



# ICT In Secondary School Education - A Perceptual Analysis

**\*Dr. K. BHANU PRAKASH & K. HIMA BINDU**

**\* Dr. K. BHANU PRAKASH, Professor & CFO, MN Infra Pvt., Ltd., Tadepalligudem, Andhra Pradesh,**

**\*\* K. HIMA BINDU, Principal, SIR CRR College of Education, ELURU, West Godavari District, Andhra Pradesh.**

## ABSTRACT

Rosy lips, fairy looks, shiny eyes, dimple chin, curly hair, lovely too, Teacher's pet, is that you? Children are 'gifts of god and rays of hope' and they have to be brought up in an atmosphere of aspiration where the mind is without fear and the head is held high, where knowledge is free for the expansion of human spirit. A nation's economic and social well-being depends on the Quality of its Primary and Secondary Education imparted. With the advent of Social Media, Mobility, Analytics, Cloud (SMAC) and Internet of Everything (IoE), the transformative power of ICT has been recognized across the world (E&Y). ICT emerged as an epistemological shift in Teaching-Learning Philosophy that facilitate kids to learn, create, interact, compete, relax, live, work and play (PWC). The raison d'être of pursuing technology-rich learning environments is 'digitalization' that permeates in every sphere of human society. ICTs' can enhance, enrich and extend the Teaching and Learning Processes in Secondary School Education.

No Books, No Pencils, No Erasers and No Sharpeners', only digital technologies serve the purpose of i-Gen / Gen- Z. The 21<sup>st</sup> century society demands 'new ways and means of Teaching and Learning pedagogy' in the form of digi-learning. At this juncture, ICTs (Information, Communication and Technology) emerged as one of the best proven platforms in 'education' that fulfils the needs of the centennials. ICT in education can be referred as 'engaging, empowering and enriching learning through technology'. The student exposure to educational ICT through curriculum integration has a significant and positive impact on basic literacy skills, student enrolment especially girls and women, student

achievement in terms of knowledge, comprehension, practical and presentation skills, and in subject areas of Mathematics, Sciences, and Social Study.

Keeping in view the afore cited, the study focuses on the perceptions of Teachers and Students in adoption of ICT in Secondary School Education (Classes VIII, IX, and X) in West Godavari District of Andhra Pradesh. The Stratified Random Sample Method is adopted for collection of data and the inferences are drawn from 1167 Secondary School Teachers and 6022 Students who are studying Class - VIII, Class - IX, and Class - X including the views and opinions of 62 ICT Instructors for the study from a Sample of 12 Revenue Mandals in the West Godavari District of Andhra Pradesh. The Semi-Structured Questionnaire and Focused Group Discussions (FGDs) form the basis for the study. The suggestions inter alia include, adopt ICT, an innovative and integrated platform, for pedagogical practices (curriculum and practicum) as well as in Teaching-Learning Practices for enhancing the Quality of Education in general and Secondary Education in specific. Talking books, hypertexts, micro-worlds, interactive white boards, dynamic geometry systems, simulations, and modeling environments have a positive effect on Pupils' attainment and enhance ICT adoption among Students. Yet, the crucial component remains with the Teacher and their pedagogical approaches. Adapt and adopt, authorize and access, receive and respond, yet, resist ICT in Secondary School Education that revolutionizes the Teaching-Learning Pedagogy in future.

### 1. ICT - An Innovatory Intervention in Teaching-Learning Pedagogy

The phrase ICT was at first coined by **William H. Melody and Robin Mansell**<sup>1</sup> in their ESRC Report on ICT: Social Sciences Research and Training in 1986 and it became a buzz word in academics in **UK, Wales, and North Ireland** since 1997 (**Stevenson, 1997**)<sup>2</sup>. ICT is defined by the **Royal Society of England (2012)**<sup>3</sup> as the school subject in the current national curriculum providing pedagogical knowledge and practice learning, and promotes managed learning environments in support of off-site learning in education.

The **UNESCO**<sup>4</sup> defined ICT as a collection of technological tools and techniques adapted for transmission, storing, creation, sharing, and exchange of information. The Information and Communications Technology (ICT) has transformed the education (**Grabe et al., 2007**)<sup>5</sup> and emerged as a driving force in knowledge society. ICT is providing dynamic and proactive Teaching-Learning environment (**Hatlevi & Arnseth, 2012**)<sup>6</sup> thereby enhances the educational standards (**Fisher, 2006**<sup>7</sup>; **Nivala, 2009**<sup>8</sup>; **Ottestad, 2010**<sup>9</sup>) as well as improving the Students achievement and attainment (**Hermans et al., 2008**)<sup>10</sup>. ICT can significantly enhance the Teaching and Learning Process (TLP) by making it more interactive and dynamic. It helps Students to develop 21<sup>st</sup> century comprehensive skills, critical

thinking, analytical reasoning, problem-solving etc., and prepare them for future (Al Hudhaifi and Al Dughaim, 2005)<sup>11</sup>.

