Research Article

A Study on ICT Integration in Vocational Education: Implications for Student Learning Experiences and Alignment with the National Education Policy 2020

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Abstract

This study investigates the integration of Information and Communication Technology (ICT) into vocational education, aiming to enhance students' learning experiences and prepare them for the demands of the modern workforce. Utilising a mixed-methods approach, data were collected from vocational teachers and students across various states in India. The study explores the benefits, challenges, and implications of ICT integration in vocational education. Findings reveal that effective integration of ICT can provide interactive and engaging learning environments, addressing disparities in access and usage while boosting students' confidence and competence in utilizing technology. Furthermore, understanding students' motivation and providing teacher support are crucial for promoting student engagement and enhancing vocational education outcomes. The study emphasises the importance of tailored teacher training programs and ongoing professional development initiatives to optimise ICT utilisation. Overall, the study underscores ICT's transformative potential in enriching vocational learning experiences and preparing students for success in the 21st-century workforce.

Keywords: Integration of Information and Communication Technology (ICT); Teaching and Learning; Vocational Subjects; School Education

Introduction

In an era marked by rapid technological advancement and evolving economic landscapes, the integration of Information and Communication Technology (ICT) into education has emerged as a pivotal component in shaping the learning landscape and preparing students for the demands of the modern workforce. Within the domain of vocational education, where practical skills and industry relevance are paramount, the effective integration of ICT holds significant promise for enriching teaching and learning practices.

The National Education Policy (NEP) of 2020, a landmark document that outlines the vision for the future of education in India, emphasises the importance of leveraging technology to enhance educational outcomes and promote inclusive practices. The NEP advocates for the integration of ICT across all levels of education, recognising its potential to democratise access to quality education, foster innovation, and empower learners with 21st century skills.

Against this backdrop, this study delves into the integration of ICT in vocational education, with a specific focus on its implications for students' learning experiences across various states in India. By examining the utilisation of ICT tools, addressing disparities

in access and usage, and exploring students' perceptions and challenges, this research seeks to offer insights into the transformative potential of ICT integration in vocational education in alignment with the goals outlined in the NEP.

The introduction of ICT in vocational education brings forth a myriad of opportunities, including the provision of interactive and engaging learning environments through simulations, multimedia resources, and online platforms. Such tools offer hands-on learning experiences that foster deeper understanding and retention of vocational knowledge, aligning with the NEP's vision of promoting experiential and holistic learning approaches.

However, alongside these opportunities, disparities in access to and utilisation of ICT facilities pose significant challenges, particularly in underserved regions. Bridging this digital divide is imperative to ensure equitable access for all vocational students, thereby maximising the benefits of ICT integration and fostering inclusive educational practices, as advocated by the NEP.

Furthermore, empowering students with confidence and competence in utilising technology is crucial for their success in the digital age. Tailored training programs and support mechanisms can enhance students' digital literacy skills, aligning with the NEP's emphasis on nurturing critical thinking, creativity, and digital fluency among learners.

Moreover, understanding students' motivation towards ICT usage and providing teacher support are essential factors in promoting student engagement and enhancing vocational education outcomes, echoing the NEP's call for learner-centric and personalised approaches to education delivery.

By addressing these challenges and capitalising on the opportunities presented by ICT integration, vocational education can evolve to meet the aspirations outlined in the NEP, ensuring that students are equipped with the skills and competencies needed for success in their careers and contributing to the socio-economic development of the nation. This study aims to contribute to the realisation of the NEP's vision for education, offering valuable insights for policymakers, educators, and stakeholders committed to shaping the future of vocational learning in India.

Research objectives

1. Investigate the integration of ICT into the learning processes of vocational students across various states, assessing the extent of utilisation and effectiveness.
2. Analyse the availability and utilisation of ICT facilities in schools across different states, examining variations and disparities in access and usage.
3. Explore students' perceptions of their ICT self-efficacy in vocational education, examining their confidence and competence in utilising technology for learning purposes.
4. Assess students' motivation towards the usage of ICT for learning vocational subjects, identifying factors influencing their engagement with technology in the educational context.
5. Examine the level of support provided by teachers to students in accessing ICT tools for teaching and learning methodologies across different states, identifying variations and areas for improvement.

Review of Literature

In contemporary education, the integration of Information and Communication Technology (ICT) has transformed traditional teaching and learning paradigms, offering unprecedented opportunities for innovation and advancement across diverse disciplines. Ishtiningsih (2022) underscores the crucial role of ICT integration within the Technological Pedagogical Content Knowledge (TPACK) framework, emphasising its potential to empower teachers and enhance student learning experiences in vocational education. Richa Banagiri (2021) highlights how globalisation and technological advancements have reshaped work dynamics, necessitating the strategic use of ICT to meet emerging literacy targets and elevate educational standards. Wiranda et al. (2020) elucidate teachers' utilisation of ICT tools in teaching methodologies, emphasising the need for comprehensive ICT support and addressing challenges to optimize its efficacy. Ghavifekr and Yulin (2021) identify challenges facing Technical Vocational Education and Training (TVET) in Malaysia, emphasising the importance of comprehensive solutions to ensure effectiveness amidst the shift to e-learning. Saripudin et al. (2020) stress targeted training programs to enhance vocational teachers' ICT abilities, while Kumar and Pandey (2021) underscore the transformative potential of ICT integration in vocational education, albeit with nuanced challenges. Barfi et al. (2020) advocate for improved ICT infrastructure and teacher training in Ghanaian schools, aligning with Ennin's (2023) emphasis on thoughtful ICT integration strategies grounded in educational theory. Wijayasundara (2020) provides insights into successful ICT integration initiatives globally, emphasising the importance of infrastructure, teacher training, and English proficiency. Banagiri et al. (2021) explored how globalisation and technological advancement reshape modern work and life perceptions. Previous studies, including Pinho et al. (2024), Pruñonosa et al. (2020), and Abdullah et al. (2021), indicate that ICT integration in vocational education enhances student motivation, engagement, and learning outcomes. However, challenges like inadequate infrastructure and teacher training require attention for successful integration. Further research is needed to explore ICT's impact comprehensively. These studies collectively underscore ICT's multifaceted role in modern education, advocating for strategic integration to optimise teaching and learning outcomes while addressing inherent challenges.

Methodology

Research Design

This study employed a mixed-methods approach, combining quantitative and qualitative data collection methods. Participants' opinions were gathered through a structured checklist and questionnaire, featuring both open-ended and descriptive questions. The utilisation of a descriptive survey design was chosen for its ability to accurately capture natural conditions. The questionnaire, comprising checklist items and various types of questions, was tailored to solicit insights from teachers and students regarding the integration of ICTs in teaching and learning.

Participants

This study included teachers and students from vocational schools within a specific geographic area. The sample size was determined based on the population of teachers and students in vocational schools within that area. The population consisted of teachers and

students from government secondary schools where vocational courses had been introduced under the National Skill Qualifications Framework. The study covered schools in Andaman and Nicobar Islands, Puducherry, Madhya Pradesh, Nagaland, Jammu and Kashmir, and Ladakh.

