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Colleges Require ICT Facilities to Enhance Educational and Employment Prospects

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Abstract: ICT infrastructure and its effective application in the college have been a topic of conflict. Many studies clearly state that the usage of ICT in college has never been regulated by the students. If students are not trained properly in ICT in college, a large segment of society will always be unemployed, implying that sufficient attention and direction should be provided to the college by the college administration. Students can be educated via online and offline courses if ICT is properly managed. This research examined at the state of ICT at the college. The survey included administrative and teaching employees from seven institutions. We only selected institutions that previously have a thorough comprehension of the survey and understood how to use ICT effectively. However, several findings did not meet our expectations. Some colleges did not grasp the survey well enough. They were utterly unaware of how to use ICT in the present and future while keeping the interests of students and institutions in mind. Some college surveys had some variances, although they were minimal in comparison to the overall survey. Our data suggest that majority of the colleges do not understand about the correct usage of ICT. They are unaware that with ICT, learners can be made employable, and financially disadvantaged students can receive education at a low cost. They were uncertain about how to use ICT and how to advance ICT at the institution so that online and offline courses could begin. Our findings also imply that by interacting with other institutions throughout the world, ICT incompetence can be overcome. Government and college administration should work together to alleviate the ICT scarcity to some extent.

Index Terms: Educational institutions, higher education, ICT, education, learning, technology

1. Introduction

The term "information and communication technology" (ICT) refers to a collection of technical devices and methods for the development, management, and exchange of information. ICT adoption as a guide to aid the education sector has been a subject of significant discussion since the late 1990s. Since almost 10 years ago, ICT has been used to encourage growth; nevertheless, it has not yet been fully integrated into development activity, and a greater understanding is anticipated.

Learning is an active process of knowledge formation rather than information acquisition, and instruction is the means through which knowledge production is fostered. In addition to teaching and research, the university's contribution to regional economic growth through innovation is now recognized as a third responsibility of colleges. The establishment of a high-speed information network linking all educational institutions is recommended by the government. The Internet serves as a catalyst for advancement and innovation among individuals, organizations, educational institutions, and society at large.

Every facet of the educational process, including justice, governance, efficiency, teaching methods, quality, enterprise, and the use of technology to address important issues with research and development, is significantly impacted by the use of ICT in higher education. To alleviate the shortage of teachers in higher education, EDUSAT aims to create a knowledge library of various subjects. To do this, among other aspects, virtual laboratories will be set up, databases will be accessible, lectures will be given, and commercial and research organizations will advance. The prospect of moving from traditional classrooms with desks, notes, pencils, and blackboards to online platforms with computers, software, and the Internet intimidates many educators. The goal of e-governance in higher education is to develop an efficient information administration by effectively allocating resources that are readily accessible.

ICT has long been employed to facilitate knowledge and information transmission for national development. In the Satellite Instructional Television Experiment, which spanned from 1975 to 1976, satellite technology was first applied

to higher education (site). There are more than 42 thousand colleges, 1043 universities, autonomous institutions, and a national initiative to use ICT to promote education in India. All educational institutions will be networked and digitalized, as well as low-cost, low-power devices will be developed, and bandwidth will be made accessible for educational purposes. The National Program on Technology Enhanced Learning and the Open Courseware Project at MIT are comparable.

To address these issues, we surveyed the administrative and teaching staffs of seven institutions. The study looked at the regulations of the colleges, the students, and the working methods of the teachers. This research concentrated on the following points, which provided information on how ICT is maintained and used.

i. Students, teachers, and administrators use ICT. Also, how much time spend on ICT throughout the school day?
ii. Knowledge of software, hardware, and the internet. A method of collecting and transferring data in a computer.
iii. Information, students, faculty, and technology exchange with other institutions.
iv. Understanding the advantages and disadvantages of online and offline courses.

The purpose of this research is to discover more about the four aspects mentioned above and to identify possible inadequacies. The reasons for the inadequacy and lack of infrastructure are also investigated. We also attempted to determine whether teaching ICT could improve students' employment prospects. Finally, we investigate that college apathy, the government's slack fundamental attitude, the college management's justification of a shortage of funds, and instructors' and students' aversion to learning about new technologies are some of the characteristics that have not delivered the desired outcomes in ICT education. In the study, data was collected from seven colleges so that we could discover how various institutions view ICT when it comes to establishing online and offline courses. At the same time, the information collected will provide insight into how much college human resources know about ICT.

1.1 Solutions of the study

The following alternative solution to this challenge can be discovered after examining the study paper:

i. The government, college administration, students, and all of the college's personnel must all demonstrate interest in ICT education because to its importance.
ii. Partnering with academic institutions and public-private partnerships (PPPs) to bring in additional technical and management competence.
iii. Seminars, FDPs, workshops, and other ICT-related activities will periodically need to be planned, at which ICT-related academics from other institutions will be invited and participants will be required to learn new skills and put them into practice.
iv. Both national and local ICT support should be included.

1.2 Limitation of the study

To a few institutions in the Union Territory of Dadra and Nagar Haveli, a comprehensive questionnaire has been sent. Out of the nine institutions that were examined, seven reported positive responses to the study. The scope of the present study only covers 7 (seven) of the institutions.

The remainder of this article is structured as follows: Briefly stated, Section 2 outlines the goal of this investigation. The literature review is examined in Section 3 to understand more about this investigation. ICT in higher education is covered in Section 4. The mission and vision of NEP-20 are then extensively discussed in Section 5. Later, in Section 6, methods and materials are addressed. The collected data is then examined in Section 7. Results are summarized and presented in Section 8. The difficulties with ICT infrastructure in colleges are described in Section 9. Section 10 focuses about future plans to deal with college ICT infrastructure. A summary follows the end of Section 11.

2. Objectives of the Study

Without ICT in college, the teaching-learning process is extremely difficult in modern context. That is why it is important to educate the next generation technological capabilities. Giving basic to job-oriented ICT knowledge in college would be very crucial in current marketplace. The fundamental objective of this research is to examine what should be acknowledged for college ICT education and the basic structure of ICT. Along with this, the major objective of this research is to identify what additional aspects of ICT education that the institution should focus on. ICT knowledge should be provided not only to students but also to college teachers in order to provide effective teaching-learning.

The following are some of the research objectives that were considered when preparing this study.

- Consultation with administrators and staff from various tertiary institutions on some of the difficulties raised in research that they experience in the deployment of ICTs in their institutions.
- Conduct a literature survey on the problems that tertiary institutions experienced while employing ICT in higher education and how they were overcome.

- Investigate tertiary institution curriculum design and how it could contribute to some of the problems associated with employing ICT in higher education.
- To evaluate and disseminate study findings so that they can be incorporated in the future.