The attitude (general and specific) and behaviour (Doll et al., 1992<sup>12</sup>; Glassman et al., 2006<sup>13</sup>; Bandura, 1997<sup>14</sup>), pedagogical training (Jung,2005<sup>15</sup>; Kiridis et al., 2006<sup>16</sup>; Steketee, 2005<sup>17</sup>), self-efficacy, technological integration, social psychology etc., will influence the adoption of ICT in classroom instruction, delivery, and learning processes (Drent et al.,2007<sup>18</sup>; Preston and Cox, 1999<sup>19</sup>).

## 2. AI and Gen-AI in Education - A Panoramic View

AI is seemingly everywhere and anywhere, red hot right now, contributing \$6 bn by 2024 (UNESCO). The term AI was at first coined by Alan Turing in 1950 in Computer Machinery and Intelligence defined as any form of digital computation. But, officially John McCarthy in 1979 introduced it as Machine Intelligence. AI refers to the simulation of human intelligence in machines, and enabling them to perform tasks. It encompasses various sub-fields such as Machine Learning (ML), Deep Learning (DL), Natural Language Processing (NLP), Robotics etc., Artificial Intelligence in Education (AIED) can be defined as an association of computer systems and human minds which perform cognitive tasks such as perceiving, learning, problem-solving, critical thinking etc., (Wang, 2019<sup>20</sup>, Barker et al., 2019<sup>21</sup>). AI revolutionizes the eco-system of education in a spectrum of ways by personalising learning experiences, augment critical thinking, engage in problem-solving, and simulate real-life scenarios (Yuan, 2023<sup>22</sup>, Alam, 2022<sup>23</sup>, Kamalov et al., 2023<sup>24</sup>). The AI Technologies viz., Natural Language Processing (NLP) and Cognitive Thinking demands novel skills in 21<sup>st</sup> century knowledge society. AI powered applications such as Open AI's Chat GPT, Google's Gemini, Inflection's Pi, and Anthropic's Claude 2 etc., can process the complex data and offer

data-driven insights which would be helpful to make more informed decisions (Popenici & Kerr, 2017, p.2<sup>25</sup>). These models are accurately assessing, forecasting, and predicting the textual features and provide output human-like intelligence (Brown et al., 2020<sup>26</sup>; Devlin et al., 2018<sup>27</sup>). AI in Education became an indispensable in School as well as University Curriculum and AI applications are embedded in every sphere of life, learning, and work (Dai et al., 2020<sup>28</sup>; Xu & Ouyang, 2022<sup>29</sup>; Touretzky et al., 2019<sup>30</sup>). AI powered Education enables adaptive and interactive learning, facilitates students reasoning

and gamification, improves critical thinking and collaboration, and provides Student feedback in classroom (Zhai et al., 2021)<sup>31</sup>. Artificial Intelligence (AI) has become ingrained in our society and eXplainable AI (XAI) produces human-like results and offer good explanations of its results. The Reinforcement Learning (RL) i.e., reward / punishment based learning is an outcome of XAI. The XAI can be used in promoting Fairness, Accountability, Transparency, and Ethics (FATE) in educational decision-making, personalised learning, and ethical educational environment (Khosravi et al., 2022<sup>32</sup>; Chiu et al., 2023b<sup>33</sup>).

### 3. ICT in Secondary Education - The Empirical Tones

Bariu, T.N. (2020)<sup>34</sup> opined that ICT plays a transforming role in Secondary Schools in Meru County, Kenya, and also evaluated the state of ICT infrastructure and the process of delivery and instruction in Secondary Schools of Kenya by adopting a descriptive survey research design. The study established that there is an imminent need of ICT infrastructure including hardware and software for the development of new skills and competencies among the Educators, Teachers, and the Learners.

Pervaiz Memon et al., (2018)<sup>35</sup> described the scenario and status of Secondary School Education in the Ghotki, a Sindh Province. Out of 40 Secondary Schools in Ghotki, only 13 Schools were selected for the study and evaluated the parameters that are responsible for the success of ICT integration and implementation. Some of the observations include irrespective of ICT infra and interests, the unavailability of electricity and high costs of maintenance can significantly impact the implementation of ICT in Secondary Schools..