Sample

The schools were selected using purposive sampling. The sample comprised 2 states and 4 union territories. 2 districts from each state and union territory were selected. 2 schools from each district were randomly chosen, resulting in a total of 4 schools from each state and union territory. In each school, 1 vocational teacher was selected from 2 job roles, totalling 2 teachers from each school. Additionally, 5 students from each job role in Class 9 were included, totalling 10 students in each class. Similarly, 10 students from each job role in Class 11 were included, resulting in 20 students from each school.

The components of the total sample have been given below:

Total no. of Sample				
States and UTs	**No. of Districts (2 districts from each state)**	**No. of Schools (2 schools from each district)**	**No. of Teachers (2 Teachers from each school)**	**No. of Students (20 students from each school)**
Madhya Pradesh	2	4	8	80
Nagaland	2	4	8	80
Andaman and Nicobar	2	4	8	80
Jammu and Kashmir	2	4	8	80
Puducherry	2	4	8	80
Ladakh	2	4	8	80
Total	12 Districts	24 Schools	48 Teachers	480 Students

Development of Questionnaire

The development and validation of questionnaires for both vocational teachers and students involved meticulous structuring by covering crucial dimensions such as ICT utilisation, self-efficacy perceptions, teacher support, and challenges encountered. Administered surveys aimed at quantifiable data through structured close-ended questions, while open-ended inquiries facilitated deeper insights and suggestions. Validation by external experts and pilot testing ensured clarity and effectiveness. By addressing these dimensions, the questionnaires sought to provide a comprehensive understanding of stakeholders' perspectives on ICT integration in vocational education.

Data Collection Methods

The study utilised checklists and questionnaires to collect quantitative data from vocational teachers and students. Qualitative data were obtained from open-ended questionnaire responses. Permission was obtained from school authorities, and data collection was conducted in Madhya

Pradesh and Andaman and Nicobar Islands through personal visits, while in Nagaland and Puducherry, it was via postal mode. In Jammu and Kashmir, a mixed approach was adopted, with teachers completing questionnaires during a capacity building program and students' responses obtained through teachers. Completed questionnaires were returned via post for analysis.

Data Analysis

Quantitative data from vocational teachers and students' questionnaire responses were analysed using Microsoft Excel to uncover patterns and trends. Thematic analysis was applied to qualitative data, identifying key themes and variations in experiences and perspectives. Integrating both quantitative and qualitative findings provided a comprehensive understanding of ICT usage in vocational education. Simple percentage methods were used for quantitative analysis, with results visually presented through tables and charts.

Validity and Reliability

The content validity of the tool was confirmed through expert review. A panel of four experts in vocational education, ICT, and curriculum design evaluated the survey to ensure that it covered all relevant aspects of ICT integration. Their feedback helped to refine the survey to better reflect the goals of the study. Also, the research instruments were pre-tested with a sample of participants.

The reliability of the data collection tool was assessed using Cronbach's alpha to determine internal consistency across different sections of the survey using SPSS software, and it was found that all sections demonstrate strong internal consistency, with Cronbach's alpha values exceeding the acceptable threshold of 0.7. These results indicate a reliable measure of the constructs assessed in this study.

Results & Discussion

The study employed a mixed-methods approach to gather insights from teachers and students in vocational schools, focusing on ICT integration in teaching and learning. Quantitative data were collected via surveys containing diverse tools such as checklists and questionnaires, covering aspects like usage, benefits, challenges, and suggestions. Qualitative data came from open-ended survey questions, allowing participants to share experiences and concerns. Results and discussions are divided into segments for teachers and students, ensuring focused analysis while offering comprehensive conclusions by integrating data from both groups.

ICT Integration in Learning Processes of Vocational Students Across Studied States

The following sections provide a comprehensive analysis of the integration of Information and Communication Technology (ICT) in teaching and learning of vocational subjects. Through an examination of various factors, including the availability of ICT facilities, students' perceptions of ICT self-efficacy, support from teachers, and challenges faced in utilising ICT for learning, this study aims to offer insights into the effectiveness and challenges of ICT integration in vocational education and the results are discussed here in:

ICT Facilities and Their Extent of Utilisation Across States

The data in Table 1 offers a comprehensive overview of the availability of Information and Communication Technology (ICT) facilities in schools across different

states in India, focusing on resources that directly impact students' learning experiences. The percentages represent the prevalence of specific ICT tools and infrastructure in schools within each state.

Table-1: Availability of the ICT facilities in schools for students

	Resources	MP	Nagaland	J&K	Ladakh	A&N	Puducherry
Generic ICT Tools	Desktop Computer	72.50%	100%	100%	100%	100%	100%
	Printer	75%	100%	86.25%	100%	100%	100%
	Laptop	20%	88.33%	87.50%	64.28%	28.50%	35%
	Tablet	30%	50%	12.50%	81.42%	2.80%	0%
	LCD projector	77.50%	51.66%	87.50%	94.28%	100%	66.66%
	Power outlets	77.50%	66.60%	76.25%	65.71%	100%	100%
	Cameras	85%	35%	68.75%	68.57%	100%	33.33%
	Speakers	95%	66.66%	91.25%	92.85%	100%	66.66%
Advanced ICT Tools	Smart phones	52.50%	66.66%	33.75%	1.25%	44.28%	35%
	Interactive/ Smart Board	52.50%	1.25%	95%	100%	100%	35%
	Internet access	87.50%	35%	58.75%	94.28%	100%	100%
	Wi-Fi	92.50%	33.33%	68.75%	100%	100%	66.66%
	E-Book reader	2.50%	1.25%	65%	27.14%	72.85%	35%
	Network Connectivity	80%	35%	51.25%	94.28%	100%	100%
	Virtual classroom	57.50%	33.33%	78.75%	98.75%	42.85%	33.33%
	Scanner	80%	35%	58.75%	64.28%	100%	100%
	Video- Recorder	46.50%	0%	68.75%	28.57%	28.57%	0%
Vocational Specific	Equipment (Sector specific)	1.25%	0%	0%	0%	0%	0%
	Software Generic	33.75%	0%	85%	65.71%	100%	0%
	Software Vocation specific	37.50%	0%	67.50%	60%	70%	0%
Miscellaneous	Supporting Staff	68.75%	0%	80%	62.85%	55.71%	100%

In Madhya Pradesh (MP), the data reveals a relatively high availability of desktop computers (72.50%), printers (75%), LCD projectors (77.50%), power outlets (77.50%), cameras (85%), speakers (95%), internet access (87.50%), and Wi-Fi (92.50%). This indicates a strong infrastructure in MP, ensuring students have access to a diverse range of ICT resoutin the provision of laptops, tablets, and smartphones. The data suggests that while Nagaland has invested in some key ICT infrastructure, there is room for improvement in ensuring access to personal computing devices for students.

Jammu and Kashmir, Ladakh, Andaman and Nicobar Islands, and Puducherry consistently exhibit high percentages across most ICT resources, indicating a robust commitment to providing students with a technologically equipped learning environment. These states have near or complete availability of desktop computers, printers, LCD projectors, power outlets, cameras, speakers, internet access, Wi-Fi, and other essential tools.