3. Literature Review

ICT in education is rapidly expanding throughout India. Academics are more open to the use of computers in education than they were previously. E-learning and online learning are often employed in on-campus and distance learning courses. Governments and organizations are increasingly relying on information and communication technology to bridge the access gap (ICT). When examining the overall impact of information technology on education, efficacy, cost, equity, and sustainability should all be considered. Because of the rising demand for higher education, both private and state programs have grown considerably [1-5].

ICT is the driving factor behind successful tertiary education delivery. Students from underdeveloped nations now have access to high-quality education and learning resources because of the use of various technologies. To improve student learning, professors can use the Internet, digital media resources, and popular software tools. The Indian ICT sector is rapidly expanding in terms of output, local market share, exports, offshore outsourcing, and investment. ICT training is a prospective area in which India could gain a competitive advantage over its worldwide competitors via the use of ICT [6-7, 9].

When there is an outside influence, such as a teacher or classmates, students prefer to use ICT tools. According to data, students who have access to necessary classroom equipment virtually always use ICT for their studies. Students that are competent with computers, mobile technology, email, and general software perform better in school. Institutions can prepare for the required use of ICT tools in their classrooms, identify user hurdles, assign suitable resources, and reward those who utilize them well [10-12].

ICT in education encourages high-level abilities such as working across time and place and dealing with complicated real-world problems. ICT can significantly impact both formal and informal education. Individuals who are unable to attend school owing to a variety of circumstances can be educated via ICT. There is an opportunity for major quality improvement following the thoughtful and purposeful adoption of ICT in education [13-15].

Education has advanced from basic reading and writing to today's global perspective. A novel perspective is required to address some of today's educational challenges. Implementing and integrating ICT into the educational system can assist in solving these difficulties [16-18].

From environmental, cultural, and pedagogical viewpoints, policymakers, educators, administrators, and students confront significant challenges in integrating the use of ICT in education. On campus, Wi-Fi technology allows users to connect to the Internet. ICT can be employed extensively and methodically in the educational and learning processes. To enhance the use of ICT, it should be normal protocol for trainers and managers in schools, workplaces, and universities to build an intelligible and accepted perspective [19-22].

Successful ICT integration may help enhance education and create quality graduates to help nations accomplish their goals. In the educational system, ICT may be utilized for a variety of objectives, including learning, teaching, entertainment, and instruction [23-25].

Online learning is at least as effective as conventional means of instruction. Online learning doesn't always outperform traditional schooling in areas that have not yet been investigated. Gender, learning style, attitude, and satisfaction are all factors that can impact effectiveness. Online learning should be permitted in schools, while a combination of online and offline learning could be more helpful [26].

Over the previous two decades, higher education has been apprehensive about accepting online education. It is yet another challenge, as well as an opportunity for entrepreneurial education. Entrepreneurial online education occasionally necessitates the employment of cutting-edge technologies. Many people doubt the discipline's capacity to educate the entrepreneurial attitude correctly online [27-31].

4. ICT in Higher Education

4.1 Why ICT in higher learning?

A skilled workforce is increasingly crucial in today's interconnected environment. It is now more crucial than ever to have access to affordable, upper higher education. ICT is used in the formation of curricular materials, the delivery of resources, and communication between students, teachers, and the outside world. ICT integration into teaching and learning is a top priority for education reform. ICT has the potential to significantly improve educational quality. When properly used, they enable and effect change, which can promote change in a workplace that prioritizes education.

4.2 Implications

Several ICT-related implications for higher education are listed below:

1. Today, teachers and students can manage writing assignments with the use of online resources that can help them identify and avoid the mistakes of copying and copyright laws. One of the many benefits of ICTs in

education is their potential to increase the standard and scope of education. To achieve this, they should be used effectively.

2. Information and communication technology (ICT) use has expanded, and system quality has improved, leading to improvements in teaching and learning from across board in the higher education system (HES).
3. Learning technology has made it possible for students to study anywhere at any time, breaking the boundaries of conventional academic institutions like universities and colleges. Information is available to everyone at all times and from anywhere.
4. With the use of ICT tools and resources, instructors can now develop and improve innovative pedagogical strategies that incorporate challenging real-world projects.
5. It presents a novel concept for the institutional classroom environment and improves academic standards to produce superior material.
6. The last 10 years have seen a rise in the significance of higher education as India's policy landscape has altered and the government has realized that its greatest resource is education. Governments and institutions have developed strategies for greater use of ICTs as a result of the imbalance between supply and demand for higher education. And in order to reduce the gap, strengthening collaboration between the public and private sectors is critical for the effective implementation of ICT in higher education.
7. How instruction is delivered at colleges has fundamentally altered as a result of the development of ICT. Distance learning can be used to establish a new educational approach with the unmatched potential of knowledge and information transmission, in addition to encouraging closer cooperation between various colleges. The way people live, work, and play around the world has been significantly impacted by the pace at which new technologies are bringing about change.

5. Vision and Mission of NEP-20 Policy

By making high-quality education accessible to everyone and transforming India into a global information giant, the National Education Policy aims to create an educational system that conflicts with Indian culture. Expert planning, a sense of change in education, the instillation of respect for the constitution, alliances with other countries, the environment, and culture in a changing world should all be included in the strategy. Beautiful Indians are proud to be Indians and to possess the knowledge, abilities, and attributes that can be developed in policy approach and IQ, as well as the gap between Indians. To keep improving one's health while maintaining a good shape [8].

The NEP-20 Policy's Mission is as follows [8]:

(i) GER Increased to 50% by 2035

According to NEP 2020, the Gross Enrollment Ratio in higher education, which includes vocational education, is anticipated to rise from 26.3 percent in 2018 to 50 percent in 2035. There will be 3.5 crores more available seats in higher education institutions.

(ii) Comprehensive, Interdisciplinary Education

Academic credits earned from various higher education institutions will be digitally stored in the Academic Bank of Credit so that they can be transferred and counted toward the conferred degree. In order to promote robust research culture and increase research capability in higher education, the National Research Foundation will be founded as the main organization. The Multidisciplinary Education and Research University would be established as the national model to provide the largest multidisciplinary education in the country.

(iii) Governance

The Higher Education Commission of India will be one comprehensive body for all higher education (HECI). The four independent verticals that comprise HECI are the National Higher Education Regulatory Council (NHERC), General Education Council (GEC), Higher Education Grants Council (HEGC), and National Accreditation Council (NAC).

(iv) Institutional Architecture with Rationale

In addition to a phased arrangement for offering institutions graded autonomy, the affiliation of colleges is to be phased down over 15 years. Each college would eventually develop into either an independent college that awards degrees or a constituent college of a university.

(v) Employing Technology in Education

The National Forum for Educational Technology (NETF) will provide a forum for an open discussion on how technology is used in classrooms.

(vi) Progression in Workforce

The higher education system must also include all sorts of vocational education. Varying operating colleges, medical schools, law schools, and agricultural universities, among others, will strive to develop into multidisciplinary institutions.