P. Mailavelan, Dr. M. Baskaran (2018)<sup>36</sup> studied the level of adoption of ICT among Secondary Schools in relate gender, local, medium of instruction and type of management. The survey method was used to collect the data from 270 Students in and around Chennai, Tamilnadu. They found out that most of the Students have a moderate level of ICT awareness and there is no significant difference observed in ICT awareness between boys and girls.

Sanat Kumar Mallick et al., (2018)<sup>37</sup> explicitly expounded on the importance of education reforms and innovations including ICT in Secondary and Higher School Education. The data was collected from 24-North Paraganas of the West Bengal viz., Nadia, Hooghly, Purulia and Malda Districts.

The cluster sampling method was adopted and data was collected from 700 Secondary school students. The t-Test and 2x2 ANOVA results revealed that there is no significant difference of mean scores on motivational effect of ICT between Boys (B) and Girls (G); Urban (U) and Rural (R) Students and between any combinations of them.

**Xiang Hu et al., (2018)<sup>38</sup>** elucidated the adoption of ICT at country, school and student-level and also examined the relationship between the ICT and Mathematics, reading and scientific literacy. The data was collected from 11075 Schools and 305414 Secondary School Students across 44-Countries and the 3-Level Hierarchical Linear Models (HLM) were employed to analyze the data. The observations reveal that the adoption of ICT skills and talents can have a positive influence on both academic performance and academic success.

**Gil-Flores et al., (2017)<sup>39</sup>** explored the factors influencing the adoption and use of ICT in Secondary School Education in Spain. The database was collected from the Teaching And Learning International Study (TALIS) and the sample includes 3339 Teachers from 192 Secondary Education Centres offering ICT at length and breadth. The significant barriers of ICT use in classrooms include snags in software and hardware, organisational barriers, perceived lack of usefulness of ICT, lack of integration of ICT in pedagogy and curriculum etc.,

**Hwa-Seon Kim and Kyeong-Ouk Jeong (2017)<sup>40</sup>** opined that the Student-Centric Teaching-Learning Process i.e., ICT plays a crucial role by facilitating connections via social networks. The proposed proto-type learner-initiated instructional syllabus is an innovative and transformative initiative that uses digital growing-up storytelling. By integrating the storytelling into the curriculum can indeed make learning more inspiring and significantly enhance student engagement.

**Julia Gerick et al., (2017)<sup>41</sup>** evaluated the Secondary School Systems across Australia, Germany, Norway and the Czech Republic and also assessed the impact of ICT use on Students' CIL (Digital Literacy or Computer and Information Literacy) in Secondary Schools. A 'Semi-Structured Questionnaire' was canvassed and collected data from 9544 Students who are studying in 545 Schools. The country-specific results indicate that Germany shows a significant relationship between ICT adoption

and its impact on Students, while others might not exhibit the same level of correlation due to varying levels of ICT integration,

**Lucian V. Ngeze (2017)<sup>42</sup>** empirically examined the integration of ICT in Secondary School Education in Tanzania and found that there is a high level of adoption of ICT among Secondary Grade Teachers infers that there is a strong inclination towards ICT integration in education. Some of the recommendations for future readiness include the imparting ICT training in all levels at an increasing pace, the provision of infrastructural facilities, and incorporating pedagogical strategies into Secondary Education can enhance the effectiveness of ICT integration, making learning more engaging, personalized, and impactful.

**Nzwili K. Mwendwa (2017)<sup>43</sup>** empirically explored on the integration of ICT in Public Secondary School Curriculum in Kitui County, Kenya. The study adopted the Technology Acceptance Model (TAM) to assess the perceptions of Teachers and Principals on the integration of ICT in the curriculum across 388 Public Secondary Schools. The findings of the study indicate that the integration of ICT in education transforms Teaching-Learning pedagogy and making learning a more efficient and engaging. The ICT integration has a positive impact on Secondary Education by transforming traditional instructional methods into more interactive and engaging experiences.

**Dr. Pratik Upadhyaya (2016)<sup>44</sup>** emphasized that ICT has a transformative impact on the Quality of Education (QoE) as well as on Teaching-Learning Styles. The empirical evidences reveal that many Indian States are significantly behind in implementing Computer Aided Learning (CAL), and E-Communication remains underdeveloped and underutilized in most Secondary Schools.