Puducherry, while showing high percentages in certain categories like power outlets (100%) and supporting staff (100%), presents a lower availability of certain hardware like laptops, tablets, and smartphones. This suggests a potential need for increased investment in personal computing devices to ensure a more holistic ICT infrastructure for students.

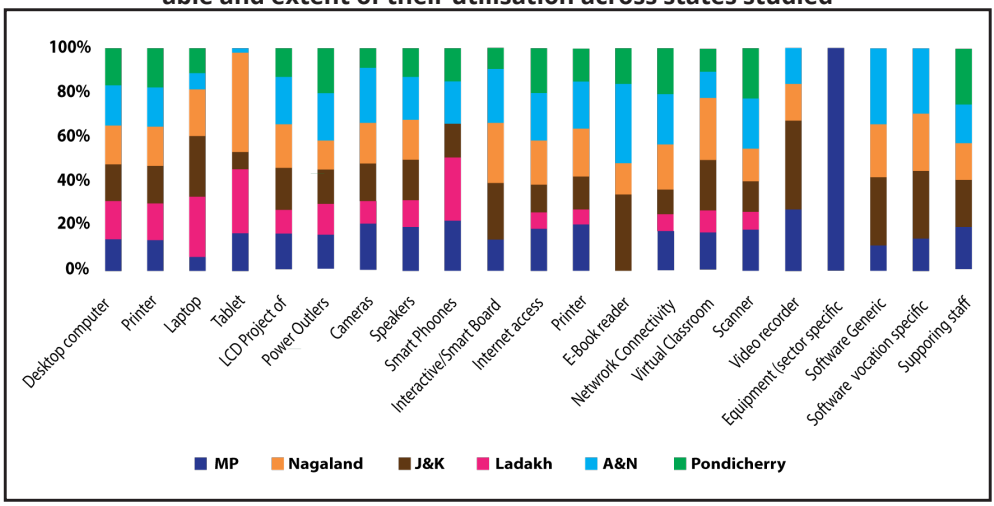
It is noteworthy that certain states, such as Andaman and Nicobar Islands, Ladakh, and Puducherry, boast a complete availability of specific resources like interactive/ smart boards and virtual classrooms, indicating a forward-looking approach to modernising the learning experience.

In conclusion, the data highlights the varying degrees of ICT facility availability across states, with some regions showcasing a comprehensive and advanced infrastructure, while others may need targeted interventions. This underscores the importance of continued government support and investment in ICT resources to ensure that students across the country have equitable access to technology for enhanced learning opportunities. The percentages serve as a quantitative benchmark, guiding policymakers to address specific areas of improvement and fostering a more inclusive ICT landscape in schools.

State Wise Analysis of Availability of ICT Facilities in Schools

Fig. 1 offers a comprehensive overview of the availability of Information and Communication Technology (ICT) facilities in schools across different states in India, and it's crucial to assess the comparative utilisation of these resources in the learning process.

Figure-1: Comparative assessment of the ICT facilities available and extent of their utilisation across states studied



(77.50%), power outlets (77.50%), cameras (85%), speakers (95%), internet access (87.50%), and Wi-Fi (92.50%) suggests a solid ICT infrastructure. However, the lower percentages for laptops (20%) and tablets (30%) indicate potential challenges in providing personal computing devices for students, impacting the extent of utilisation.

Nagaland, with complete availability of desktop computers (100%) and printers (100%), presents a mixed scenario regarding personal computing devices. The higher percentages for laptops (88.33%) and tablets (50%) suggest a better-equipped ICT infrastructure, potentially enhancing utilization compared to MP. Jammu and Kashmir, Ladakh, Andaman and Nicobar Islands, and Puducherry consistently exhibit high percentages across most ICT resources, indicating robust availability. The utilisation, however, depends on factors such as the integration of these resources into the curriculum and teacher training.

Puducherry's relatively lower percentages in laptops (28.50%), tablets (2.80%), and smartphones (44.28%) may impact utilisation. However, the complete availability of interactive/ smart boards and virtual classrooms suggests a progressive approach, potentially enhancing the interactive and collaborative learning experiences. Comparatively, the availability of smartphones in Ladakh (1.25%) is low, impacting potential utilisation in mobile learning. In contrast, the high availability of laptops (64.28%) and tablets (81.42%) in Ladakh indicates a more diverse range of personal computing devices for students.

The availability of sector-specific equipment and vocation-specific software is relatively low across states, potentially limiting the utilisation of resources tailored to specific educational needs. Overall, while the availability of ICT resources is a crucial first step, their effective utilisation depends on factors such as teacher training, curriculum integration, and policies supporting technology-enhanced learning. States with comprehensive infrastructure, like Jammu and Kashmir and Ladakh, may need to focus on strategies to maximise the utilisation of available resources, while states with lower availability, like MP, should prioritise investments in essential devices for students to ensure equitable access and utilisation.

Student's Perceptions of ICT Self-Efficacy

Assessing students' self-efficacy in ICT is crucial for understanding the implementation and status of ICT in the studied schools. Comprehensive evaluation of observed results across states provides valuable insights into students' perceptions of their ICT abilities.

Table 2 provides insights into students' perceptions of ICT self-efficacy in the context of learning vocational subjects. In terms of confidence levels, a majority of students (60.00%) feel very confident in using ICT for learning vocational subjects, while 22.85% feel somewhat confident. This indicates a positive outlook among students towards utilising technology in their studies

Table-2: Students Perception of ICT Self Efficacy

Response	Very Confident	Somewhat Confident	Not Very Confident	Not Confident at all	-
Feel confident in using ICT in learning of vocational subjects	60.00%	22.85%	17.14%	0.00%	-
Motivation towards usage of ICT for learning vocational subjects	Highly motivated	Moderately motivated	Not motivated at all	-	-
	76.42%	23.57%	0.00%	-	-
The Pace of Utilisation of ICT Tools in the study of vocational subjects	Frequent	Moderately motivated	Average	Less Motivated	Not at all Motivated
	24.52%	34.52%	30.95%	8.30%	0.95%

Furthermore, when it comes to motivation, a significant proportion of students (76.42%) report being highly motivated to use ICT for learning vocational subjects. This high level of motivation suggests that students recognise the benefits and value of incorporating technology into their educational experiences.

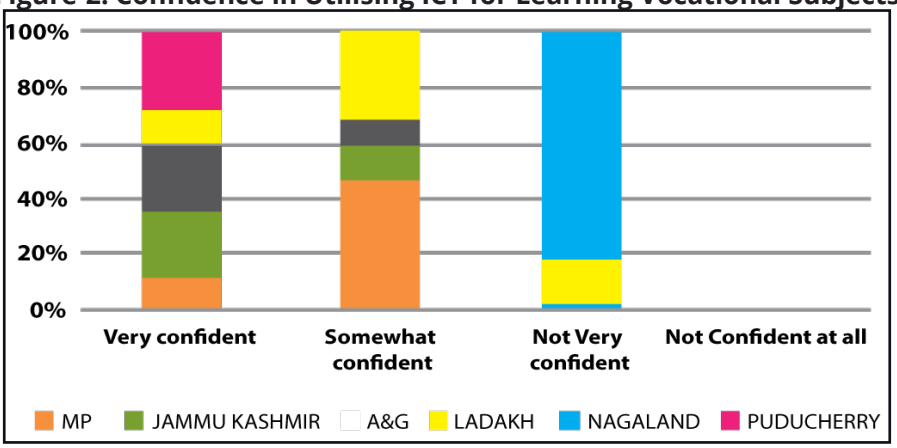
Regarding the pace of utilisation of ICT tools, the data shows that a notable percentage of students (24.52%) frequently utilise ICT tools in the study of vocational subjects. However, there is also a considerable proportion reporting moderate motivation (34.52%) and average motivation (30.95%). This suggests that while many students are actively using ICT tools, there is room for improvement in increasing the pace of utilisation among others.

