Impact of Information and Communication Technology on Engineering Faculty of Thanjavur District Colleges

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Abstract

This study examines the impact of Information and Communication Technology (ICT) on engineering faculty in Tamil Nadu's Thanjavur district. It investigates the adoption levels, usage patterns, and challenges educators face. The research aims to understand the profound influence of ICT on pedagogical approaches, research effectiveness, and faculty professional development. The sample included 150 engineering faculty members selected through stratified random sampling. A comprehensive questionnaire was administered, resulting in 139 responses. The data will provide an in-depth analysis of how ICT is reshaping educational practices and productivity in the region.

Keywords
ICT; Engineering Education; Thanjavur District; Faculty Development; Digital Tools,

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1. Introduction

Information and Communication Technology (ICT) encompasses various technological tools and resources for creating, storing, managing, and disseminating information. In recent years, the integration of ICT into educational settings has significantly transformed traditional teaching and learning methods, fostering a more dynamic and interactive environment. In engineering education—where the rapid pace of technological innovation is a key consideration—ICT has emerged as an essential foundation that enhances pedagogical approaches and boosts research effectiveness and output. Specifically, in the Thanjavur district, which is home to a variety of engineering colleges, understanding how ICT is adopted and its resultant impact on faculty members is crucial. This understanding can provide valuable insights into the region's educational developments, successes, and pressing challenges. This paper will explore how engineering faculty employ ICT tools to enrich their teaching methodologies, streamline research processes, and effectively manage administrative responsibilities. Additionally, it aims to identify obstacles that might impede the optimal utilisation of ICT, such as lack of training, inadequate infrastructure, or resistance to change. By examining these aspects, we hope to uncover potential strategies for overcoming these barriers, thereby maximising the positive influence of ICT on teaching and learning within the engineering education landscape in Thanjavur.

Information and Communication Technology (ICT)

Information and Communication Technology (ICT) integrates telecommunications, computers, and other related devices that enable information access, retrieval, storage, transmission, and manipulation. It encompasses a broad range of technologies used for managing and communicating information.

Key Components of ICT

Computing Devices: This includes computers, laptops, tablets, and smartphones that process and manage data.

Telecommunications: This encompasses all forms of communication technology, including telephones, mobile devices, and internet connectivity that facilitate real-time communication.

Software Applications: These are programs and applications that help in data processing, communication, and information management, like word processors, spreadsheets, databases, and web browsers.

Networks: ICT involves the interconnected systems and infrastructure that support communication, such as the Internet, intranets, and extranets, along with local area networks (LAN) and wide area networks (WAN).

Digital Content: This includes various forms of information that can be communicated digitally, such as text, audio, video, and images.

Importance of ICT:

Enhanced Communication: ICT has revolutionised communication, allowing instant messaging, video conferencing, and social media interactions regardless of geographical barriers.

Information Access: The internet is a vast repository of information, enabling individuals and organisations to access knowledge and resources easily.

Economic Development: ICT plays a significant role in boosting productivity and efficiency in various sectors, including education, healthcare, and business, and contributes to overall economic growth.

Educational Tools: It supports e-learning and provides various platforms for students and educators to engage with educational content innovatively.

Job Creation: The expansion of ICT has led to new job roles and industries focused on technology development, support, and management.

Challenges:ICT presents challenges, such as digital divides, cyber security threats, and privacy concerns, despite its benefits. Addressing these issues is important to ensure equitable access and safety in the digital space.