**Eva P. Brooks et al., (2014)<sup>45</sup>** emphasized the interrelationship between ICT and learning within a creative learning environment that plays a significant role in influencing the adoption and effective use of ICT in Secondary School Education. The data was collected from 100 Secondary School Students through Focus Group Discussions (FGDs) and Workshops. They devised a creative pedagogy that leverages technology to boost creativity, enhance engagement, and interaction in educational environments. Additionally, the pedagogy stimulates Students' imagination, problem-solving skills, and engagement by integrating innovative teaching methods and models into curriculum.

## 4. Database and Methodology

Data plays a pivotal role in evaluating efficiency and efficacy of ICT Teaching and Learning. The primary data is the core and cornerstone for analytical framework. The Semi-Structured Questionnaire was canvassed among 1167 Secondary School Teachers and 6022 Students of Classes VIII, IX & X including 62 ICT Instructors in 12 Revenue Mandals of the West Godavari District of Andhra Pradesh and the responses are duly pilot tested.

The scholarly articles from Emerald, Routledge, SAGE, Science Direct, Springer, Taylor & Francis, Working Group Studies of UNESCO, UNICEF, RMSA, DISE, Performance and Review Reports of Directorate of School Education (DSE), and Office of the District Education Officer (DEO), Eluru, form the basis of secondary sources.

### 4.1. Objectives of the Study

The prime objective of the study is to evaluate the impact of ICT Enabled Teaching-Learning Pedagogy in Quasi-Govt., Secondary Schools (Classes from VIII, IX & X) of the West Godavari District, Andhra Pradesh.

The other objectives inter alia include:

- to examine the level of adoption of ICT Pedagogy among Teachers and Students of Secondary School Education (Classes of VIII, IX and X) in the West Godavari District, Andhra Pradesh.
- to explore new ways and means of ICT in Teaching - Learning Pedagogies at Secondary School-Level; and
- to offer suggestions for the effective and efficient adoption of ICT in Secondary School Education.

### 4.2. Hypothesis of the Study

For the purpose of the present study it is hypothesized that

**H<sub>0</sub>:** The use of ICT at Secondary School Education-Level (Classes of VIII, IX and X) has no impact on Teaching-Learning Process;

**H<sub>1</sub>:** There is an impact of ICT adoption on Teaching-Learning Process at Secondary School Level (Classes of VIII, IX & X);

### 4.3. Need for the Study

In order to realize the SDG-4, a committed and concerted effort would be required across all levers of Secondary School Education from curricula, pedagogy, ICT technologies, and collaborations to governance and funding. In this context, an earnest attempt has been made to assess the impact of ICT Enabled Teaching - Learning Pedagogy in Quasi-Govt., Secondary Schools of the West Godavari District, Andhra Pradesh. The study also evaluates the impact of ICT Enabled Pedagogy on Learning Outcomes of Secondary School Education (Classes of VIII, IX & X).

### 4.4. Significance of the Study

Teacher Education plays a pivotal role in transforming and strengthening the 'Education System' of any country. ICT in Education is an innovatory intervention in Teaching - Learning Process (Skinner, 2010)<sup>46</sup>. ICT adoption in Teaching can enhance the competencies of Teachers thereby improving the effectiveness in Classroom Teaching. ICT-Tools and Techniques promote learning activities, develop innovative methods of learning, facilitate and evaluate student performance. Keeping in view the manifold positive outcomes and evidences from the adoption of ICT, an earnest attempt is made in the study to evaluate the impact of ICT Enabled Teaching-Learning Pedagogy in Secondary School Education.

### 4.5. Time Period of the Study

ICT Enabled Teaching-Learning Pedagogy adopted in Quasi-Govt., Secondary Schools (Class VIII, IX and X) is considered for the study. The elicited responses and reflections from the Secondary School Teachers, Students, and ICT-Instructors are collected for pertinent analysis. The 'Time Period' i.e., 01<sup>st</sup> April, 2022, to 31<sup>st</sup> March, 2023 is considered for the study.

### 4.5. Sample Design

The elicited responses and reflections from 1167 Secondary School Teachers and 6022 Students who are studying Class - VIII, Class - IX, and Class - X including the views and opinions of 62 ICT Instructors are considered for the study from a Sample of 12 Revenue Mandals in the West Godavari District of Andhra Pradesh. The Semi-Structured Questionnaire and Focused Group Discussions (FGDs) form the basis for the study.

**Table-1: An Overview of Mandals, Quasi-Govt., Secondary Schools, Teachers, Students & ICT Instructors (Classes of VIII, IX & X) -**

**The West Godavari District, Andhra Pradesh**

(Academic Year 2022-2023)

No. of Mandals	Govt., Secondary	No. of Students			No. of Teachers												ICT Instructors		
		Boys	Girls	Total	Maths		Physics		Biology		Telugu		English		Hindi			Total	
					Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female		Male	Female
48	475	43999	48731	92730	763	180	665	72	705	78	460	11	650	123	501	18	3744	482	276

Source: Office of DEO (2022-23), Eluru, West Godavari District, Andhra Pradesh.