Overall, the data paints a positive picture of students' perceptions of ICT self-efficacy in the context of learning vocational subjects. The high levels of confidence, motivation, and frequent utilisation suggest a generally favourable environment for leveraging technology in education. However, it is crucial for educators and policymakers to address the varied responses in the pace of utilization, ensuring that all students have equitable access and support to maximise the benefits of ICT in vocational education.

Student's Perceptions of ICT Self-efficacy: Interstate Studies

The provided data in Figure 2 reveals significant variations in students' perceptions of ICT self-efficacy across different states in India. The responses are categorized into four levels: Very Confident, Somewhat Confident, Not Very Confident, and Not Confident at all. Analysing the percentages allows for a comprehensive understanding of the extent of students' confidence in using Information and Communication Technology (ICT) across states

Figure-2: Confidence in Utilising ICT for Learning Vocational Subjects



In Madhya Pradesh (MP), the majority of students (38.75%) report being Very Confident in their ICT self-efficacy. However, a sizable portion (60%) falls into the Somewhat Confident category. This indicates a mixed level of confidence among students in MP, suggesting that while many feel very confident, there is a considerable number with a moderate level of confidence.

Jammu and Kashmir stands out with an overwhelming percentage (83.75%) of students reporting Very Confident in their ICT self-efficacy. This suggests a high level of confidence among students in the region, indicating effective ICT integration in the educational system and potentially robust support structures for students. In the Andaman and Nicobar Islands (A&N) and Ladakh, a substantial percentage of students (87.14% and 42.85%, respectively) express Very Confident in their ICT abilities. This indicates a positive perception of ICT self-efficacy among students in these regions, with A&N showing particularly high levels of confidence.

Nagaland presents a unique scenario with only 1.66% of students reporting Very Confident, and the majority (98.33%) falling into the Not Very Confident category. This suggests a significant challenge in building confidence and enhancing ICT self-efficacy among students in Nagaland, highlighting potential areas for targeted interventions and support.

Puducherry stands out as the only state where 100% of students report being Very Confident in their ICT self-efficacy. This indicates a highly favourable environment for technology-enabled education in Puducherry, potentially driven by robust infrastructure, effective training, and supportive policies.

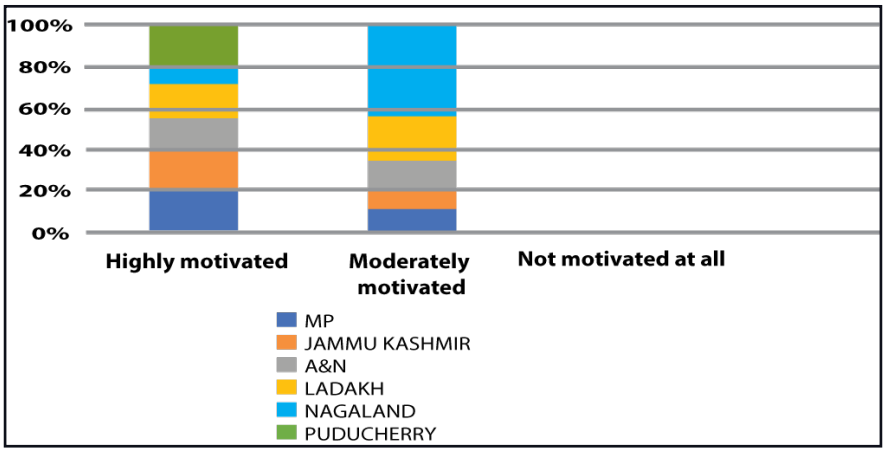
Comparing these states, Jammu and Kashmir, Andaman and Nicobar Islands, and Puducherry shows higher percentages of students with Very Confident perceptions, suggesting a more positive outlook on their ICT abilities. On the other hand, Nagaland faces challenges, with a significant proportion of students expressing lower confidence in using ICT.

In conclusion, the data emphasises the need for tailored strategies and interventions to enhance students' perceptions of ICT self-efficacy, ensuring that all states strive towards creating an environment where students feel confident and empowered in utilising technology for learning. The varying percentages highlight the importance of considering regional nuances and implementing targeted initiatives to address specific challenges in building ICT self-efficacy among students.

Motivation towards usage of ICT for learning Vocational subjects

The data in Fig. 3 on students' motivation levels towards utilising Information and Communication Technology (ICT) in the context of learning across various states in India. The responses are categorized into three levels: 'Highly motivated', 'Moderately motivated', and 'Not motivated' at all. Analysing these

Figure-3: Motivation level towards using ICT for learning



percentages provides valuable insights into students' perceptions of ICT self-efficacy and their willingness to engage with technology in the learning process. In Madhya Pradesh (MP), an impressive 85% of students express being 'Highly motivated' to use ICT, showcasing a strong positive attitude towards technology in education. The remaining 15% report being 'Moderately motivated', indicating that the majority of students in MP exhibit a high level of enthusiasm and readiness to integrate ICT tools into their learning experiences.

Jammu and Kashmir and the Andaman and Nicobar Islands (A&N) closely follow with 83.75% and 80% of students, respectively, reporting as 'Highly motivated'. This indicates a significant level of motivation among students in these regions, aligning with the positive trends observed in the previous analysis of ICT self-efficacy. These states show a robust commitment to fostering students' positive attitudes toward utilising technology for learning.

In Ladakh, 68.57% of students report being 'Highly motivated', and 31.42% as 'Moderately motivated'. While the 'Highly motivated' percentage is noteworthy, there is a substantial proportion in the 'Moderately motivated' category, suggesting a diverse range of motivation levels among students. This may indicate variations in the exposure and accessibility of ICT resources.

Nagaland presents a distinctive scenario, with only 33.33% of students reporting as Highly motivated and a significant majority (66.66%) falling into the 'Moderately motivated' category. This suggests a comparatively lower overall motivation towards utilising ICT in Nagaland, highlighting potential challenges that need to be addressed to enhance students' engagement with technology.

Puducherry stands out as the only state where 100% of students report being 'Highly motivated'. This exceptional level of motivation suggests a highly favourable environment for technology-

enabled education in Puducherry, potentially driven by effective policies, infrastructure, and support mechanisms.

