators to create customized learning paths for each		
,	student	.0+0	
8	Facilitate timely and personalized feedback on student performance	.835	
9	Allow students to learn at their own pace, accessing course materials,		
,	lectures, and resources		
10	Empower students to create personalized learning environments that	.581	
10	suit their preferences and needs		
	Access to Resources		.860
11	Allows students to easily search for and access relevant materials	864	
11	from anywhere		
12	Online material has reduced costs and increased the accessibility for	851	
12	students	.051	
13	Digital tools had provided hands-on learning experiences that	715	
15	supplement traditional laboratory activities	.715	
14	Allowed students to navigate and access course materials from a	647	
14	single online portal	.0+/	

"Table 4 Rotated Component Matr	ix"
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	Collaborative Learning		.862
15	Smart classrooms had promoted teamwork and collaboration among	8/11	
15	students	.041	
Allowed to work together on group projects, share ideas, and discuss		830	
10	concepts in real-time	.037	
Fostered a collaborative learning environment that mirrors real-		777	
17	world professional settings	.///	
18	Opened up opportunities for global collaboration and cultural	740	
10	exchange	.740	

Table 4 is showing the impact of Smart Classrooms in teaching learning effectiveness in higher education. First factor is Enhanced Engagement which includes the variables like Smart classrooms had increased student participation and interest in the subject matter, captured students' attention more effectively than traditional methods, Visual aids, videos, and interactive presentations make learning more engaging, improves student's active participate in activities and Smart classroom experiences ensured student's engagement and challenges at their level. Second factor is named as Personalized Learning and its associated variables are Enable educators to tailor their teaching methods to individual learning styles and preferences, allowed educators to create customized learning paths for each student, Facilitate timely and personalized feedback on student performance, Allow students to learn at their own pace, accessing course materials, lectures, and resources and Empower students to create personalized learning environments that suit their preferences and needs. Third factor is Access to Resources which includes the variables like Allows students to easily search for and access relevant materials from anywhere, Online material has reduced costs and increased the accessibility for students, Digital tools had provided hands-on learning experiences that supplement traditional laboratory activities and Allowed students to navigate and access course materials from a single online portal. Fourth factor is Collaborative Learning and its associated variables are Smart classrooms had promoted teamwork and collaboration among students, allowed to work together on group projects, share ideas, and discuss concepts in real-time, fostered a collaborative learning environment that mirrors real-world professional settings and opened up opportunities for global collaboration and cultural exchange.

"Table	5	Reliability	Statistics"
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"Cronbach's Alpha"	"N of Items"	
.918	18	

The reliability for 4 constructs with total of eighteen elements is 0.918.

Conclusion

Higher education in India has changed a lot because of smart classes, which have had a huge effect on how well teachers and students learn. These modern learning spaces are great because they are able to easily incorporate technology into the teaching and learning process. Students are more likely to participate when they are in smart classes. Learning is more lively and interesting when there are interactive whiteboards, video slideshows, and online tools to use. Being involved in this way helps people remember and understand what they are learning. Personalising learning is easier in smart schools. They can learn about subjects at their own pace and go deeper into areas that interest them because they have access to many digital resources and tools. For students with a range of learning styles and skills, adaptive learning tools can adapt the material they offer to meet their specific needs. Another benefit is that it makes learning together easier. Students can work together with their friends inside and outside of school using online discussions, virtual group projects, and real-time communication tools. In addition to improving students' ability to work together and talk to others, this joint method also lets them see things from different points of view. Smart classes have the advantage of providing prompt feedback. Instructors can know on the spot how much progress the students are making with the help of online quizzes, polls, and tests.

This will allow them to adjust their teaching styles for greater impact and to quickly address any gaps in understanding. To sum up, the incorporation of smart classes in higher education in India has revolutionized teaching and learning, making them more effective. The knowledge and skills that one needs to be successful in the digital era by being able to interact with technology, learning in his own way, working with others, and getting immediate feedback in such tech-rich settings are being made available through them. From this perspective, smart classes will continue to play a crucial role in the future of higher education in India, even as other classroom technologies change.