**Table-2: Sample Design of No. of Mandals, Quasi-Govt., Secondary Schools, Teachers, Students & ICT Instructors (Classes of VIII, IX & X) -**

**The West Godavari District, Andhra Pradesh**

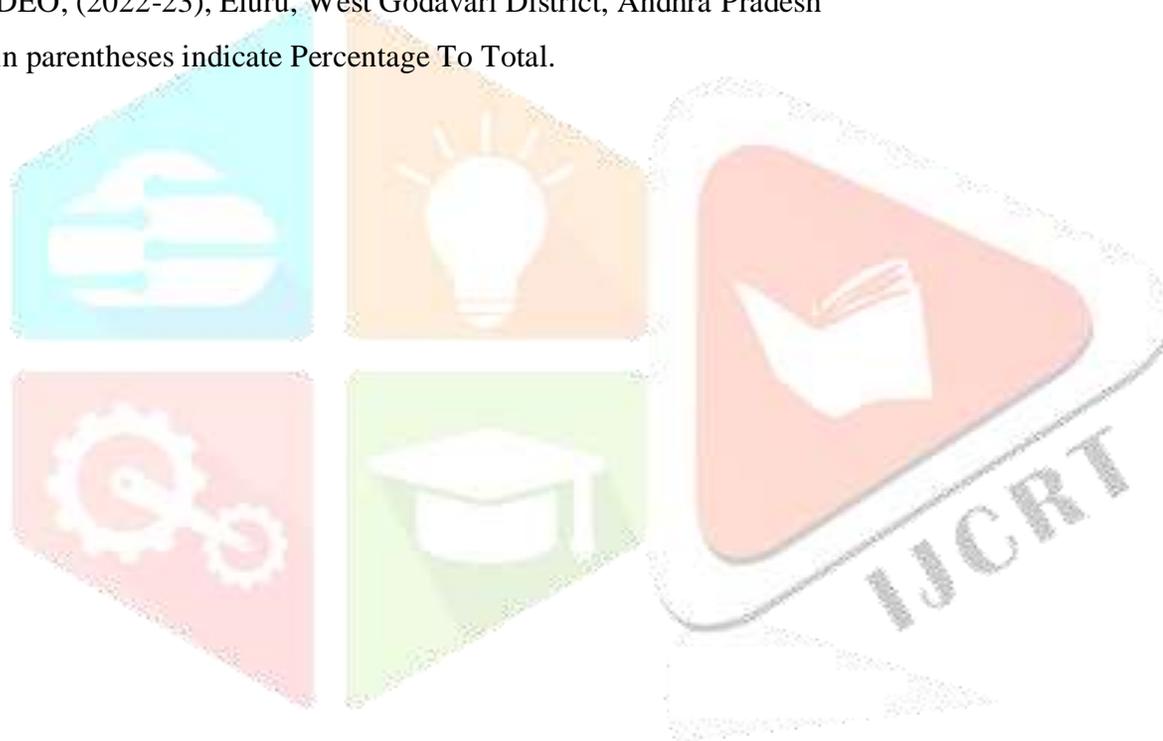
(25% of Total Population) (Academic Year 2022-2023)

No. of Mandals	No. of Quasi-Govt. Schools	No. of Students			No. of Teachers														ICT Instructors
		Boys	Girls	Total	Maths		Physics		Biology		Telugu		English		Social Studies		Total		
					Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
12	12	2754	3268	6022	47	12	42	6	45	7	30	1	43	9	43	7	249	43	62

2	(1101 6)	(1307 2)	(2408 8)	(187 )	(50)	(169 )	(25)	(178 )	(28)	(121 )	(4)	(171 )	(36)	(171 )	(27)	(997 )	(170)	
Hindi Teaching Community		Tribal		Rural		Urban												
		<b>Male</b>	<b>Female</b>	<b>Male</b>	<b>Female</b>	<b>Male</b>	<b>Female</b>											
		15	0	82	8	38	3											

Source: Office of DEO, (2022-23), Eluru, West Godavari District, Andhra Pradesh

Note : Numbers in parentheses indicate Percentage To Total.