2. Profile of Study Area

Nestled in the heart of southern India, Thanjavur district in Tamil Nadu is a treasure trove of cultural richness and historical depth. Often affectionately dubbed the "Rice Bowl of Tamil Nadu," this district thrives on the bountiful agricultural yields from its lush fields, primarily driven by extensive paddy cultivation. The lifeblood of this agricultural haven is the Cauvery River, which courses through the region, nourishing the fertile delta that has sustained generations of farmers. Thanjavur's history is steeped in the legacy of the Chola dynasty, which once made this vibrant district its capital. The Cholas are celebrated for their remarkable contributions to the arts, architecture, and literature, with their most iconic masterpiece being the magnificent Brihadeeswarar Temple. This UNESCO World Heritage Site, constructed under the reign of Raja Raja Chola I, stands as an awe-inspiring architectural feat, showcasing intricate carvings and grandiose proportions that reflect the ingenuity of its creators. Beyond its temples and monuments, Thanjavur pulses with life through its rich classical music and dance traditions. The region is famous for its exquisite Thanjavur dolls, handcrafted figurines that symbolise local artistry, and the distinctively vibrant Thanjavur paintings, known for their intricate gold foiling and deep colours that depict religious themes and folklore. Cultural celebrations in Thanjavur are a spectacle to behold. Lively festivals such as Pongal, a harvest festival marked by joyous gatherings and traditional feasts, and Navaratri, a celebration honouring the divine feminine through music, dance, and elaborate rituals, are a testament to the district's deeply rooted traditions, which continue to thrive amidst the winds of change. In the modern era, Thanjavur seamlessly weaves its illustrious historical narrative with progressive advancements in education and agriculture. The district is home to many educational institutions and research centres, fostering a spirit of innovation and development that supports its agricultural base while preserving its rich heritage. In essence, Thanjavur stands as a vibrant tapestry where the past elegantly complements the present, offering a unique glimpse into the soul of Tamil Nadu.

3. Review of Literature

A thorough review of existing studies reveals that ICT significantly enhances educational delivery by enabling innovative teaching methods and broadening access to global resources. Research indicates that engineering educators increasingly leverage digital platforms for designing curricula, conducting assessments, and engaging with students. However, gaps persist in infrastructure, training, and digital literacy, particularly in rural regions like Thanjavur district. This section synthesizes findings from global

and regional studies, providing a foundation for the current research.

Kumar, R. (2020) A study determined the digital divide among rural and urban students. From 64 rural and urban high schools, 2592 respondents were selected. Findings revealed that only 20.66% of rural students used computers, while 69.70% of urban students used computers for various academic purposes. It was also revealed that most students depended highly on the teachers to learn computers. It was further revealed that very few rural schools, 6.25%, had permanent computer teachers, but most urban schools had 96.87% computer teachers to teach computers and their applications.

Sharma, P., & Singh, S. (2021): The article, Digital Tools for Teaching: Transforming Higher Education, explores how digital technologies reshape teaching methodologies in higher education.The authors discuss both the benefits and challenges associated with these tools. Benefits include improved engagement, flexibility in learning, and the ability to cater to diverse learner needs. On the other hand, the study notes challenges like the digital divide, lack of training for educators, and data privacy issues.. However, a limitation is the lack of detailed analysis of the long-term implications of digital reliance in education, such as potential impacts on critical thinking or the digital literacy gap among students.Overall, the paper is a valuable resource for understanding the transformative potential of digital tools in higher education and offers practical recommendations for their effective implementation.

4. Statement of Problem

The rapid integration of Information and Communication Technology (ICT) into education has significantly transformed teaching and learning processes, particularly in engineering institutions. While ICT offers immense potential to enhance pedagogical methods, facilitate resource access, and improve administrative efficiency, its implementation and impact vary across regions and institutions. In the context of Thanjavur district, which holds a blend of urban and rural educational institutions, there is limited empirical evidence regarding the extent to which ICT has been adopted and its effects on engineering faculty. Challenges such as technological infrastructure, faculty digital literacy, institutional support, and resource accessibility may hinder the effective utilisation of ICT tools. Furthermore, the disparity between urban and rural institutions raises concerns about equity and inclusivity in ICT adoption. This study aims to investigate the impact of ICT on engineering faculty in Thanjavur district colleges, focusing on its influence on teaching practices, professional development, and overall job satisfaction. By addressing these concerns, the study seeks to identify the challenges faced by faculty and propose strategies for optimising ICT use in the region's engineering education system.

5. Objectives of the study:

- ← To assess the level of ICT adoption among engineering faculty.
- ← To analyse the impact of ICT on teaching methodologies and learning outcomes.

6. Null and Alternative Hypotheses:

H_0: There is no significant link between respondents' views on ITC tool purposes and their satisfaction.

H_1: There is a significant link between respondents' views on ITC tool purposes and their satisfaction.