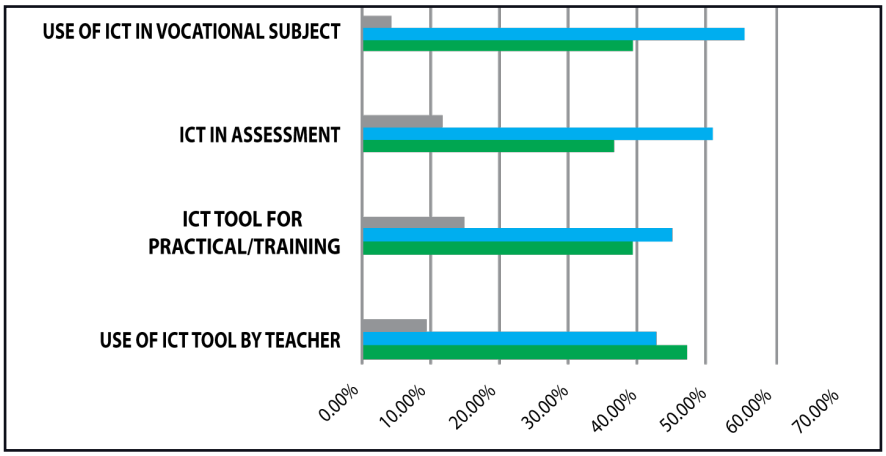
Comparing across states, while the majority of students across MP, Jammu and Kashmir, A&N, and Puducherry exhibit a high level of motivation, Ladakh and Nagaland show more varied responses. This underscores the importance of understanding regional dynamics and tailoring interventions to address specific challenges and enhance students' motivation for utilising ICT tools effectively.

In conclusion, the data highlights the varying levels of students' motivation towards ICT utilisation across states, emphasising the need for targeted strategies to foster positive attitudes and enhance engagement with technology in education. The percentages provide a quantitative measure of students' motivation, guiding educators and policymakers in developing region-specific initiatives to promote ICT self-efficacy and create a more technology-friendly learning environment.

Support from Teacher to Students in Assessing ICT Tools in Teaching Learning Methodology

Support from teachers to students in pursuance of assessing the ICT Tools in teaching and learning was evaluated under one of the parameters and it has been represented in terms of scale i.e. No, occasionally and frequently in Figure 4. It has been evaluated comprehensively as well as state wise and reported in Figure 4 and Figure 5.

Figure-4: Teacher Assistance and Support for Student ICT Tool Assessment



The data illustrates the level of support provided by teachers to students in assessing ICT tools across different aspects of teaching and learning methodology. Regarding the use of ICT tools by teachers, the majority reported frequent utilisation (47.61%), with occasional usage following closely behind (42.85%). Only a small percentage indicated no use of ICT tools for teaching, suggesting a proactive approach by teachers in integrating technology into their instructional methods. Similarly, in the context of practical/training activities, a significant portion of teachers reported frequent use of ICT tools (40%), with occasional usage slightly higher (45%).

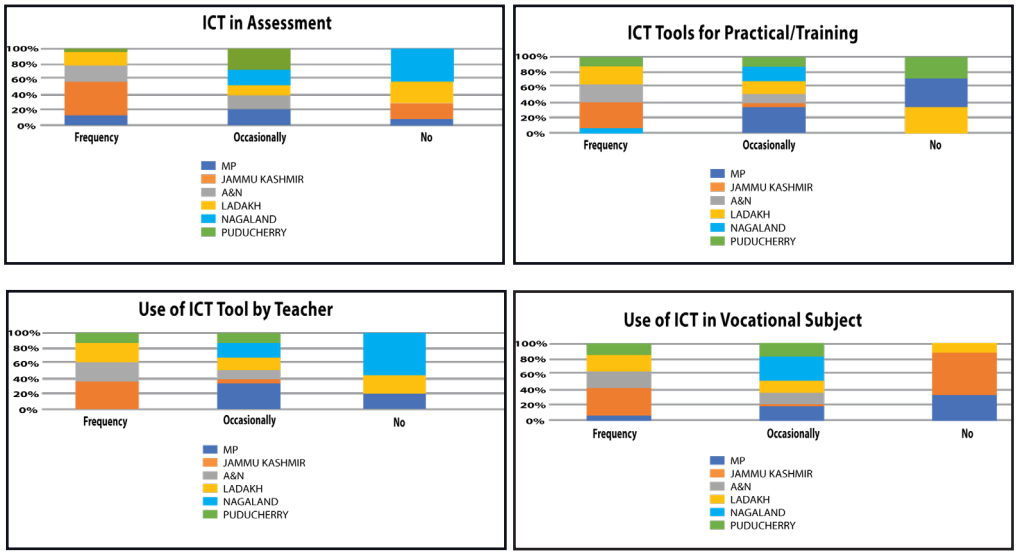
This indicates a substantial reliance on technology to enhance hands-on learning experiences, aligning with the modernisation of vocational education. In terms of ICT usage for assessment purposes, a considerable number of teachers reported frequent use (37%), with occasional usage being slightly higher (51%). This suggests an evolving trend towards more dynamic and technology-driven assessment methods, potentially offering more accurate and efficient evaluation processes.

Furthermore, when considering the overall integration of ICT in vocational subjects, the data indicates a balanced approach, with a substantial proportion of teachers reporting both frequent (40%) and occasional (56%) usage. This highlights a widespread adoption of technology to support teaching and learning activities within vocational education settings.

Overall, the data underscores the importance of teacher support in facilitating the effective use of ICT tools across various aspects of teaching and learning methodology. It also reflects a positive trend towards embracing technology to enhance instructional practices and improve student outcomes within vocational education.

State wise Compendium of Support from Teachers to Students in assessing ICT Tools in Teaching and Learning Meth

Figure-5: State wise Compendium of Support from Teachers to Students (a) ICT in Assessment (b) ICT Tools For Practical & Training (c) Use of ICT Tool by Teacher (d) Use of ICT in Vocational Subject



The data reveals varying levels of ICT integration in assessment practices among teachers across regions in Figure 5 (a). Jammu and Kashmir exhibits the highest frequency of frequent ICT usage in assessment, while Nagaland and Puducherry show minimal usage. Madhya Pradesh and Andaman and Nicobar Islands demonstrate moderate levels of frequent and occasional ICT usage in assessment. Notably, Puducherry stands out with a significantly higher frequency of

occasional ICT usage compared to other regions. Overall, there are discernible differences in the incorporation of ICT in assessment among teachers.

The data presented in Figure 5 (b) reveals varying frequencies of ICT tool usage by teachers across different regions. Jammu and Kashmir stands out with 83.75% frequently utilising ICT tools, while Nagaland shows the lowest frequency at 1.66%. Madhya Pradesh and Andaman and Nicobar Islands have a substantial percentage of teachers occasionally using ICT tools. Puducherry has a notable portion of teachers frequently using ICT tools but also a considerable number who do not use them at all. Overall, there's a spectrum of adoption levels among teachers, suggesting differing levels of ICT integration in teaching practices.

The data illustrates varied frequencies of ICT tool utilisation for practical training among teachers across regions Fig. 5 (c). Jammu and Kashmir shows the highest frequency of frequent usage at 72.50%, while Nagaland reports no frequent usage. Madhya Pradesh and Andaman and Nicobar Islands demonstrate moderate levels of both frequent and occasional usage. Puducherry stands out with a relatively higher frequency of occasional usage compared to other regions. Overall, there's a notable discrepancy in the adoption of ICT tools for practical training among teachers.