**Table-3: ICT Tools and Techniques adopted in the Class Room - The Perceptions of Teachers**

ICT- Tools and Techniques	Residential Status			Total
	Urban	Rural	Tribal	
Radio Lessons	31 (40.26)	31 (40.26)	15 (19.48)	77 (100)
Virtual Class Rooms	19 (63.34)	10.00 (33.33)	1 (3.33)	30 (100)
Digital Classes	18 (60.00)	10 (33.33)	2 (77.67)	30 (100)
Smart Classes	71 (73.20)	23 (23.71)	3 (3.09)	97 (100)
Video Conferences	19 (79.17)	3 (12.50)	2 (8.33)	24 (100)
Power Points etc.,	28 (80)	6 (17.14)	1 (2.86)	35 (100)
<b>Total</b>	<b>186</b> <b>(63.48)</b>	<b>83</b> <b>(28.33)</b>	<b>24</b> <b>(8.19)</b>	<b>293</b> <b>(100)</b>

Source: Questionnaire

Note : Numbers in parentheses indicate Percentage To Total

**Table-4: ICT Teaching Tools and Techniques - The Rankings and Ratings (Cross Tabulation)**

ICT Teaching Tools & Techniques	Rate of Adoption					Total
	Excellent	Very Good	Good	Average	Poor	
Radio Lessons	73 (24.90)	0 (0)	11 (3.80)	120 (41)	89 (30.40)	293 (100)
Virtual Class Rooms	89 (30.40)	116 (39.60)	0 (0)	88 (30)	0 (0)	293 (100)
Digital Classes	72 (24.60)	63 (21.50)	61 (20.80)	76 (25.90)	21 (7.20)	293 (100)
Smart Classes	78 (26.60)	68 23.2%	21 (7.20)	126 (43)	0 (0)	293 (100)
Video Conferences	49 (16.70)	154 (52.60)	0 (0)	90 (30.70)	0 (0)	293 (100)
Electronic Boards	59 (20.10)	110 (37.50)	0 (0)	36 (12.30)	88 (30)	293 (100)
E-Learning	94 (32.10)	2 (0.70)	102 (34.80)	4 (1.40)	91 (31.10)	293 (100)
Multi-media	42 (14.30)	57 (19.50)	95 (32.40)	65 (22.20)	34 (11.60)	293 (100)
Power Points etc.,	0 (0)	140 (47.80)	0 (0)	85 (29)	68 (23.20)	293 (100)
<b>Symmetric Measures</b>						
			<b>Value</b>	<b>Approximate Significance</b>		
<b>Nominal by Nominal</b>	<b>Phi</b>		.708	.000		
	<b>Cramer's V</b>		.354	.000		
<b>N of Valid Cases</b>			2637			

Source: Questionnaire

Note : Numbers in parentheses indicate Percentage To Total

Since the calculated Significant Value of the Pearson Cramer's V-Test is 0.000, which is less than 0.05,

it indicates that there is a significant difference in the rate of adoption of ICT-Tools and Techniques across different levels of residential status selected for the study, as shown in **Table-4**.

**Table-5: ICT Tools & Techniques in Class Room Teaching-Learning Process-The Perceptions of Students**

ICT - Tools and Techniques	Types of ICT Applications	No. of Sessions	Percentage
	1. Radio Lessons	2517	41.80
	2. Virtual Class Rooms	573	9.51
	3. Digital Classes	631	10.48
	4. Smart Classes	1619	26.88
	5. Video Conferences	511	8.49
	6. Power Point Presentations etc.,	171	2.84
	<b>Total</b>	<b>6022</b>	<b>100.0</b>

Source: Questionnaire

**Table-6: ICT in Learning Process - The Impact Assessment**

ICT in Learning - The Perceptions of Students	Residential Status			Total
	Urban	Rural	Tribal	
Excellent	716	417	23	1156
Good	96	100	25	221
Average	1831	633	346	2810
Poor	1152	502	181	1835
<b>Total No. of Valid Cases</b>	<b>3795</b>	<b>1652</b>	<b>575</b>	<b>6022</b>
<b>Pearson Chi-Square Test</b>	<b>Value</b>	<b>df</b>	<b>Asymp. Sig., (2-Sided)</b>	
	189.986 <sup>a</sup>	6	0.000	

**Table-7: Impact of Virtual Classes in ICT-Learning - The Rankings and Ratings**

Excellent	1182	462	192	1836
Very Good	1473	675	201	2349
Average	1140	515	182	1837
<b>Total No. of Valid Cases</b>	<b>3795</b>	<b>1652</b>	<b>575</b>	<b>6022</b>
<b>Pearson Chi-Square Test</b>	<b>Value</b>	<b>df</b>	<b>Asymp. Sig., (2-Sided)</b>	
	10.244 <sup>a</sup>	6	.037	

