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The Impact of Information and Communication Technologies on Education: A Gap Analysis of the Perception of Teachers and Students of Engineering Colleges in NCR

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Abstract

The paper attempts at finding out the perception of teachers and students at technical colleges in the National Capital Region (NCR) of India towards the use of Information and Communication Technologies (ICT) in education. The paper also tries to explore if there is a gap in the perception of teachers and students. Earlier works in this field include the study of the impact of ICT and its potential for the education sector; increasing dependence on ICT; and roles of information technology in higher education. In the current study, a survey was conducted wherein a questionnaire related to ICT in education was administered to teachers and students of some of the engineering colleges in NCR. Data were collected from 100 students and 30 teachers which were then descriptively analyzed. The study explored majorly two areas - Perceptions of teachers and students towards the use of ICT in education, and the gap between the perceptions of the teachers and the students. It was found that the attitude of the teachers is more towards neutrality whereas that of the students is closer to being positive. However, there is no significant gap in the attitudes or perceptions of the teachers and the students.

Discipline: Education and Information and Communication Technologies.

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1 Introduction

The development and progress of a country depend directly on the kind of education imparted to its masses and the application of that education. The pedagogy, however, keeps changing to incorporate new methods and approaches to teaching. The teaching pedagogy has been ever-evolving and several newer methods and approaches to teaching or imparting education are devised every now and then. Researchers in the field keep exploring the latest methods and ways to make education more and more effective. The advent of computers and the internet brought about a revolution in almost every field and the education sector was no exception. Computers and the Internet were extensively used to make teaching pedagogy and delivery more and more student-oriented. Students too got access to a large repertoire of material available on the internet. However, the use of computers and the Internet was blended into physical classes wherein the teacher taught using PowerPoint presentations and projectors instead of traditional blackboards; and the notes were not to be taken on notebooks but rather on iPads. Nevertheless, the recent transition into the digital world has completely changed the way education was imparted. The advancements in digital technology and the advent of Information and Communication Technologies (ICT) have impacted the education sector severely. It has changed the whole pedagogy. ICT has affected not only the teaching-learning process but also the method of evaluation and assessment. The use of ICT enhances the scope and reach of education since online platforms used to conduct classes can be accessed by students from anywhere and at any time. ICT, in fact, has become integral to the teaching-learning process (Ghaffari et al., 2020).

ICT stands for Information and Communication Technologies which is an amalgamation of information technology and telecommunications. ICT refers to the software, audiovisual, and storage that enable the users to store, use and manipulate information. In today's time, because of the advancements in ICT, access to loads of information has become very easy and quick. Particularly, in the education sector, this access to information does help the students and teachers a lot. There is ample evidence, too, that the integration of ICT in education would give effective results. Integrating ICT into the pedagogy produces better results than "traditional methods alone or ICT alone" (Genlott & Grönlund, 2016).

There are multitudes of opportunities provided by integrating ICT with education. ICT provides the access to e-learning which further renders convenience of online learning to many learners who otherwise do not have access to education due to several constraints including time, location, cost, age, etc. (Kumar, 2008). The use of ICT in education not only improves the classroom teaching-learning process but also provides an e-learning facility. E-learning has rendered the convenience of online learning to thousands of learners who cannot avail of the benefits of higher education due to several constraints, such as time, cost, geographical location, age, etc. ICT has enhanced distance learning. Advancement in information technologies has certainly given almost all people access to a vast repertoire of information and knowledge. Students can access, on portals like YouTube, lectures of senior professors at top universities and colleges. Teachers, too, can

access updated information online and can undergo training online without having to take leaves from work.

On the other hand, there are some limitations and disadvantages, too, of using ICT in education. However, the disadvantages are major because of the improper use of technology. Some agencies regulate and monitor the content on the internet, but still, the easy accessibility leads to the addition of content, which is not very authentic and reliable, and consequently, if the source is not properly examined, the students might be getting and relying on wrong information. Furthermore, the regular use of gadgets like mobile phones, laptops, and tablets, which are essential to access information online, is also leading to major medical problems.

This paper, thus, tries to explore the expectations and perceptions of teachers and students towards integrating ICT into education. This paper also compares the perceptions of the teachers and the students regarding the same and tries to find out gaps if there are any.