6. Methods and Materials

6.1 Planning of Data Collection

This study report focuses exclusively on colleges in Dadra and Nagar Haveli. We gathered college information for this union state using various media. The preliminary survey covered seven institutions. Seven institutions decided to participate when we invited them for information. We personally visited all of the institutions and met the administrative personnel, teachers, and students. It was decided during the meeting that they should have a good understanding of questions and ICT. Furthermore, the college's background and attitudes towards work were considered. Personal interaction allowed for a greater understanding of the college.

6.2 Data Collection and Participants

In order to collect primary data from the respondents, the study's research methodology employs questionnaires, interviews, and the observational technique. The purpose of the questionnaire is to collect data on the ICT infrastructure, ICT-based services provided online, and the difficulties associated with integrating ICT in colleges. The colleges were selected at random, and data was gathered from the colleges. The questionnaires were sent personally or by email to the college, and they likewise received them personally or via email. Some of the key information was gathered through telephone interviews. Similar to this, some information was gathered by direct observation when visiting the campus. The information obtained from the returned questionnaires is categorized, evaluated, tabulated, and logically interpreted. In order to determine the frequency, mean, and standard deviation of the study difficulties, the well-known software tool was used.

6.2.1. Response Rate

Seven institutions sent surveys, and seven of them received responses and completed questionnaires back. The proportion of the response rate is shown as 77.78% in Fig. 1.

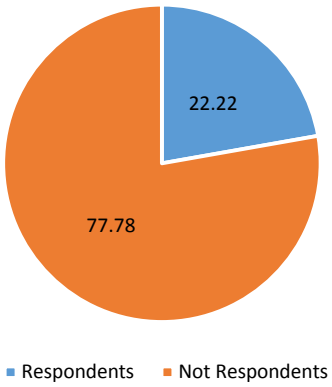

Fig. 1. Percent of total of responses rate

6.2.2. Hardware Infrastructure facilities

The college's infrastructure is vital to the growth of the institution. Importantly, the institutions feature first-rate facilities with up-to-date laboratories equipped with cutting-edge equipment. You must adhere to specific requirements in order to present on the campus of a college. Projectors, computers, and other necessary equipment should be available to students as needed. College professors should educate their pupils about new technology. When it comes to job and further education, it will be beneficial to others.

Applying a variety of the parameters stated in Table 1 and Fig. 2, the robustness of hardware infrastructure facilities in college is examined.

Table 1. Hardware infrastructure facilities questionnaire

SNo	*Particulars*	*Yes*	*No*	*%Yes*	*%No*
01.	sufficient computers for ICT activities	6	1	85.714	14.286
02.	sufficient laptops for ICT activities	4	3	57.143	42.857
03.	server for data repository	1	6	14.286	85.714
04.	sufficient printers for course materials.	5	2	71.429	28.571
05.	sufficient scanners for ICT course materials	3	4	42.857	57.143
06.	sufficient projectors for ICT activities	4	3	57.143	42.857

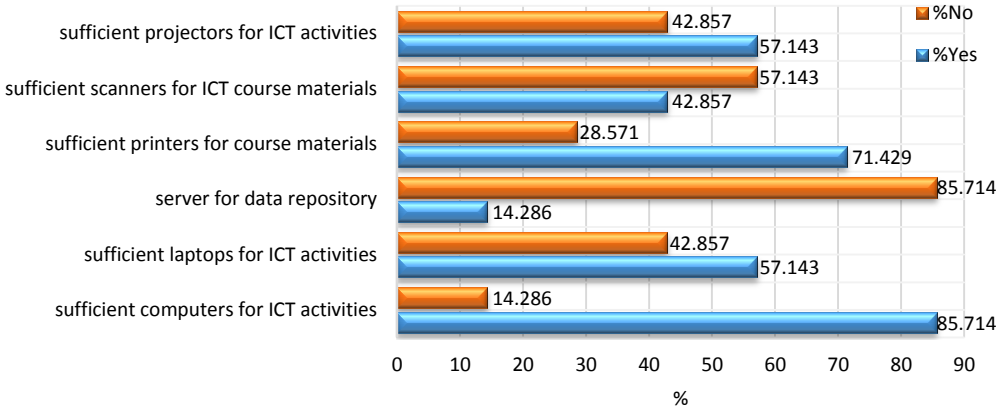

Fig. 2. Hardware infrastructure facilities distribution in colleges

6.2.3. Software facilities

A student information system for higher education collects and maintains student data that academics and staff require to administer university campus operations. These systems keep track of information such as grades, attendance records, admission details, and financial assistance details. As a result of the system, there is a large decrease in paperwork for faculty and staff, and students can now independently access crucial information. For teachers to handle student data successfully, these systems are generally coupled with a learning management system (LMS) and a classroom management tool. Students and teachers can both access information regarding college activities, classes, attendance, grades, and announcements owing to cloud-based technologies. The user-friendly interface, creative design, and high data processing required throughout the admissions process are all best suited to college or school time.

Table 2. Software facilities questionnaire

SNo	*Particulars*	*Yes*	*No*	*%Yes*	*%No*
01.	collection of proprietary software	4	3	85.714	14.286
02.	learning Management System	1	6	57.143	42.857
03.	e-content	0	7	14.286	85.714
04.	basic learning software (MS-Office)	7	0	71.429	28.571

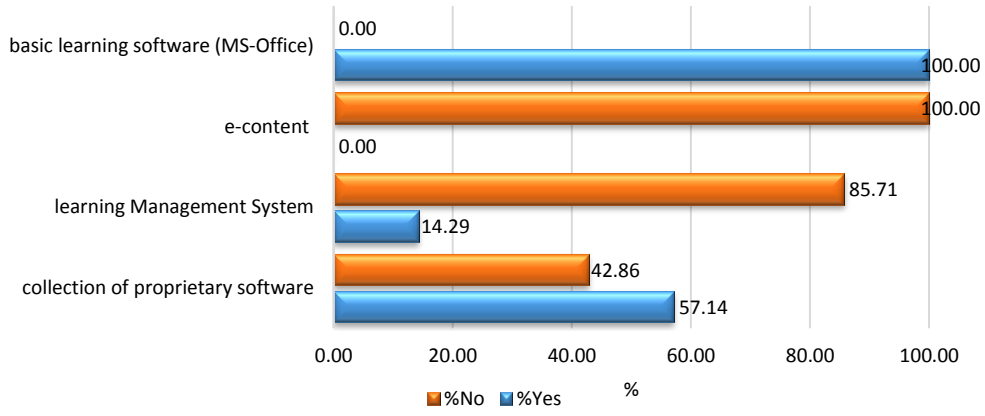

Fig. 3. Software infrastructure facilities distribution in colleges

In most colleges, there are MS Word, MS Excel, and MS PowerPoint software for fundamental learning (71.43 percent). Thus, each college has a collection of proprietary software (85.71 percent). In addition, there was no e-content gathering system at the investigated college. Learning management systems were used by 57.14 percent of the colleges in the survey. The evaluated colleges lack the necessary software to offer ICT instruction (Fig. 3 and Table 2).