**Table-8: Impact of Digital Classes in ICT-Learning - The Rankings and Ratings**

Excellent	912	258	104	1274
Very Good	843	422	140	1405
Good	755	302	106	1163
Average	964	414	119	1497
Poor	321	256	106	683
<b>Total No. of Valid Cases</b>	<b>3795</b>	<b>1652</b>	<b>575</b>	<b>6022</b>
<b>Pearson Chi-Square Test</b>	<b>Value</b>	<b>df</b>	<b>Asymp. Sig., (2-Sided)</b>	
	131.860 <sup>a</sup>	8	0.000	

**Table-9: Impact of Smart Classes in ICT-Learning - The Rankings and Ratings**

Excellent	926	181	35	1142
Very Good	953	326	118	1397
Good	180	203	48	431
Average	1736	942	374	3052

<b>Total No. of Valid Cases</b>	3795	1652	575	<b>6022</b>
<b>Pearson Chi-Square Test</b>	<b>Value</b>	<b>df</b>	<b>Asymp. Sig., (2-Sided)</b>	
	329.163 <sup>a</sup>	6	0.000	

<b>Table-10: Impact of Video Classes in ICT-Learning - The Rankings and Ratings</b>				
Excellent	580	184	58	822
Very Good	2035	893	324	3252
Average	1180	575	193	1948
<b>Total No. of Valid Cases</b>	3795	1652	575	<b>6022</b>
<b>Pearson Chi-Square Test</b>	<b>Value</b>	<b>df</b>	<b>Asymp. Sig., (2-Sided)</b>	
	26.285 <sup>a</sup>	6	0.000	

<b>Table-11: Impact of Electronic Board in ICT-Learning - The Rankings and Ratings</b>				
<b>ICT in Learning - Perceptions of Students</b>	<b>Residential Status</b>			<b>Total</b>
	<b>Urban</b>	<b>Rural</b>	<b>Tribal</b>	
Excellent	754	347	104	1205
Good	1314	342	106	1762
Average	587	448	183	1218
Poor	1140	515	182	1837
<b>Total No. of Valid Cases</b>	3795	1652	575	<b>6022</b>
<b>Pearson Chi-Square Test</b>	<b>Value</b>	<b>df</b>	<b>Asymp. Sig., (2-Sided)</b>	
	223.923 <sup>a</sup>	6	0.000	

<b>Table-12: Impact of E-Learning in Class Room ICT Learning - The Rankings and Ratings</b>				
Excellent	1145	319	108	1572
Very Good	57	58	16	131
Good	1312	599	227	2138
Average	64	67	21	152
Poor	1217	609	203	2029
<b>Total No. of Valid Cases</b>	3795	1652	575	<b>6022</b>
<b>Pearson Chi-Square Test</b>	<b>Value</b>	<b>df</b>	<b>Asymp. Sig., (2-Sided)</b>	
	128.400 <sup>a</sup>	8	0.000	

<b>Table-13: Impact of Multi-Media in Class Room ICT-Learning - The Rankings and Ratings</b>				
Excellent	498	123	21	642
Very Good	719	328	97	1144
Good	1271	550	216	2037
Average	798	418	130	1346
Poor	509	233	111	853
<b>Total No. of Valid Cases</b>	3795	1652	575	<b>6022</b>
<b>Pearson Chi-Square Test</b>	<b>Value</b>	<b>df</b>	<b>Asymp. Sig., (2-Sided)</b>	
	90.415 <sup>a</sup>	8	0.000	

<b>Table-14: Impact of Power Point Presentations in ICT - Learning - The Rankings and Ratings</b>				
Very Good	1644	255	83	1982
Average	1075	484	158	1717
Poor	1076	913	334	2323

<b>Total No. of Valid Cases</b>	3795	1652	575	6022
<b>Pearson Chi-Square Test</b>	<b>Value</b>	<b>df</b>	<b>Asymp. Sig., (2-Sided)</b>	
	617.329 <sup>a</sup>	4	0.000	

Source: Questionnaire

## 5. Results and Discussion

The following are emerged from the present study.