The data illustrates varied levels of ICT utilisation in teaching vocational subjects among teachers across regions as represented in Figure 5 (d). Jammu and Kashmir and Puducherry exhibit higher frequencies of occasional ICT usage, while Madhya Pradesh and Ladakh demonstrate moderate to frequent usage. Notably, Nagaland shows minimal ICT integration in vocational teaching. Overall, there are discernible differences in the incorporation of ICT in vocational subject instruction among teachers across the studied regions.

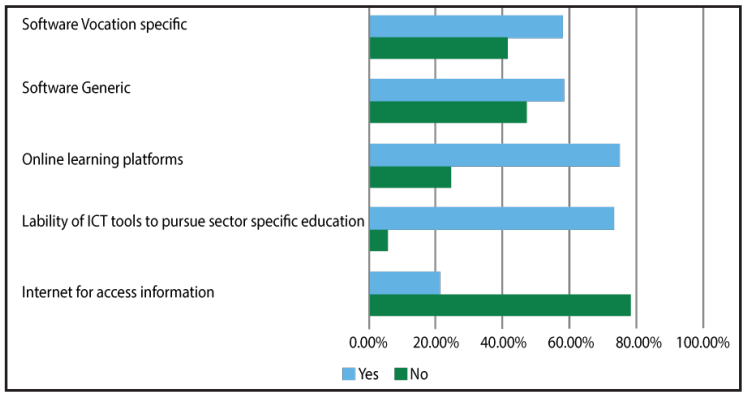
Students' Perception in Using ICT Towards Learning Vocational Subjects: Overall

The presented data in Figure 6 provides valuable insights into students' perceptions of using Information and Communication Technology (ICT) for learning vocational subjects across various aspects, including internet usage, availability of sector-specific tools, online learning platforms, and generic and vocation-specific software. It has been evaluated for overall as well as individually and is presented here under:

Internet for Accessing Information: A majority of students, 79.04%, perceive using the internet to access information for learning vocational subjects, indicating a high level of reliance on online resources.

Availability of ICT Tools for Sector-Specific Education: Only 5.20% of students perceive the availability of ICT tools for pursuing sector-specific education, suggesting a significant gap in providing specialized resources for vocational learning.

Figure-6: Overall Perception of students of using ICT in learning



Online Learning Platforms: A relatively lower percentage, 24.52%, of students perceive using online learning platforms for vocational education, indicating a potential underutilisation or awareness gap regarding such platforms.

Generic Software Usage: Nearly half of the students, 47.41%, perceive using generic software for learning vocational subjects, indicating a moderate level of adoption of general-purpose software tools in their education.

Vocation-Specific Software Usage: Around 41.66% of students perceive using vocation-specific software for learning, suggesting a considerable interest in specialised software tailored to their vocational fields.

In summary, the data highlights a positive perception among students in using the internet for accessing information related to vocational subjects. However, there are significant gaps in their awareness and utilisation of sector-specific ICT tools, online learning platforms, and software designed for vocational education. The high percentage of students indicating a lack of awareness or availability of these resources underscores the importance of enhancing digital literacy, providing access to specialised tools, and promoting the integration of technology in vocational education to better meet the evolving needs of students in this domain.

State wise distribution of Students' Perception in using of ICT towards learning vocational subjects

The following Table 3 provides an overview of students' perceptions regarding the use of Information and Communication Technology (ICT) in learning vocational subjects across different states.

Table-3: Students' Perception in using of ICT towards learning vocational subjects: Across states

Students' Perception in using of ICT towards learning vocational subjects		
	MP	
	Yes	No
Internet for access Information	87.50%	12.50%
lability of ICT tools to pursue sector specific education	1.25%	98.75%
Online learning platforms	0%	100%

Students' Perception in using of ICT towards learning vocational subjects		
	MP	
	Yes	No
Software Generic	33.75%	66.25%
Software Vocation specific	37.50%	62.50%
Jammu and Kashmir	Yes	No
Internet for access Information	58.75%	41.25%
lability of ICT tools to pursue sector specific education	0%	100%
Online learning platforms	40%	60%
Software Generic	85%	15%
Software Vocation specific	67.50%	32.50%
AN	Yes	No
Internet for access Information	100%	0%
lability of ICT tools to pursue sector specific education	0%	100%
Online learning platforms	95.71%	4.29%
Software Generic	100%	0%
Software Vocation specific	70%	30%
Ladakh	Yes	No
Internet for access Information	94.28%	5.72%
lability of ICT tools to pursue sector specific education	0%	100%
Online learning platforms	1.42%	95.80%
Software Generic	65.71%	34.29%
Software Vocation specific	60%	40%
Nagaland	Yes	No
Internet for access Information	35%	65%
lability of ICT tools to pursue sector specific education	0%	100%
Online learning platforms	0%	100%
Software Generic	0%	100%
Software Vocation specific	0%	100%
Puducherry	Yes	No
Internet for access Information	100%	0%
lability of ICT tools to pursue sector specific education	0%	100%
Online learning platforms	15%	85%
Software Generic	0%	100%
Software Vocation specific	0%	100%

The data on students' perceptions of using ICT for learning vocational subjects across different states provides a diverse picture of the digital landscape in education. Let's delve into the analysis of each state's responses:

1. **Madhya Pradesh (MP):**
   - Internet for Accessing Information: A significant majority (87.50%) of students in MP perceive the internet as a valuable tool for accessing information related to vocational subjects.
   - Availability of Sector-Specific ICT Tools: Unfortunately, only a small percentage (1.25%) believes that there are ICT tools available for pursuing sector-specific education.
   - Online Learning Platforms: None of the respondents in MP reported using online learning platforms for vocational subjects, indicating a potential area for improvement.
   - Software Usage: A relatively higher percentage (33.75%) acknowledges the use of generic software, while a lower percentage (37.50%) indicates awareness of vocation-specific software.
2. **Jammu and Kashmir (JK):**
   - Internet for Accessing Information: A majority (58.75%) of students in JK recognise the internet's importance for accessing information relevant to vocational subjects.
   - Availability of Sector-Specific ICT Tools: None of the respondents in JK believe there are ICT tools available for pursuing sector-specific education.
   - Online Learning Platforms: A notable portion (40%) of students uses online learning platforms for vocational subjects.
   - Software Usage: There is a high percentage (85%) of students using generic software, and a substantial proportion (67.50%) utilises vocation-specific software.
3. **Andaman and Nicobar Islands (AN):**
   - Internet for Accessing Information: All respondents (100%) in AN recognise the internet as a vital tool for accessing information related to vocational subjects.
   - Availability of Sector-Specific ICT Tools: Like JK, none of the respondents believe that there are ICT tools available for pursuing sector-specific education.
   - Online Learning Platforms: A vast majority (95.71%) of students in AN utilises online learning platforms for vocational subjects.
   - Software Usage: All respondents in AN use generic software, and a significant percentage (70%) utilises vocation-specific software.
4. **Ladakh:**
   - Internet for Accessing Information: The majority (94.28%) of students in Ladakh use the internet for accessing information related to vocational subjects.
   - Availability of Sector-Specific ICT Tools: None of the respondents in Ladakh believe that there are ICT tools available for pursuing sector-specific education.