7. Scope of the study

The study explores the impact of Information and Communication Technology (ICT) on the engineering faculty in colleges located in Thanjavur district, Tamil Nadu. It is limited to engineering colleges in Thanjavur district and covers urban and rural institutions to capture a diverse perspective. Engineering faculty members, including professors, associate professors, and assistant professors from various engineering disciplines, are the primary focus. The study examines the adoption of ICT tools in teaching, research, and administrative activities. It explores how ICT has influenced teaching methodologies, student engagement, professional development, and job satisfaction. The research also evaluates the challenges faced by faculty, such as infrastructure gaps, training needs, and resistance to change.

8. Methodology

The study employs a mixed-methods approach, combining quantitative surveys and qualitative interviews. Data were collected from engineering faculty members across 10 colleges in Thanjavur district. The survey instrument includes questions on ICT usage, frequency, perceived benefits, and barriers. Interviews were conducted to gather in-

depth insights into faculty experiences and perceptions. Statistical methods were used to interpret the data, including descriptive and inferential analyses. Thematic analysis was applied to qualitative data. The sample Size is 150 engineering faculty members who were selected using a stratified random sampling technique. The questionnaire was distributed, and the respondents fully completed 139 responses.

9. Limitations

- ⇒ The study's focus on engineering colleges in Thanjavur limits the generalizability of the findings to other regions.
- ⇒ The study is purely based on primary data, so the results depend upon the truthfulness of responses from the respondents.

10. Data Analysis and Interpretation

Table 1: Demographic Profile of Respondents

	Category	Number	Percentage
Gender	Male	52	37.41
	Female	87	62.59
Age	< 30 Years	31	22.30
	30 – 50Years	63	45.32
	>50 Years	45	32.37
Educational Qualifications	B.E./ B. Tech	14	10.07
	M.E./M.Tech.	57	41.01
	Ph. D	41	29.50
	Gate	27	19.42
Marital Status	Married	41	29.50
	Unmarried	98	70.50
Type of Engineering College	Government	44	31.65
	Constituent college	39	28.06
	Private colleges	56	40.29
Designation	Assistant Professor	62	44.60
	Associate Professor	32	23.02
	Professor	19	13.67
	Others	26	18.71
Monthly income	Below ₹ 50,000	38	27.34
	₹50,000 – ₹1,00,000	64	46.04
	₹1,00,000 – ₹2,00,000	21	15.11
	Above ₹ 2,00,000	16	11.51

The demographic profile of respondents in this study is diverse, reflecting a wide range of backgrounds and experiences. The gender distribution shows that 52 respondents are male (37.41%), while 87 are female (62.59%). Age-wise, 31 respondents are under 30 years (22.30%), 63 are between 30 and 50 years (45.32%), and 45 are over 50 years (32.37%). Regarding educational qualifications, 14 respondents hold a B.E./B. Tech degree (10.07%), 57 have an M.E./M.Tech degree (41.01%), 41 possess a Ph.D. (29.50%), and 27 are GATE-qualified (19.42%). The marital status of respondents indicates that 41 are married (29.50%) and 98 are unmarried (70.50%). When it comes to the type of engineering college, 44 respondents are from government colleges (31.65%), 39 are from constituent colleges (28.06%), and 56 are from private colleges (40.29%). In terms of designation, 62 respondents are Assistant Professors (44.60%), 32 are Associate Professors (23.02%), 19 are Professors (13.67%), and 26 hold other positions (18.71%). The monthly income data reveals that 38 respondents earn below ₹50,000 (27.34%), 64 earn between ₹50,000 and ₹1,00,000 (46.04%), 21 earn between ₹1,00,000 and ₹2,00,000 (15.11%), and 16 earn above ₹2,00,000 (11.51%). This comprehensive demographic overview provides valuable insights into the diverse composition of the study population.