2 Literature Review

ICT has become an integral part of the world today and is being used in all sectors. In education As Daniels (2002) put it across, information and communication technologies have become the building blocks of the modern world. The understanding and good command over the ICTs have become the need of the hour. It would be wise to say, at this point, that ICT does not only mean using computers and computer-related activities. It is a very broad field that includes technologies other than only computers. The online platforms which can be used to share knowledge, gadgets that can be used to share information; mobile applications; social media platforms; artificial intelligence; and any other means which can be used to transmit and share information and communicate. In the late 1980s, the term 'computers' was replaced by the term 'information technology' emphasizing the fact that computers were no longer used only for computation but for many other purposes including information sharing. The term further developed and was changed to Information and Communication Technologies (ICT) in 1992 which incorporated e-mailing and started the use of ICT for communication (Pelgrum & Law, 2003). Today, the term ICT encompasses the use of computers and the Internet; information technology services; telecommunication services; media and broadcasting; social media; and many other information and communication services. There are multitudes of ICT products available in the market today. The products which are being used in the education sector include email, podcasts, audio and video conferencing, interactive voice systems, radio broadcasts, CD ROMs, and cassettes (Bhattacharya & Sharma, 2007). To use new technologies and impart education through various ICT, teachers need to be trained in the use of ICT. "Our society needs quality teachers in the 21st century. ICTs increase 21st-century skills which include digital age literacy (consisting of functional literacy, visual literacy, scientific literacy, technological literacy, information literacy, cultural literacy, and global awareness), inventive thinking, higher-order thinking and sound reasoning, effective communication, and high productivity" (Kumar, 2009). Youngsters of today live in a completely digitized world and are often surrounded by a lot of digitized equipment and

facilities. The easy access to technology has changed the education sector too. We must know the various technologies which can be used in the education sector to make the delivery of the content to the learners more effective (Kanematsu & Barry, 2016).

There is a lot of evidence that ICT-based education is way better than traditional education delivery. The United Nations Educational, Scientific and Cultural Organization (UNESCO) is also promoting the use of ICT in education and has taken an initiative in the same direction in order to ensure equity and access to quality education.

"Information and Communication Technology can contribute to universal access to education, equity in education, the delivery of quality learning and teaching, teachers' professional development, and more efficient education management, governance, and administration. UNESCO takes a holistic and comprehensive approach to promoting ICT in education. Access, inclusion, and quality are among the main challenges they can address. The Organization's Intersectoral Platform for ICT in education focuses on these issues through the joint work of three of its sectors: Communication & Information, Education and Science (UNESCO, 2021).

The integration of ICT in education will certainly lead to making education delivery more efficient. At the same time, however, there are concerns, too, about the proper implementation of ICT in education. The major issue in this regard is the improper implementation of ICT in education with very little evidence that the teachers have been able to properly integrate ICT into the teaching-learning process (Blackwell et al., 2014).

3 Method and Design

This paper attempts at exploring the attitude of the teachers and students toward the use of ICT in education and also attempts to find out the gaps between the attitudes of the teachers and the students. To explore the expectations, the following domains were investigated:

1. Teachers' attitude towards using ICT while teaching.
2. Students' attitude towards the use of ICT in the delivery and content.
3. Gap analysis between the perceptions of the teachers and the students.

3.1 Instrument

A questionnaire was designed to record the responses of the teachers and the students regarding their attitude towards the use of ICT in imparting education. The statements were formed to get clear responses from the respondents who were teachers and students at some engineering colleges in the NCR (National Capital Region (NCR) is a unique example of inter-state regional planning and development for a region with NCT-Delhi as its core. The NCR as notified covers the whole of NCT-Delhi and certain districts of Haryana, Uttar Pradesh, and Rajasthan, covering an area of about 55,083 sq. km. (Source: National Capital Region Planning Board, Ministry of Housing and Urban Affairs, Govt. of India). The questionnaire comprised 10 items out of which 9 items were based on a 5-point Likert scale from Strongly Agree to Strongly Disagree.

One item aimed at recording the platform which the respondents either preferred to use or were made to use was framed and was not structured on the Likert Scale.

3.2 Hypotheses Formulation

Based on the literature review, objectives, and research questions, the following hypotheses may be formulated:

H_1: The attitude of the teachers towards the use of ICT in education is considered positive.

H_2: The attitude of the students towards the use of ICT in education is considered positive.

H_3: There is a considerable gap in the perception and attitude of teachers and students towards the implementation of ICT in education.