1. The Curriculum is interpreted not in terms of 'certain subjects to be learned' but in terms of 'certain activities to be undertaken'. The Curriculum Academic Standards are designed and prescribed by SCERT as per CCE (Continuous Comprehensive Evaluation) Model.
2. The Teacher and Pedagogical Approaches play a vital role in ICT-Enabled Education. The adoption of ICT-Pedagogy (curriculum and practicum) in secondary education will depend on the skills and competencies of the Teacher.
3. The primary factors influencing ICT integration in teaching pedagogy include the internet connectivity, infrastructural bottlenecks, and lack of integration between pedagogy and curriculum. Some of the secondary influences on ICT integration in teaching pedagogy comprise the educational policies and planning, need for ICT training, language barriers etc.,
4. The integration of ICT in educational settings is often hindered by various operational challenges including lack of infrastructure and broadband access, software and hardware authentication and authorisation issues, ineffective integration in pedagogy and curriculum, and inadequate ICT training etc.,
5. The demographics, socio-economic-cultural environment, self-efficacy, internet, M-Learning, E-Learning, system quality, system accessibility, technological complexity etc., significantly influence the perceived usefulness and ease of use of ICT. There exists a significant difference between the modes and methods adopted in ICT learning and the residential status of Students at various Degrees of Freedom (df).
6. In OECD Countries, an average of 89 per cent of Students owns a Personal Computer, and 96 per cent have an internet connection. In India, digital incompetence and lack of confidence are primary reasons for the slow adaptation of ICT in Teaching and Learning, whether in the classroom or at home.

7. ICT is an essential requirement for 21<sup>st</sup> century Teaching and Learning. The degree of impact and incidence of ICT-Learning varies widely across the Rurban and Tribal regions selected for the study.
8. Teachers' perceive that ICT enhances their professional skills and prepares them to embrace new forms of work, while Students believe that ICT improves their digital skills and talents, making them ready for the future.
9. Integrating ICT in education has the potential to transform the learning experience, significantly enhancing students' arithmetic, analytical, reasoning, verbal, logical, artistic, and life skills.
10. ICT facilitates personalized learning paths for Students while connecting them with peers, experts, and resources worldwide, broadening their perspectives on learning opportunities. ICT provides Students with essential digital infrastructure, including software and hardware, while nurturing practical and analytical skills through diverse content delivery and interaction methods.
11. The deployment of broadband and the development of ICT infrastructure including software, hardware, high-speed networks, and e-government services are driving the adoption of ICT in the Secondary Schools selected for the study.
12. The use of radio lessons, smart boards, and digital classes represents a significant boon to the educational system. These technologies boost students' confidence in adopting ICT for learning, inspiring them to think beyond conventional boundaries.
13. The Integration of ICT Curriculum has a significant and positive impact on Student achievement, specifically in terms of Knowledge, Comprehension, Practical and Presentation skills and in Mathematics, Science, and Social Study.
14. ICT offers solutions that can be successfully brought to scale in order to bridge the knowledge divide and to build multiple life-long learning pathways that span formal and informal systems and support the job-related skill development.

## 6. ICT in Teaching-Learning Pedagogy - The Future Forward

Education for the 21<sup>st</sup> Century is a multi-day, innovative think-tank. In order to be globally competitive and develop engaged citizens, our Schools should weave innovative skills and competencies throughout the Teaching-Learning Process. The digi-education offers Life Skills for Work as well as Life. These include the development of critical thinking, complex problem solving, collaboration, and adding multi-media communication into the teaching of traditional academic subjects.

Talking Books, Hypertexts, Micro-Worlds, Interactive White Boards, Dynamic Geometry Systems, Simulations, and Modeling Environments have a positive effect on Pupils' attainment and enhance ICT adoption among Students. Yet, the crucial component remains with the Teacher and their Pedagogical Approaches. Adopt and Adapt, Authorize and Access, Receive and Respond, yet, Resist ICT in Secondary School Education that revolutionizes the Teaching-Learning Pedagogy in future.

Undoubtedly, adoption of ICT in Pedagogical (Curriculum and Practicum) as well as in Teaching-Learning Practices can enhance and enrich 'Quality in Education' and also act as a catalyst for good ideas among 'nurtured children'.

ICT adoption intensifies with the rise of placeless connectivity, embracing the anywhere, anytime approach, allowing education to transcend physical boundaries. However, the level of innovation, involvement, and ICT adoption among Gen-X still requires focused attention. In light of this, it becomes necessary to develop new models and methodologies that promote effective adoption of ICT in Teaching.

ICT lies not just in theories but in practical application. It enhances performance, significantly impacts classroom learning, and provides valuable insights into educational processes. The prominent influencers of ICT adoption in Teaching include the behavior divide, the demographic divide, the activity divide, the level of confidence and capability, and the access, usage, and appropriate technology adoption. The social influence factors that affect ICT adoption in classroom instruction include shared social identity, social support, social interaction, subjective norms, motivation etc.

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