- Online Learning Platforms: A very small percentage (1.42%) of students utilises online learning platforms for vocational subjects.
- Software Usage: A substantial majority uses generic software (65.71%), and a significant portion (60%) utilises vocation-specific software.

5. Nagaland:

- Internet for Accessing Information: A lower percentage (35%) of students in Nagaland use the internet for accessing information related to vocational subjects.
- Availability of Sector-Specific ICT Tools: None of the respondents in Nagaland believe that there are ICT tools available for pursuing sector-specific education.
- Online Learning Platforms: None of the respondents in Nagaland use online learning platforms for vocational subjects.
- Software Usage: None of the respondents in Nagaland use generic or vocation-specific software.

Puducherry:

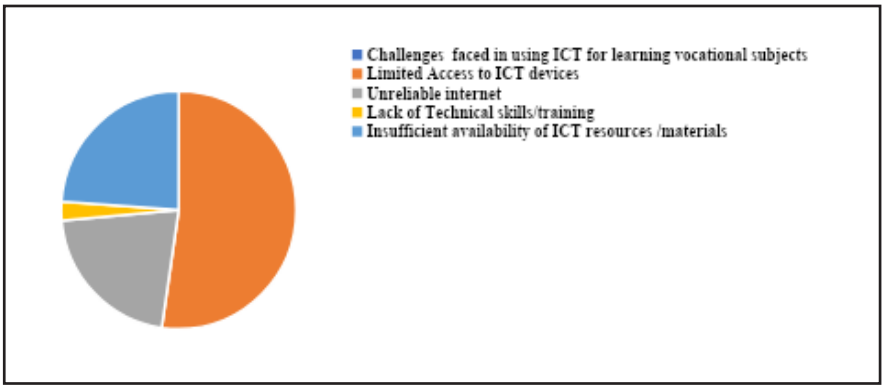
- Internet for Accessing Information: All respondents (100%) in Puducherry recognize the internet as a crucial tool for accessing information related to vocational subjects.
- Availability of Sector-Specific ICT Tools: None of the respondents in Puducherry believe that there are ICT tools available for pursuing sector-specific education.
- Online Learning Platforms: A notable but comparatively lower percentage (15%) of students in Puducherry uses online learning platforms for vocational subjects.
- Software Usage: None of the respondents in Puducherry use generic or vocation-specific software.

In comparing these states, there are noticeable variations in the perception and utilisation of ICT tools for vocational subjects. AN stand out with all respondents recognising the importance of the internet and widespread usage of online learning platforms. JK demonstrates a significant usage of generic and vocation-specific software. On the other hand, Nagaland shows lower utilisation of the internet and a complete absence of software usage. Puducherry reflects a high reliance on the internet but lower usage of online learning platforms.

Challenges Faced in Using ICT For Learning Vocational Subjects

The data in Figure 7 underscores the necessity for targeted initiatives aimed at bridging the gaps in awareness and utilisation of ICT tools for vocational education. Improving internet accessibility, promoting sector-specific tools, and raising awareness about online learning platforms can significantly contribute to a more comprehensive and effective integration of ICT in vocational education across different states.

Figure-7: Overall Challenges reported by students in learning Vocational Subjects



The provided data highlights five distinct challenges encountered in using Information and Communication Technology (ICT) for learning vocational subjects. These challenges, as indicated by the percentages, highlighted the obstacles faced by students across various regions.

Firstly, nearly half of the respondents (48.57%) identify limited access to ICT devices as a significant challenge, revealing disparities in device availability and emphasising the need for initiatives to ensure equal access to essential ICT tools.

Secondly, around one-fifth of the participants (19.76%) express concerns about unreliable internet access, highlighting the importance of stable and accessible internet connectivity for effective ICT integration in vocational learning.

Thirdly, a relatively low percentage of respondents (2.38%) mention a lack of technical skills or training as a challenge. Despite the low percentage, this emphasises the need for targeted training programs to enhance students' proficiency in utilising ICT tools effectively for vocational subjects.

Additionally, over one-fifth of participants (22.14%) indicate challenges related to the insufficient availability of ICT resources and materials, calling for comprehensive resource planning and distribution strategies to ensure students have access to necessary digital content and tools.

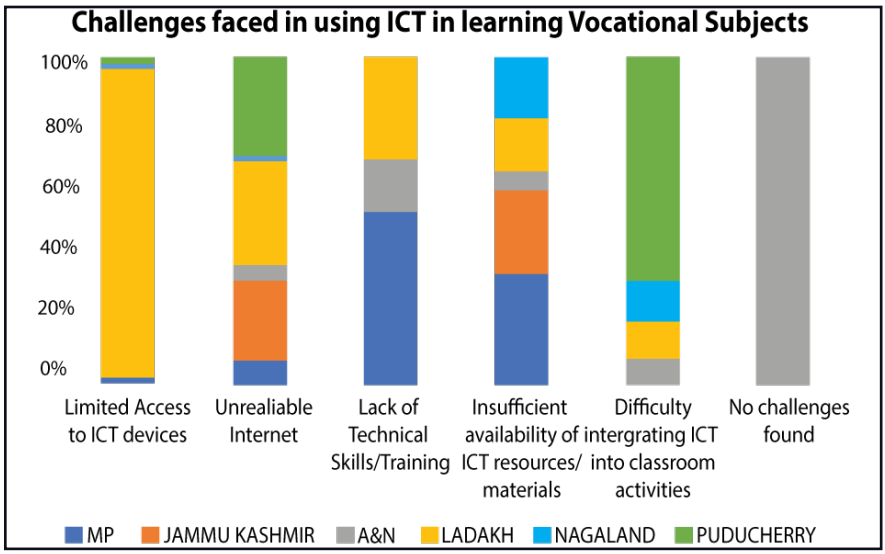
Lastly, a moderate percentage of respondents (8%) find it challenging to integrate ICT into classroom activities, which may stem from various factors such as resistance to change or lack of pedagogical support. Addressing this challenge requires collaborative efforts between educators and administrators to promote effective integration strategies.

Challenges faced in using ICT in learning Vocational Subjects: Across States Studied

The data presented in Fig.8 illustrates the significant challenges encountered in using ICT for learning vocational subjects across different states. Limited access to ICT devices is a prevalent issue, with high percentages reported in states like MP (51.25%), Nagaland (75%), and Puducherry (41.66%). This indicates a disparity in device availability, necessitating initiatives to ensure equal access to essential ICT tools. Additionally, unreliable internet access poses challenges, with percentages ranging from 8.75% in MP to 33.33% in Puducherry. Addressing this issue is crucial for effective ICT integration in vocational learning. A

lack of technical skills or training is mentioned by a small percentage of respondents across states, emphasising the need for targeted training programs. Insufficient availability of ICT resources and materials is cited as a challenge in several states, indicating the need for comprehensive resource planning. Some states also face difficulties integrating ICT into classroom activities, underscoring the importance of promoting effective integration strategies through collaborative efforts between educators and administrators.