Table 2: Frequency of ITC Tools used

Sl. No	Frequency of ITC Tools used	Number of Respondents	Percentage
1.	Daily	32	23.02
2.	Thrice in a week	44	31.65
3.	Twice in a week	35	25.18
4.	Once in a week	16	11.51
5.	As and when needed	12	8.63
	Total	**139**	**100**

(Source: Primary Data)

It is observed that out of the 139 respondents, 32 individuals (23.02%) reported using ITC tools daily. This indicates that many respondents rely heavily on these tools in their regular activities. A larger group of 44 respondents (31.65%) uses ITC tools thrice a week, the most common reported frequency. Additionally, 35 respondents (25.18%) utilise ITC tools twice weekly, suggesting a moderately frequent usage pattern.A smaller segment of the respondents, totalling 16 individuals (11.51%), reported using ITC

tools once a week. Lastly, 12 respondents (8.63%) indicated that they use ITC tools only as and when needed, reflecting a more sporadic usage pattern.Most respondents use ITC tools multiple times weekly, demonstrating their importance and regular integration in their activities. This distribution provides valuable insights into the respondents' varying levels of dependence on ITC tools.

Fig 1

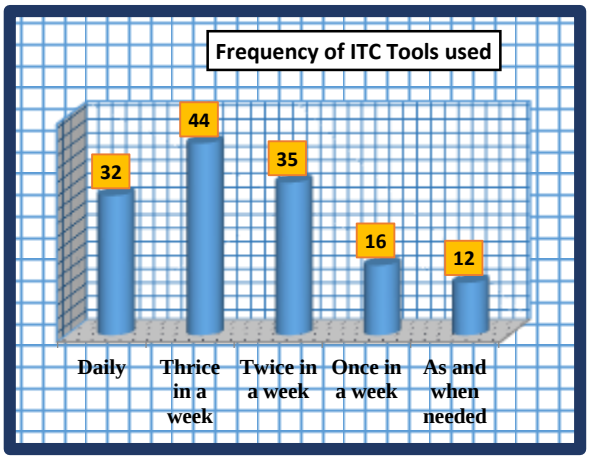

Table 3: Ranking based on the Purpose of Using ITC Tools

Sl. No	Purpose of Using ITC Tools	WAS	Rank
1.	Enhanced Teaching Methods	3.975	I
2.	Simulation and Modeling	3.246	VII
3.	Remote Learning	3.418	V
4.	Student Engagement	3.842	II
5.	Research and Development	3.681	III
6.	Laboratory Management	3.159	VIII
7.	Assessment and Evaluation	3.573	IV
8.	Professional Development	3.472	VI
9.	Collaboration	2.986	X
10.	Resource Sharing	3.049	IX

(Source: Primary Data)

The table reveals the ranking of various purposes for which ICT tools are used by engineering faculty based on their Weighted Average Scores (WAS). The most common use, with the highest score of 3.975, is for enhanced teaching methods, reflecting the tools' critical role in improving pedagogical approaches. Student engagement ranks second with a score of 3.842, underscoring the importance of ICT in keeping students actively involved. Research and development follow in third place with a score of 3.681, highlighting its significance in fostering academic research. Assessment and evaluation come fourth, scoring 3.573, indicating their importance in managing assessments efficiently. Remote learning is ranked fifth with a score of 3.418, showcasing the utility of ICT tools in facilitating virtual education. Professional development is sixth, with a score of 3.472, emphasising continuous learning for faculty. Simulation and modelling hold seventh place with a score of 3.246, used for demonstrating engineering problems and solutions. Laboratory management ranks eighth with a score of 3.159, aiding in managing lab operations. Resource sharing is ninth, with a score of 3.049, indicating its role in distributing educational materials. Lastly, collaboration, with the lowest score of 2.986, reflects using ICT tools for teamwork among faculty members. This ranking highlights the diverse applications of ICT tools in enhancing teaching, student engagement, research, and other academic activities.

Table 4: Association between the purpose of using the ITC Tools and respondents' satisfaction

Variables	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.299	.111		2.697	< 0.05
VAR 1	.084	.017	.088	4.818	< 0.05
VAR 2	.079	.020	.080	4.042	< 0.05
VAR 3	.006	.018	.006	.327	> 0.05
VAR 4	.086	.021	.084	4.052	< 0.05
VAR 5	-.031	.017	-.032	-1.805	> 0.05
VAR 6	.197	.016	.218	12.361	< 0.05
VAR 7	.135	.019	.154	7.093	< 0.05
VAR 8	.069	.021	.054	3.195	< 0.05
VAR 9	.154	.020	.143	7.704	< 0.05
VAR 10	.107	.018	.109	5.851	< 0.05
"R"	**0.849**				
"R^2"	**0.721**				
Adjusted "R^2"	**0.719**				
"F" value	**81.231**		**Sig. Value .000**		