6.2.4. Availability of ICT based Technologies

Teachers must encourage critical thinking skills, information literacy, and collaborative work practices in order to prepare students for a new world where there is no lifetime job guarantee and where people regularly change employment. Because the Internet is a network of networks, it provides the opportunity for discovery-based learning where teachers and students freely access the world's biggest collection of information, connect with one another, and learn on their own terms. One of the key responsibilities of a teacher in an electronic classroom is to distinguish between accurate and incorrect material because there is a lot of misleading information on the Internet. The identification, categorization, and verification of electronic data sources will be important new tasks for trainers. One of the finest instances of ICT in schools in American classrooms, and even in schools in the same district, is the appropriate use of video systems for the transmission of television programs and information. Through the usage of these common systems, students gain knowledge of other cultures, languages, and customs as well as transferrable skills including literary authoring, keyboarding, and written communication. As a result, ICT plays a significant part in many school curriculum and collaborative learning is becoming increasingly prevalent.

Education sector shows how quickly it is transitioning to a quality assurance system. These criteria will surely be used by students when selecting a school, and the government is already working to assure high-quality education. Online involvement will encourage learning without time constraints and make evaluation and report preparation easier because there is no need for manual data entry. In order to foster and improve a digital culture in schools and colleges, the government has started an initiative to encourage teachers and educators to embrace ICT in teaching and learning. Since technology and human advancement are inextricably intertwined, and education is no exception.

Table 3. Availability of ICT based technologies questionnaire

SNo	***Particulars***	***Yes***	***No***	***%Yes***	***%No***
01.	internet	5	2	71.43	28.57
02.	video conferencing	4	3	57.14	42.86
03.	smart classroom	3	4	42.86	57.14
04.	Wi-Fi in college campus	5	2	71.43	28.57
05.	digital attendance system	1	6	14.29	85.71

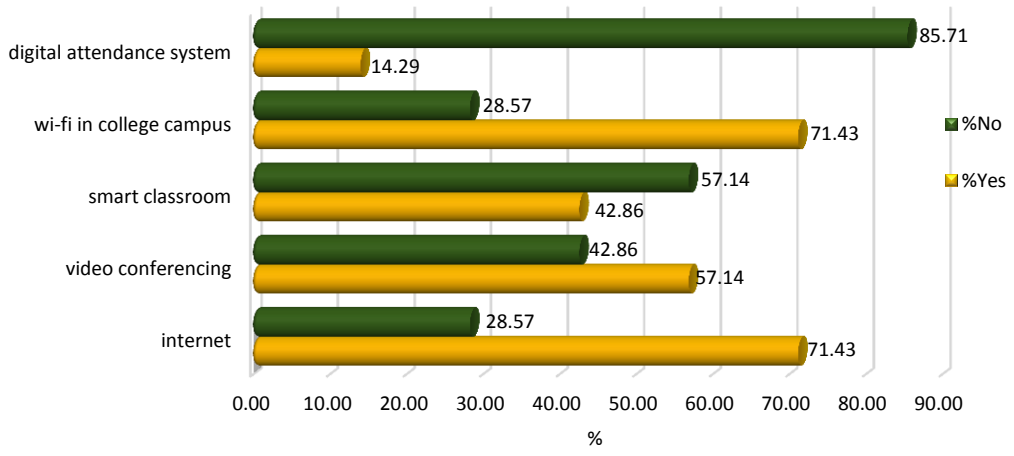

Fig. 4. Availability of ICT based technologies distribution in colleges

In our research, we discovered that the majority of colleges (85.71%, say 'Yes') had internet connection for both administrative and teaching-learning needs. Additionally, Wi-Fi is available at the majority of colleges (i.e., 71.43%, say 'Yes'). The automated attendance system has not yet been implemented in the majority of the examined colleges. In other words, administrative tasks are being performed digitally rather than through traditional means. However, the shift from conventional to digital ways of teaching and learning has not yet been fully accomplished (Fig. 4, Table 3).

6.2.5. Benefits of using e-resources

The use of electronic resources in a variety of academic subjects, such as health, higher education, engineering, and other disciplines, has been the subject of much research. All appropriate material that, when used properly, e-resources could enhance the students' academic performance. According to the majority of study results, adopting

electronic resources can benefit education since they offer a variety of effective alternatives for sorting through content. E-resources are a useful tool for teachers and students to use while conducting research, so make use of it. Even when the teachers are unavailable, communication between the two parties is possible via email. The most apparent use of cloud services, which are now widely employed by many higher education institutions, is email delivery, particularly for students.

The colleges who took part in our survey acknowledged that e-resources have advantages. They all agreed that leveraging electronic resources would improve accountability and workplace effectiveness. They completely agreed with the assertions in our questionnaire that accessing e-resources saves time (100%, say 'Yes'), provides access to current knowledge (100%, say 'Yes'), is simple to use (100%, say 'Yes'), and there is a superior source of information (100%, say 'Yes'). However, they somewhat disputed that the ability for professional work has expanded (85.71%, say 'Yes'), that the material was available in many formats, and that it was always accessible (85.71%, say 'Yes') (Table 4, Fig. 5).

Table 4. Benefits of using e-resources questionnaire

SNo	*Particulars*	*Yes*	*No*	*%Yes*	*%No*
01.	saves time	7	0	100.00	0.00
02.	access to current knowledge	7	0	100.00	0.00
03.	simple to use	7	0	100.00	0.00
04.	better source of info	7	0	100.00	0.00
05.	less expensive	5	2	71.43	28.57
06.	accessible information in a various formats	6	1	85.71	14.29
07.	24/7 availability of information	5	2	71.43	28.57
08.	professional works' quality has improved	6	1	85.71	14.29
09.	portable electronic resources	5	2	71.43	28.57