3.3 Profile of the Respondents

The respondents for this study were the teachers and students at Engineering Colleges in the National Capital Region (NCR) of India. There are hundreds of engineering colleges in the NCR but responses to the instrument were collected from 4 different engineering colleges. Almost all the educational institutions in India have started following the ICT-based teaching-learning method. The engineering colleges, being technical institutions, certainly follow ICT-based delivery of the content to the students. These colleges keep themselves up to date with technological advancements and include the latest technology in imparting quality technical education. The programmes like B.Tech. (Bachelor of Technology) in various streams including Computer Application, Artificial Intelligence, Information Technology, Mechanical Engineering, etc. have to be taught using the latest technology available. The responses to the questionnaire were collected from 5 teachers and 100 students. The responses were recorded and then analyzed qualitatively considering only the mean scores of the individual items and overall.

4 Result and Discussion

The responses to item 1 have been analyzed descriptively. Almost 87% of respondents used Microsoft Teams to conduct or attend classes. Other applications which were used by the respondents to conduct or attend the online classes included Go To Meet, Google Meet, and Zoom. Just 3.6 % of the respondents used any other online application to conduct or attend classes.

Items 2 to 10 were analyzed statistically.

4.1 Attitudes of the Students and Teachers towards the use of ICT in the Teaching-Learning Process

From Table 1 (N = 130), the overall mean score of the responses of the teachers clearly shows that the teachers have almost neutral attitudes towards the use of ICT in education. The overall mean score for teachers is 3.54 which is very close to neutral. The response of the teachers to item 10 is strongly positive and the teachers believe that online education does inculcate independent learning habits in the students. The low value of standard deviation for item 10 (0.45) shows the homogeneity of the responses further strengthening the positive response. The responses, to some of the items, are 'Agree' and show a positive attitude towards those statements. In Items 5, 7, and 8

the teachers completely agree with the statements and show a positive attitude towards using ICT in teaching. Standard deviation values for items 7&8 (0.00), very strongly establish the homogeneity of the responses. Surprisingly, all the teachers agree with these statements. They strongly believe that ICT provides access to very good resources for gaining knowledge. They also firmly believe that ICT saves the time and effort of people in searching for relevant resources. In addition to this, they also agree that ICT may provide useful ways to evaluate the performance of the students and their feedback. However, very low mean scores are given to items 4 and 6 i.e., 2.53 and 2.17 respectively. Teachers have outrightly rejected the statement that ICT-based education is more effective than face-to-face education. It depicts that teachers believe that physical classroom teaching is more effective than digital classes. The biggest drawback, according to the teachers, of ICT-based education is that there is no interpersonal relationship between the teachers and the students in digital classes. The interpersonal rapport between the teachers and the students is very important to make classes effective.

Table 1: Mean Values and Standard Deviation Values.

Item	Item	Teachers Mean (n=30)	SD	Students Mean (n=100)	SD
2	I am personally very satisfied with ICT-based education.	3.50	0.731	3.9	0.76
3	I am aware of the great opportunities that ICT offers for an effective education system.	3.63	0.49	4.13	0.66
4	ICT-based education is more effective than face-to-face education.	2.53	0.90	3.49	1.08
5	ICT provides a powerful resource for gaining academic knowledge.	4.03	0.81	3.77	0.86
6	Online education enhances interpersonal relationships between students and teachers.	2.17	0.38	3.39	1.08
7	ICT-based education saves time and effort in searching for learning resources from a repository of millions of resources online.	4.00	0.00	3.86	0.65
8	ICT provides useful ways to evaluate student performance and feedback.	4.00	0.00	3.77	0.75
9	ICT-based education encourages people to take an active part in learning.	3.73	0.87	3.63	0.85
10	Online education inculcates independent learning habits.	4.27	0.45	3.77	0.72
Overall Means		3.54		3.74	

The attitude of the students, however, seems to be more positive than the teachers. The overall mean score of the responses of the students is 3.74 which is clearly more towards positivity towards the use of ICT in education. The highest mean score for the student respondents is for item 3 (4.13) which indicates that most of the students firmly believe that ICT provides them with better opportunities for a more effective education system. In the case of the students, the mean scores of almost all the items are more than '3' and more towards '4' which very clearly depicts the pattern that students have a relatively more positive attitude toward the use of the ICT-based education system. The mean score of item 2 in the case of students is 3.9 which is almost equivalent to 'Agree', which that means individually the students are quite satisfied with ICT-based education.