Figure-8 : Challenges Faced in using ICT in Learning: Students Perspective



Implications of the Study for Vocational Education

The study's findings highlight the transformative potential of integrating Information and Communication Technology (ICT) into vocational education, offering a multifaceted approach to enriching students' learning experiences. By implementing ICT tools like simulations and multimedia resources, vocational education can transcend traditional boundaries, providing hands-on learning opportunities that foster deeper understanding and retention of vocational knowledge. However, the study also reveals significant disparities in access to and utilisation of ICT facilities across different states, underscoring the need for targeted interventions to ensure equitable access for all vocational students. Policymakers must prioritise bridging this digital divide by providing adequate infrastructure and resources, particularly in underserved regions. Furthermore, students' perceptions of their ICT self-efficacy underscore the importance of fostering confidence and competence in utilising technology for vocational learning. Tailored training programs and support mechanisms can empower students, enhancing their digital literacy skills and preparing them for the demands of the modern workplace. Additionally, understanding students' motivation towards ICT usage emphasises the importance of designing learning experiences that align with their interests and preferences. Incorporating gamification elements, interactive multimedia, and real-world applications of ICT can enhance student engagement and motivation, ultimately leading to improved learning

outcomes. Lastly, the study highlights the crucial role of teachers in facilitating students' access to ICT tools and supporting their learning journey. Comprehensive teacher training programs and ongoing professional development initiatives are essential to ensure educators are equipped with the skills and competencies to integrate ICT effectively into vocational teaching practices, further enhancing the quality of vocational education delivery.

Conclusion

The study underscores the profound impact of integrating Information and Communication Technology (ICT) into vocational education, offering a pathway to enhance students' learning experiences and prepare them for the challenges of the modern workforce. By leveraging ICT tools such as simulations, multimedia resources, and interactive learning platforms, vocational education can transcend traditional boundaries, providing hands-on learning opportunities that foster deeper understanding and retention of vocational knowledge. However, the study also sheds light on significant disparities in access to and utilisation of ICT facilities across different states, highlighting the pressing need for targeted interventions to ensure equitable access for all students. Furthermore, empowering students with confidence and competence in utilising technology, alongside promoting engagement and motivation through tailored learning experiences, are essential aspects of enhancing vocational education outcomes. Additionally, the crucial role of teachers in facilitating students' access to ICT tools and supporting their learning journey cannot be overstated, emphasising the importance of comprehensive teacher training and ongoing professional development initiatives. By addressing these challenges and capitalising on the opportunities presented by ICT integration, vocational education can evolve to meet the evolving demands of the 21st-century workforce, ensuring that students are equipped with the skills and competencies needed for success in their careers.

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Refernces

Abdullah, S. A., Saud, M. S., & Kamin, Y. (2019). M-learning for technical and vocational education training (TVET). *International Journal of Recent Technology and Engineering*, 8(3), 7236-7239.

Bal, I. A., Arslan, O., Budhrani, K., Mao, Z., Novak, K., & Muljana, P. S. (2020). The balance of roles: Graduate student perspectives during the COVID-19 pandemic. *TechTrends*, 64, 796-798.

Banagiri, R., Kumar, A., & Pandey, A. (2021). Use of ICT in Teaching Vocational Subjects. *International Journal of Education and Development using Information and Communication Technology,* 17(4), 148-158.

Banagiri, R., Kumar, A., & Pandey, A. (2021). Use of ICT in Teaching Vocational Subjects. *International Journal of Education and Development using Information and Communication Technology,* 17(4), 148-158.

Barfi, K. A., & Opoku, F. K. (2023). Technology Integration in the Teaching of Human Resource Management by Practicing Lecturers. *Journal of Educators Online*, 20(1), n1.

Cheung, W. S., Hew, K. F., & Chua, S. L. (2016, June). What Information Communication Technology (ICT) had been used in preschool education during the recent decade? In *EdMedia+ Innovate Learning*. Association for the Advancement of Computing in Education (AACE). 914-920

Das, S., Mondal, P., & Das, R. K. (2021). ICT Based Agricultural Knowledge Transfer of Women Farmers: A Case of Gender Responsiveness from a Developing Country Perspective. *Library Philosophy and Practice,* (0) 1-13.

Ennin, F. (2023). Integrating ICT in Teaching and Learning: Theoretical Perspective.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration. *Educational Technology Research and Development*, 53, 25-39.

Ghavifekr, S., & Yulin, S. (2021). Role of ICT in TVET Education: Teaching & Learning Amid COVID-19 Pandemic. I*nternational Journal of Advanced Research in Education and Society,* 3, 119-131.

Istiningsih, I. (2022). Impact of ICT integration on the development of vocational high school teacher TPACK in the digital age 4.0. *World Journal on Educational Technology: Current Issues*, 14(1), 103-116.

Otieno C, O., Liyala, S., Odongo, C. B., & Abeka, S. (2016). Theory of Reasoned Action as an underpinning to technological innovation adoption studies. *World Journal of Computer Application and Technology*, 4(1), 1-7.

Pandey, D. K., De, H. K., & Kumar, P. (2021). ICT Integration in Agriculture Education: A Perspective of College Principals.

Pinho, C., Reis, F., & Rodrigues, R. (2024). The impact of COVID-19 on university education in Portugal: insights from students and teachers. *Revista Paidéi@-Revista Científica de Educação a Distância,* 16(29), 174-200.

Saripudin, S., Budiyanto, I. B., Listiana, R. E. N. I., & Ana, A. (2021). Digital literacy skills of vocational school teachers. *Journal of Engineering Science and Technology,* 16(1), 666-680.

Selwyn, N. (2016). E*ducation and technology: Key issues and debates*. Bloomsbury Publishing.

Shannon, C., Reilly, J., & Bates, J. (2019). Teachers and Information Literacy: Understandings and Perceptions of the Concept. *Journal of Information Literacy*, 13(2), 41-72.

Sharma, P. (2019). Digital revolution of education 4.0*. International Journal of Engineering and Advanced Technology*, 9(2), 3558-3564.

Shukla, G., Ansari, M. N., Lal, S. P., & Bandhavya, M. (2022). Information seeking behaviour of farmers through mobile: An innovative ICT tool. In *Biological Forum–An International Journal* 14 (1) 586-590.

Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. *Computers & Education,* 57(4), 2432-2440.

Torres-Pruñonosa, J., Plaza-Navas, M. A., Díez-Martín, F., & Prado-Roman, C. (2020). The sources of knowledge of the economic and social value in sport industry research: a co-citation analysis. *Frontiers in Psychology*, 11, 629951.

Wang, M., & Wu, D. (2021). ICT-based assistive technology as the extension of human eyes: technological empowerment and social inclusion of visually impaired people in China. Asian J*ournal of Communication*, 31(6), 470-484.

Wijayasundara, M. (2020). Integration of ICT in teaching and learning in schools. *International Journal of Research*, 1(10), 198-209.

Wiranda, R., Petrus, I., & Vianty, M. (2020). The use of ICT in learning process by vocational teachers of English. English Review: *Journal of English Education*, 8(2), 283-290.