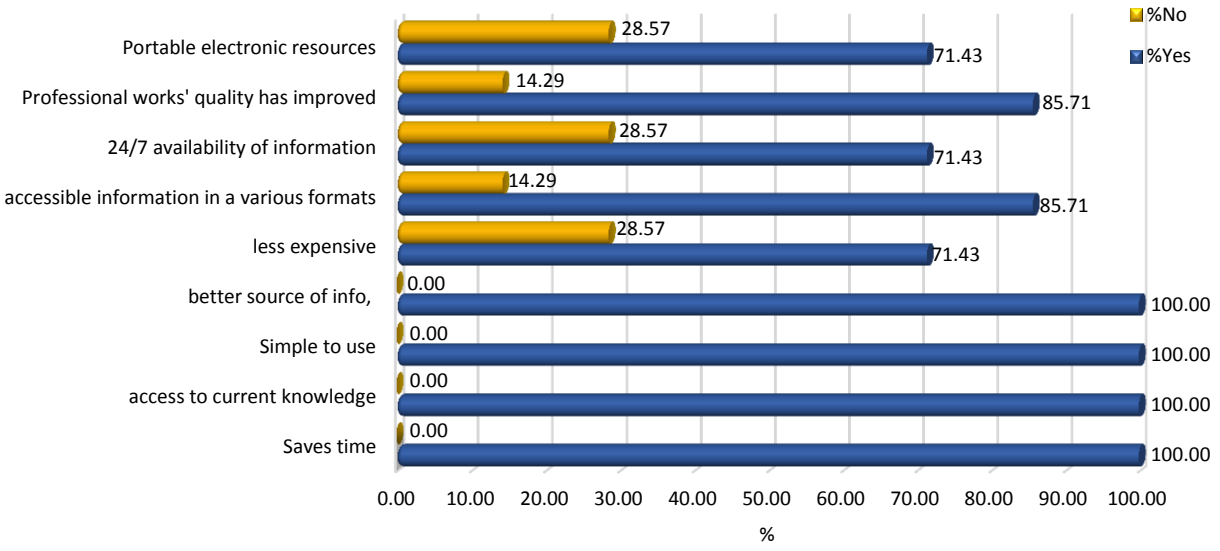

Fig. 5. Benefits of using e-resources distribution in colleges

6.2.6. Barriers associated with the implementation of ICT

Along with the advantages of accessing electronic resources, several publications have addressed the drawbacks for university and college students, such as screen readings, slow Internet, inadequate infrastructure, and shortcomings. E-resources' extraordinary usability and the liberty to use them rather than own them have, among other things, caused a change in perspective. Not all internet information may be used for educational purposes. E-resources on the Internet are sometimes not supervised or monitored since there is no quality control. Not all content on the Internet is of high quality, and it is impossible to discriminate between reliable and dubious sources of information, which adds to data overload. E-resources are typically pricey. Due to the confluence of these variables, teachers and students print the majority of online resources. E-resources confront several challenges at every level of their selection, acquisition, conservation, maintenance, and operation, as was covered in the article above. Recent studies have also demonstrated that researchers think that having quick access to electronic resources has helped them by helping them to keep current with their research and save time.

Table 5. Barriers associated with the implementation of ICT questionnaire

SNo	*Particulars*	*Yes*	*No*	*%Yes*	*%No*
01.	insufficient training in ICT applications	6	1	85.71	14.29
02.	lack of network and IT infrastructure	2	5	28.57	71.43
03.	inadequate support from the authorities	5	2	71.43	28.57
04.	ICT budgetary constraints	6	1	85.71	14.29
05.	staff coordination problems	6	1	85.71	14.29
06.	services for consultation are not available	5	2	71.43	28.57
07.	ICT strategy is not being upgraded.	6	1	85.71	14.29
08.	disinterest to learning ICT applications	4	3	57.14	42.86
09.	work overload	6	1	85.71	14.29
10.	unstable power supply	1	6	14.29	85.71
11.	lack of IT professionals	5	2	71.43	28.57

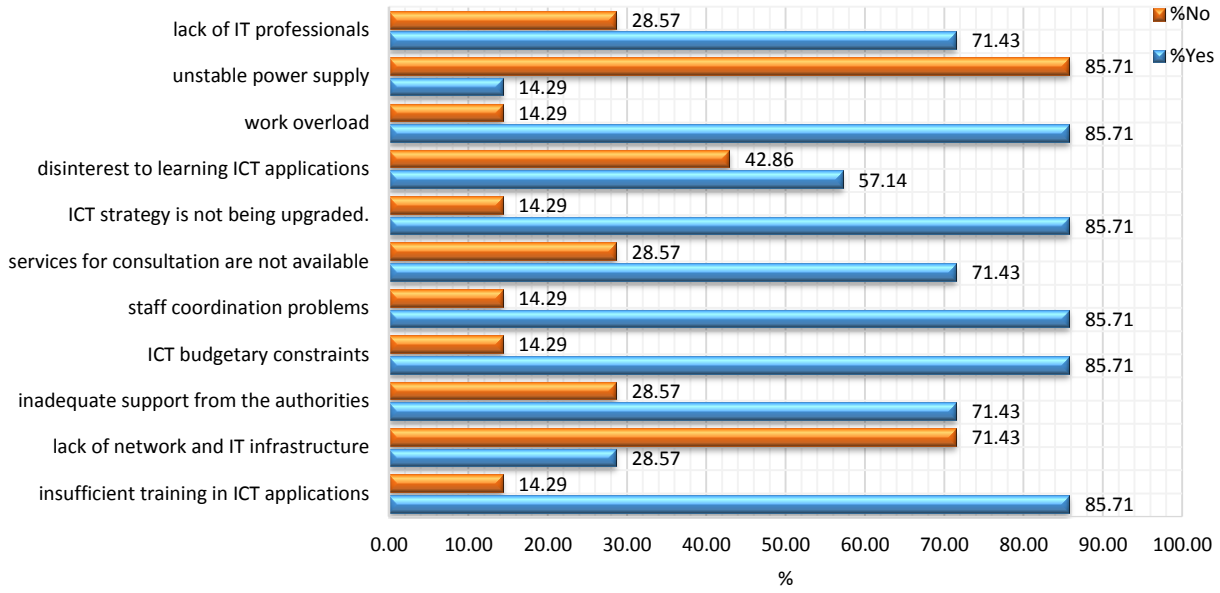

Fig. 6. Barriers associated with the implementation of ICT distribution in colleges

When we distributed questionnaires about the obstacles to ICT distribution in colleges, the majority of the colleges agreed that inadequate ICT application training (85.71%, say 'Yes'), ICT budgetary restrictions (85.71%, say 'Yes'), staff coordination issues (85.71%, say 'Yes'), outdated ICT strategy (85.71%, say 'Yes'), work overload (85.71%, say 'Yes'), and a lack of ICT professionals (71.43%, say 'Yes') were the main obstacles. The paucity of network and infrastructure (28.57 percent) and unstable power supply (14.29 percent) are not the biggest problems experienced by college staff while delivering ICT education in higher education (Fig. 6, Table 5).

6.3. Materials and Methods

The questionnaire was based on an exploratory interview research conducted at Dadra and Nagar Haveli institutions. The questions that were divided into five sections were sent to all of the institutions, and they attempted to gather information through interviews. All of the colleges received the same questionnaire. All of the colleges were mandated to respond to all of the questions. If a question does not fit into one of the college categories, it is feasible to leave it blank. The questionnaire was dynamic, so further questions were shown dependent on the answer to the question. This research is broken into five sections, which we will investigate one after the other in this section to make it simpler to grasp. We will now explain the questions and response alternatives that were based on these, as well as how we constructed the metrics that were used in the study.