The study was conducted to know the factors that determines different impact of Smart Classrooms in teaching learning effectiveness in higher education and concludes that Enhanced Engagement, Personalized Learning, Access to Resources and Collaborative Learning are the factors that determines the impact of Smart Classrooms in teaching learning effectiveness in higher education.

References

- 1. Ansari, M. S., & Tripathi, A. (2017). An investigation of effectiveness of mobile learning apps in higher education in India. International Journal of Information studies and libraries, 2(1), 33-41.
- 2. Bharadwaj, A. (2023). The new era of online education. International Journal of Indian Culture and Business Management, 29(2), 188-199.
- Chatterjee, P., Gantait, A., Swamy, G. A., & George, B. (2023). Information and Communication Technologies in Education: A Framework for Transforming the Indian Education System through Smart Learning. In Digital Technologies for Smart Business, Economics and Education: Towards a Promising Future (pp. 283-301). Cham: Springer International Publishing.
- 4. Di, W., Danxia, X., & Chun, L. (2019). The effects of learner factors on higher-order thinking in the smart classroom environment. Journal of Computers in Education, 6(4), 483-498.
- Kaur, A., Bhatia, M., & Stea, G. (2022). A survey of smart classroom literature. Education Sciences, 12(2), 86.
- 6. Kaur, R., & Ahuja, N. (2023). Impediments to Adopt Nep 2020 & Integrate Ict in Indian Educational Ecosystem. European Economic Letters (EEL), 13(5), 768-773.
- 7. Kwet, M., & Prinsloo, P. (2020). The 'smart'classroom: a new frontier in the age of the smart university. Teaching in Higher Education, 25(4), 510-526.
- Lakshmypriya, K., Rai, R., & Kudal, P. (2021). Digital transformation in higher education: Impact of instructor training on class effectiveness during COVID-19. Pandemic, Lockdown, and Digital Transformation: Challenges and Opportunities for Public Administration, NGOs, and Businesses, 175-196.
- Lall, H., Biswas, S., & Biswas, S. D. (2020). Smart Classroom-An Innovative Concept of Modern Education. International Journal of English Learning & Teaching Skills, 2(3), 1436-1452.
- Murugesan, B., & Deepa, H. (2019). Effectiveness Of Smart Classroom Teaching On Achievement In Science Among Secondary School Students. Think India Journal, 22(3), 1490-1498.
- 11. Naidu, V. R., Singh, B., Hasan, R., & Al Hadrami, G. (2017). Learning analytics for smart classrooms in higher education. IJAEDU-International E-Journal of Advances in Education, 3(8), 356-362.
- Palanivel, K. (2020). Emerging technologies to smart education. Int. J. Comput. Trends Technol, 68(2), 5-16.
- 13. Saini, M. K., & Goel, N. (2019). How smart are smart classrooms? A review of smart classroom technologies. ACM Computing Surveys (CSUR), 52(6), 1-28.
- 14. Shanwal, V. K. (2017). A comparative study of traditional and smart classrooms in relation to their creativity and academic achievement. Integrated Journal of Social Sciences, 4(1), 15-19.
- Shamim, M., Hussain, M. I., Gorde, S. U., Malik, R., Kumar, P. R., & Nagpal, P. (2022). Smart Classes Teaching Using Advanced Techniques for Quality Education. Journal of Positive School Psychology, 1891-1897.
- 16. Singh, A. (2022). Conceptual framework on Smart Learning Environment-An Indian perspective. Revista de Educación y Derecho, (25).
- 17. Uskov, V. L., Howlett, R. J., & Jain, L. C. (Eds.). (2020). Smart Education and E-learning 2021 (Vol. 188). Singapore: Springer.