Table 4illustrates the association between the purpose of using ICT tools and respondents' satisfaction. The

model's unstandardized coefficients indicate the extent of change in satisfaction per unit change in each variable. The standardized coefficients (Beta) measure the strength of the association. The t-values and significance levels (Sig.) reveal the statistical significance of each variable. The constant term has an unstandardized coefficient of .299 and is statistically significant with a t-value of 2.697 ($p < 0.05$). Among the variables, VAR 1 (.084), VAR 2 (.079), VAR 4 (.086), VAR 6 (.197), VAR 7 (.135), VAR 8 (.069), VAR 9 (.154), and VAR 10 (.107) are all statistically significant with p-values less than 0.05. These variables show positive associations with satisfaction, with VAR 6 (.197) and VAR 9 (.154) having the highest Beta values, indicating a stronger impact on satisfaction. VAR 3 (.006) and VAR 5 (-.031) are not statistically significant ($p > 0.05$), suggesting no substantial impact on satisfaction. The model's R-value is 0.849, indicating a strong correlation between the purposes of using ICT tools and respondents' satisfaction. The R^2 value of 0.721 signifies that the model can explain 72.1% of the variability in respondents' satisfaction. The adjusted R^2 value of 0.719 supports this strong explanatory power. The F value of 81.231, with a significance level of .000, indicates that the overall model is statistically significant. This analysis highlights the significant factors contributing to respondents' satisfaction with ICT tools, with specific variables showing a more substantial influence.

11. Findings

- The gender distribution shows that 52 respondents are male (37.41%), while 87 are female (62.59%).
- Age-wise, 31 respondents are under 30 years old (22.30%), 63 are between 30 and 50 years old (45.32%), and 45 are over 50 years old (32.37%).
- Regarding educational qualifications, 14 respondents hold a B.E./B. Tech degree (10.07%), 57 have an M.E./M. Tech degree (41.01%), 41 possess a Ph.D. (29.50%), and 27 are GATE-qualified (19.42%).
- The marital status of respondents indicates that 41 are married (29.50%) and 98 are unmarried (70.50%).
- Regarding the type of engineering college, 44 respondents are from government colleges (31.65%), 39 are from constituent colleges (28.06%), and 56 are from private colleges (40.29%).
- In terms of designation, 62 respondents are Assistant Professors (44.60%), 32 are Associate Professors (23.02%), 19 are Professors (13.67%), and 26 hold other positions (18.71%).
- The monthly income data reveals that 38 respondents earn below ₹50,000 (27.34%), 64 earn between ₹50,000 and ₹1,00,000 (46.04%), 21 earn between ₹1,00,000 and ₹2,00,000 (15.11%), and 16 earn above ₹2,00,000 (11.51%).
- The comprehensive demographic overview provides valuable insights into the diverse composition of the study population.
- About 32 individuals (23.02%) reported using ITC tools daily. This indicates that many respondents rely heavily on these tools in their regular activities.
- A larger group of 44 respondents (31.65%) uses ITC tools thrice a week, the most common reported frequency. Additionally, 35 respondents (25.18%) utilise ITC tools twice weekly, suggesting a moderately frequent usage pattern.
- The analysis highlights the significant factors contributing to respondents' satisfaction with ICT tools, with specific variables showing a more substantial influence.

12. Conclusion

The study underscores the transformative potential of Information and Communication Technology (ICT) in engineering education. While significant strides have been made in incorporating ICT tools into the academic framework, numerous challenges remain. Key issues, such as inadequate infrastructure, insufficient training for educators and students, and disparities in digital access across different populations, must be addressed to realise the full benefits of ICT. Implementing strategic initiatives is crucial to fostering a more technology-enhanced academic environment. These initiatives should encompass comprehensive training programs to equip educators and students with the requisite skills for effective ICT utilisation. Furthermore, upgrading existing infrastructure to support advanced technologies is essential. Additionally, intentional policy interventions are required to ensure equitable access to digital resources for all stakeholders. Addressing these critical areas can amplify the overall impact of ICT in engineering education, thereby paving the way for a more innovative and inclusive academic experience.

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