(i) First and foremost, they requested for basic information about the institution, such as the name of the college, the name of the principal, the stream, the total number of students, and so on.

(ii) Each question required a "yes" or "no" response. Many questions are dependent on the answer to the preceding question. For example, 'Do computer classes run at your college?' If the participant answered 'yes,' the following question in the series was displayed. Only if participants had previously indicated in the questionnaire that these dimensions were included in college ICT education were they asked dimension-specific questions.

(iii) Some of the questions included fundamental concepts such as "Will the online course assist the student and the college?" and "Are students and teachers necessary to have basic computer expertise in today's era?" All

of these responses were to be supplied as 'yes,' 'no,' or 'don't know.' The knowledge of the participants was to be evaluated using this question. All of the chosen participants already had a basic understanding of ICT, so they could comprehend and respond to the questions.

(iv) Some academic integrity issues were addressed. For example, "whether or not to get permission from the college administration before answering all of these questions"; "Have you ever attended an ICT seminar or not"; and so on. We needed to understand how the college operates and what its social standing is based on the answers to these questions.

7. Data Analysis

For the four dimensions discussed in the Material and Method section, descriptive statistics were used. The majority of the queries had a one-dimension response. We obtained single-dimension responses from this. Pearson Correlation was utilized to assess the degree of ambiguity in the response. With the support of the MS-Excel software, descriptive analysis, t-tests, and ANNOVA calculations have been accomplished. The most of the computed results were found in accordance with the studies. Means, median and standard deviation (SD) for normally distributed data, and frequencies for categorical data are all considered in descriptive analysis. The relationship between the collected datasets was evaluated using the t-test and ANNOVA tests.

8. Result

8.1. Hardware Infrastructure facilities

The questionnaire from the hardware infrastructure facilities section was examined using descriptive statistics. This part included six questions that could only be answered with a ‘Yes' or a 'No'. By using descriptive statistics on the recorded data, we were able to reach a concrete conclusion. Table 6 examines the 'Yes' and 'No' dimensions. The value of standard deviation is determined by the study. The data scattered by the standard deviation is determined by looking at the relationship between the 'Yes' and 'No' mean. It appears that there is a strong association between 'Yes' and 'No' standard deviation. The variability in the value 'Yes' and 'No' samples was calculated using sample variance, which is compatible with the study. The variance in Table 7 is 2.967 for ‘Yes’ and ‘No’ data, respectively, indicating that the mean value data has less scatter. The Kurtosis value, which is consistent with our aggregated data, is used to assess the scattering data risk. Further, skewness =-0.6784361 for ‘Yes’ and skewness = 0.678436 for ‘No’ implies that the recorded data has a normal distribution.

Table 6. Descriptive statistics of Table 1 sample data

	Yes		***No***
Mean	3.833333333	Mean	3.166667
Standard Error	0.703167437	Standard Error	0.703167
Median	4	Median	3
Mode	4	Mode	3
Standard Deviation	1.722401424	Standard Deviation	1.722401
Sample Variance	2.966666667	Sample Variance	2.966667
Kurtosis	0.814291125	Kurtosis	0.814291
Skewness	-0.67843611	Skewness	0.678436
Range	5	Range	5

t-Test: Paired Two Sample for Means

	Yes	***No***
Pearson Correlation	-1	
Hypothesized Mean Difference	0.666666667	`

Table 7. Single Factor ANNOVA of Table 1 sample data

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Yes	6	23	3.833	2.967
No	6	19	3.167	2.967

ANNOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1.333	1	1.333	0.449	0.517784	4.964603
Within Groups	29.67	10	2.967			
Total	31	11				

SS: sum of squares, *df*: degrees of freedom, *MS*: mean square, *F-crit*: F-critical

Table 7's P-value is 0.517784, indicating that the stored data has no significant influence on the examined data. The F-value demonstrates that the dimensions 'Yes' and 'No' are equivalent. Since there is no discernible difference between the mean in Tables 6, and 7, our obtained data observations are interrelated (P>0.05 is a significant benchmark for determination of the analysis dataset according to the study hypothesis).

8.2. Software facilities

The questionnaire from the software facilities section was examined using descriptive statistics. This part included four questions that could only be answered with a 'Yes' or a 'No'. By using descriptive statistics on the recorded data, we were able to reach a concrete conclusion. Table 8 examines the 'Yes' and 'No' dimensions. The value of standard deviation is determined by the study. The data scattered by the standard deviation is determined by looking at the relationship between the 'Yes' and 'No' mean. It appears that there is a strong association between 'Yes' and 'No' standard deviation. The variability in the value 'Yes' and 'No' samples was calculated using sample variance, which is compatible with the study. The variance in Table 8 is 9 for 'Yes' and 'No' data, respectively, indicating that the mean value data has less scatter. The Kurtosis value, which is consistent with our aggregated data, is used to assess the scattering data risk. Further, skewness =0.632455532 for 'Yes' and skewness = -0.632455532 for 'No' implies that the recorded data has a normal distribution.

Table 9's P-value is 0.670412, indicating that the stored data has no significant influence on the examined data. The F-value demonstrates that the dimensions 'Yes' and 'No' are equivalent. Since there is no discernible difference between the mean in Tables 8, and 9, our obtained data observations are interrelated (P>0.05 is a significant benchmark for determination of the analysis dataset according to the study hypothesis).

Table 8. Descriptive statistics of Table 2 sample data

Yes		***No***	
Mean	3	Mean	4
Standard Error	1.58113883	Standard Error	1.58113883
Median	2.5	Median	4.5
Mode	#N/A	Mode	#N/A
Standard Deviation	3.16227766	Standard Deviation	3.16227766
Sample Variance	10	Sample Variance	10
Kurtosis	-1.7	Kurtosis	-1.7
Skewness	0.632455532	Skewness	-0.632455532
Range	7	Range	7
t-Test: Paired Two Sample for Means			
		Yes	***No***
Pearson Correlation		-1	
Hypothesized Mean Difference		1	

Table 9. Single Factor ANNOVA of Table 2 sample data

SUMMARY

Groups	***Count***	***Sum***	***Average***	***Variance***		
Yes	4	12	3	10		
No	4	16	4	10		
ANNOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	2	1	2	0.2	0.670412	5.987377607
Within Groups	60	6	10			
Total	62	7				

SS: sum of squares, *df*: degrees of freedom, *MS*: mean square, *F-crit*: F-critical

8.3. Availability of ICT based Technologies

The questionnaire from the availability of ICT based technologies section was examined using descriptive statistics. This part included five questions that could only be answered with a 'Yes' or a 'No'. By using descriptive statistics on the recorded data, we were able to reach a concrete conclusion. Table 10 examines the 'Yes' and 'No' dimensions. The value of standard deviation is determined by the study. The data scattered by the standard deviation is determined by looking at the relationship between the 'Yes' and 'No' mean. It appears that there is a strong association between 'Yes' and 'No' standard deviation. The variability in the value 'Yes' and 'No' samples was calculated using sample variance, which is compatible with the study. The variance in Table 10 is 11 for 'Yes' and 'No' data, respectively, indicating that the mean value data has less scatter. The Kurtosis value, which is consistent with our aggregated data, is used to assess

the scattering data risk. Further, skewness =-1.088511769 for ‘Yes’ and skewness = 1.088511769 for ‘No’ implies that the recorded data has a normal distribution.