Students also think that ICT helps them save time and effort in searching for resources as a multitude of resources is available online today. The lowest mean score in the case of students is in item 4 which says that 'ICT-based education is better than face-to-face education. It indicates that even the students do not clearly agree with this statement. They, too, somewhere feel that ICT-based education cannot completely replace education through physical classes. Low mean scores of items 2, 3, 7, 8, and 10 further establish the result that the students, though, agree that ICT provides access to better material and resources, but ICT-based education cannot completely replace physical classes.

4.2 Comparison of Means

The teachers' attitude towards the use of ICT in imparting education is almost neutral while the attitude of the students towards the same is a bit towards positivity. The students have close to a positive attitude towards implementing ICT in education whereas the teachers still have some inhibitions in transitioning completely into an ICT-based education system.

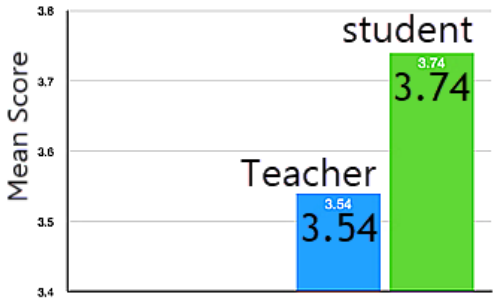

Figure 1: Mean Comparison

4.3 Paired Samples T-Test Results

From Table 2, p-value = 0.331 i.e., greater than 0.05, implies that no difference between the perceptions of the teachers and the students of the impact of ICT in the education sector is 'statistically insignificant.'

Table 2: Paired Samples T-Test (Student's t-test) Results.

Measure 1	Measure 2	T	df	p	Mean Difference	SE Difference	95% CI for Mean Difference	
							Lower	Upper
Teachers	Students	-1.035	8	0.331	-0.206	0.199	-0.664	0.252

Descriptives

	N	Mean	SD	SE
Teachers	9	3.540	0.719	0.240
Students	9	3.746	0.221	0.074

5 Discussion

The teachers' responses to items 2-10 clearly suggest that the teachers have an overall neutral perception of the ICT-based education system. They, however, believe that ICT reduces efforts to search for resources and that it promotes the habit of independent learning but overall, they believe that Face-to-Face classes or teaching are still better than ICT-based teaching since, in the physical classes, the teachers are able to form some kind of rapport with the students which are

indeed important in motivating the students to learn while in the online classes or ICT-based teaching the interpersonal connect is completely missing and there is no rapport between the teachers and the students. It may be inferred that teachers believe in blending ICT with physical classes. ICT may help in getting hold of resources that can be further practiced in face-to-face classes.

The responses of the students depict their inclination toward the use of ICT and towards online delivery of the content. The students firmly believe that ICT reduces their time and effort in finding content and material on various topics and subjects. They also believe that ICT provides them with better opportunities and a variety of learning.

The comparison of the responses of the teachers and the students does point out towards a gap between the perceptions and attitudes of the students and the teachers towards the use and implementation of ICT in education. However, the statistical analysis establishes that the gap is statistically insignificant.

Based on the results and the discussion, the following can be established:

H_1 stands rejected since the attitude of the teachers is non-positive.

H_2 stands accepted since the attitude of the students is very close to being positive or we can say reasonably positive.

H_3 stands rejected since it has been established that the gap between the perceptions of the students and teachers is 'statistically insignificant.'

6 Conclusion

The advent of Information and Communication Technologies (ICT) has certainly brought in a paradigm shift in the teaching pedagogy and the education system. ICT provides easy access to numerous resources related to different fields of study and makes it easier for the teachers as well as for the students to get information and academic knowledge. The recent advancements in the same field which brought in more ICT-based applications and portals which can be used by the teachers to even conduct classes online and the students to access classes and lectures from any place at any time. However, still, both the teachers and the students believe that ICT-based education, as of now, cannot completely replace the face-to-face education system. ICT, undoubtedly, provides better access to material but if that material is blended into physical classes, then it is still better.

It was also seen that the attitude of the students towards the use of ICT is relatively more positive as compared to the attitude of the teachers. Perhaps, teachers still believe that physical classes are more effective in imparting education. ICT may help in getting hold of more material online but teaching still is, more effective through the traditional face-to-face classroom setting. The gap, however, between the attitude of the students and the teachers towards the implementation of information and communication technologies in the field of education is insignificant. It implies that students, too, believe that physical classes are more effective, however, they think that ICT does provide access to better resources.

7 Availability of Data and Material

Data can be made available by contacting the corresponding author.

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