Table 11's P-value is 0.854813, indicating that the stored data has no significant influence on the examined data. The F-value demonstrates that the dimensions 'Yes' and 'No' are equivalent. Since there is no discernible difference between the mean in Tables 10, and 11, our obtained data observations are interrelated (P>0.05 is a significant benchmark for determination of the analysis dataset according to the study hypothesis).

Table 10. Descriptive statistics of Table 3 sample data

Yes		***No***	
Mean	3.6	Mean	3.4
Standard Error	0.748331477	Standard Error	0.748331477
Median	4	Median	3
Mode	5	Mode	2
Standard Deviation	1.673320053	Standard Deviation	1.673320053
Sample Variance	2.8	Sample Variance	2.8
Kurtosis	0.535714286	Kurtosis	0.535714286
Skewness	-1.088511769	Skewness	1.088511769
Range	4	Range	4
t-Test: Paired Two Sample for Means			
		Yes	***No***
Pearson Correlation		-1	
Hypothesized Mean Difference		0.2	

Table 11. Single Factor ANNOVA of Table 3 sample data

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Yes	5	18	3.6	2.8
No	5	17	3.4	2.8

ANNOVA

Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Between Groups	0.1	1	0.1	0.035714	0.854813	5.317655072
Within Groups	22.4	8	2.8			
Total	22.5	9				

SS: sum of squares, *df*: degrees of freedom, *MS*: mean square, *F-crit*: F-critical

8.4. Benefits of using e-resources

The questionnaire from the benefits of using e-resource section was examined using descriptive statistics. This part included nine questions that could only be answered with a ‘Yes' or a 'No'. By using descriptive statistics on the recorded data, we were able to reach a concrete conclusion. Table 12 examines the 'Yes' and 'No' dimensions. The value of standard deviation is determined by the study. The data scattered by the standard deviation is determined by looking at the relationship between the 'Yes' and 'No' mean. It appears that there is a strong association between 'Yes' and 'No' standard deviation. The variability in the value 'Yes' and 'No' samples was calculated using sample variance, which is compatible with the study. The variance in Table 12 is 13 for ‘Yes’ and ‘No’ data, respectively, indicating that the mean value data has less scatter. The Kurtosis value, which is consistent with our aggregated data, is used to assess the scattering data risk. Further, skewness =-0.263200397 for ‘Yes’ and skewness = 0.263200397 for ‘No’ implies that the recorded data has a normal distribution.

Table 13's P-value is 2.2177E-09, indicating that the stored data has significant influence on the examined data. The F-value demonstrates that the dimensions 'Yes' and 'No' are equivalent. Since there is no discernible difference between the mean in Tables 12, and 13, our obtained data observations are not interrelated (P<=0.05 is an alternative benchmark for determination of the analysis dataset that is not according to the study hypothesis).

Table 12. Descriptive statistics of Table 4 sample data

Yes		*No*	
Mean	6.111111111	Mean	0.888888889
Standard Error	0.309320242	Standard Error	0.309320242
Median	6	Median	1
Mode	7	Mode	0
Standard Deviation	0.927960727	Standard Deviation	0.927960727
Sample Variance	0.861111111	Sample Variance	0.861111111
Kurtosis	-2.017541252	Kurtosis	-2.017541252
Skewness	-0.263200397	Skewness	0.263200397
Range	2	Range	2

t-Test: Paired Two Sample for Means

	Yes	*No*
Pearson Correlation	-1	
Hypothesized Mean Difference	5.222222	

Table 13. Single Factor ANNOVA of Table 4 sample data

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Yes	9	55	6.111111	0.861111
No	9	8	0.888889	0.861111

ANNOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	122.7222	1	122.7222	142.5161	2.2177E-09	4.493998478
Within Groups	13.77778	16	0.861111			
Total	136.5	17				

SS: sum of squares, *df*: degrees of freedom, *MS*: mean square, *F-crit*: F-critical

8.5. Barriers associated with the implementation of ICT

The questionnaire from the barriers associated with the implementation of ICT section was examined using descriptive statistics. This part included nine questions that could only be answered with a ‘Yes' or a 'No'. By using descriptive statistics on the recorded data, we were able to reach a concrete conclusion. Table 14 examines the 'Yes' and 'No' dimensions. The value of standard deviation is determined by the study. The data scattered by the standard deviation is determined by looking at the relationship between the 'Yes' and 'No' mean. It appears that there is a strong association between 'Yes' and 'No' standard deviation. The variability in the value 'Yes' and 'No' samples was calculated using sample variance, which is compatible with the study. The variance in Table 14 is 15 for ‘Yes’ and ‘No’ data, respectively, indicating that the mean value data has less scatter. The Kurtosis value, which is consistent with our aggregated data, is used to assess the scattering data risk. Further, skewness =-1.447112473 for ‘Yes’ and skewness = 1.447112473 for ‘No’ implies that the recorded data has a normal distribution.

Table 15's P-value is 0.003467676, indicating that the stored data has significant influence on the examined data. The F-value demonstrates that the dimensions 'Yes' and 'No' are equivalent. Since there is no discernible difference between the mean in Tables 14, and 15, our obtained data observations are not interrelated (P<=0.05 is an alternative benchmark for determination of the analysis dataset that is not according to the study hypothesis).

Table 14. Descriptive statistics of Table 5 sample data

Yes		*No*	
Mean	4.727272727	Mean	2.272727273
Standard Error	0.523813101	Standard Error	0.523813101
Median	5	Median	2
Mode	6	Mode	1
Standard Deviation	1.737291518	Standard Deviation	1.737291518
Sample Variance	3.018181818	Sample Variance	3.018181818
Kurtosis	1.101091111	Kurtosis	1.101091111
Skewness	-1.447112473	Skewness	1.447112473
Range	5	Range	5

t-Test: Paired Two Sample for Means

	Yes	*No*
Pearson Correlation	-1	
Hypothesized Mean Difference	2.454545	

Table 15. Single Factor ANNOVA of Table 5 sample data

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Yes	11	52	4.727272727	3.018182
No	11	25	2.272727273	3.018182

ANNOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	33.13636364	1	33.13636364	10.97892	0.003467676	4.351244
Within Groups	60.36363636	20	3.018181818			
Total	93.5	21				

SS: sum of squares, *df*: degrees of freedom, *MS*: mean square, *F-crit*: F-critical

9. ICT Infrastructure Challenges in Colleges

ICT adoption in education provides a number of noteworthy benefits, but it also has certain limitations. The high expense of purchasing, setting up, utilizing, maintaining, and replacing ICTs comes first. ICT integration in education is still in its infancy while having massive potential. Although other costs are frequently significantly lower, ICT systems for teaching in undeveloped nations have a particularly high potential cost since they are typically more expensive to install than in industrialized ones.

1. Resistance to transition from conventional pedagogical approaches to more contemporary, technologically oriented teaching and learning methods among academics and students. In certain circumstances, the attitude of different managements inside and outside of institutions toward acquiring ICT-related facilities like computers and the Internet is delayed, while in others, the government offers no assistance or support.
2. There is a lack of ICT infrastructure, including access, computer hardware, software, and bandwidth, while the advent of 4G technology has somewhat addressed this problem.
3. A shortage of experienced ICT employees. Most institutions need computer-savvy teachers and ICT experts who can supervise and support the integration of computing and/or Internet connectivity into to the teaching-learning process. Equipment is quite expensive in a nation like India, which has a low economy and a significantly depreciated currency. It should be emphasized, however, that the challenge might not be one of resources or technology, but rather of political will.
4. Colleges lack the ICT required infrastructure to reap the rewards. And again, the most of ICT infrastructure, including the Internet, telefax, and e-mail, relies on several service providers. These services are delivered in an irregular manner and come with exorbitant prices.
5. The high cost of acquisition and installing the latest software, as well as numerous opportunity costs to the institutions for infrastructure development, make the use of ICT in educational institutions a considerable challenge.
6. Building ICT infrastructure only will not be enough to effectively incorporate ICT into educational institutions. ICT is indeed very focused about the integration of in progress education among stakeholders since the development, dissemination, selection, and evaluation of e-content need substantial networking between producer and consumer.
7. There are numerous institutions that offer online courses in India, but are these degree programs approved in India for employment purposes? Do these courses receive the same benefits as more conventional ones? Do these colleges have the right to provide such online courses? There has to be an answer to these queries.
8. In addition to a lack of infrastructure that supports the technology, additional challenges with power, network accessibility, a lack of technology awareness, and improper use of technology with expertise were making it difficult to use ICT effectively in educational institutions.
9. India has the lowest percentage of institutions adopting information and communication technology, according a research by the UNESCO Statistical Institute.

Access to internationally competitive knowledge outputs will be facilitated by the expansion of English as a significant language for research, technology, trade, and interaction. As a result, there will be more alternatives for educational and training programs that are more diversified. One of the greatest societal obstacles to the adoption of ICT, particularly in rural areas, is indeed language. The teachers' attitudes have a big impact upon how new technology is being used in educational institutions. Corruption is one of the major obstacles to ICT use in education. While other teachers are unable to properly integrate technology in their classrooms, others are reluctant to engage because of

boredom, fear, or lack of passion. In order to properly incorporate technology into the curriculum, one needs technical proficiency, subject-matter expertise, and an awareness of how students learn.

10. Future plans to address college ICT Infrastructure

The following recommendations have been made based on the current study:

(i) At all levels of education, adequate ICT infrastructure facilities are required.
(ii) Many challenges have obstructed the progress of ICT integration in education. It has been suggested that collaborative study by stakeholders is needed to identify potential solutions for comprehensive ICT integration in education.
(iii) Professional development for teachers, administrators, and other stakeholders is vital to shift the perspective of the use of ICT in education.
(iv) Long-term and extensive integration of ICT in education need significant financial resources.
(v) There is a need to provide cost-effective ICT services so that they are accessible to the country's less privileged and underprivileged citizens.
(vi) The shift from learning about ICT to learning with ICT or learning via ICT is important.
(vii) ICT literacy should be addressed at all levels of education's curriculum.

11. Conclusion

The hardware and software infrastructure at the college is now reasonably accessible. The primary problems presented by a scarcity of qualified IT employees and inadequate training in ICT applications. To help colleges in addressing their challenges, college administration should increase funding allotments. UGC requirements state that the authority must take the initiative to employ professional, IT-savvy employees. Colleges nowadays need to use technology in order to provide information services and meet the expectations of the users as a whole. In addition to helping colleges in providing better information services, automation or computerization is effective in promoting access to online information services. Additionally, it is essential for all institutions of higher education to automate processes so that resource sharing initiatives can be extended effectively in a network setting. The transformation of classrooms into computer labs has an effect on ICT facilities, instructors, and students. This study includes multiple ICT investment opportunities so that colleges are in responsibility of maintenance and repairs to their own facilities. These colleges shouldn't have to wait until the government can fulfill their needs or go at the government's pace.

Over the past 50 years, the higher education system has rapidly evolved to meet the requirement of providing high-quality education to all. Due to the rapid development of information and communication technology(ICT), this aspect has gained further momentum. In today's globally integrated world, there is indeed a rising a need competent and skilled workforce. In context of this, accessibility to increased higher education has been identified as the fundamental to economic development and growth. In the present circumstances, this study provides a comparative analysis of integrating ICT into several facets of higher education. This article also provides an essential analysis of several ICT-related challenges the educational system nowadays is experiencing

The purpose of this study was to determine the state of the college's ICT infrastructure. That is why we carried out a survey of seven institutions and gathered data. While gathering information, we prioritized the college's expertise of ICT and subsequently questioned them in this setting. We have further categorized them into five sections focused on the pertinent questions, namely: software facilities; hardware infrastructure facilities; availability of ICT-based technologies; benefits of adopting e-resources; and challenges associated with ICT adoption. The consistency of the questions was taken in mind while partitioning. Following that, all of the sections were evaluated using software. We evaluated the collected data using descriptive statistics, a t-test, and anova. All of the sections' results contradicted each other. This demonstrates that seven colleges responded to the questions based on their comprehension and the current scenario of ICT at the institution. Along with this, it is discovered that the ICT facilities at each college differ between them. Variations in the studied data could be attributed to changes in the questions asked. Overall, the sectional analysis was satisfactory. Based on the data reviewed, it can be concluded that the college is still unconcerned about ICT education and its effective use. In our investigation, we focused on issues that are directly relevant to the learners. The study's research will benefit educational institutions, trainers, and students in identifying deficiencies and variables influencing performance. However, because we only analyzed seven institutions, our study has certain limitations. In the future, this information could be employed for more than seven institutions, allowing the accuracy of the data to be further investigated. In future study, the questions can be modified while considering the time, background, and methodology of working in mind, and the research can be continuing. Furthermore, information about institutions in various states can be gathered to strengthen the accuracy of the findings. As a result, we advocate conducting more study based on this research paper.

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