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Learning Innovation Utilization in Technical Education: A Quantitative Study

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This paper investigated students' perceptions and usage of learning innovations in technical and vocational education and training (TEVT) colleges in Punjab, Pakistan. Technologies explored included computers, software, internet, CDs/DVDs, and multimedia. A survey methodology gathered input from 406 randomly selected students pursuing technology-related diploma and undergraduate programs. It was a quantitative study. Keeping in view the objective of the study, a 5-point Likert scale was developed. The data were analysed through Statistical Package for Social Sciences (SPSS) 20. Findings revealed foundational technology access is decent, including computer availability (mean=3.44) and internet connectivity (mean=3.90). Self-professed digital literacy levels were also relatively high (mean=3.59). However, actual integration into instruction lagged in areas like leveraging software tools (mean=3.16), multimedia systems (mean=3.76), and especially CD/DVDs (mean=2.75). Analysis illuminated gaps between infrastructure readiness and full-fledged adoption to enhance learning experiences. Students showed an appetite for online self-directed usage, though formal blended integration models are still developing. Findings confirm that while technical access provides a starting point, TEVT institutions should still activate progress through teacher readiness, active learning pedagogies, and reduced barriers inhibiting sophisticated digitally enabled instruction. Strategic commitments can leverage student capabilities toward truly immersive technical education fitting industry innovation.

1. Introduction

Technology has become deeply embedded across all aspects of society, and education is no exception (Dontre, 2021). The integration of innovations like learning management systems, collaboration platforms, and multimedia tools has unlocked new opportunities to enrich teaching and learning within technical and vocational contexts (Phakamach et al., 2023). These technologies offer multidimensional pathways for delivering interactive content, facilitating knowledge construction, and enabling project-based learning that mirrors real-world work environments (Patiar et al., 2021; Yusuf, 2005). Such immersive, competency-building approaches help cultivate precisely the kinds of dynamic skills demanded by today's increasingly digitized industries.

However, substantial obstacles inhibit the actualization of this vision of technology-transformed technical education in many institutions. Studies highlight lagging adoption rates regarding modernized curricula, assessments, and pedagogies that strategically incorporate emerging tools. Realizing potential gains requires commitment across policies, resources, and culture - it is not simply a matter of purchasing the latest gadgets. Leaders must prioritize evidence-based strategies for implementation and instructor readiness if students hope to thrive in a technology-driven workforce (Dang et al., 2021). Global bodies like UNESCO provide guidance, but local champions are essential for sustainable, customized innovation initiatives tailored to community needs (Lazaro Ortiz & Jimenez de Madariaga, 2022).

Learning innovations in the field of education have been there in the form of teaching aids or apparatus, as it was earlier called audio-visual aids (Winarto et al., 2020). However, current achievements in the field of information and communication technology have offered tremendous opportunities for learning by electronic means, the use of e-learning and internet technology in learning. It is seen as a means to improve accessibility, efficiency, and quality of learning. The 21st-century innovations have stretched educational boundaries and created new ones, some of which are the Internet and e-learning (Abimbade, 1997; Achuonye & Diseph, 2021).

Adomi and Kpangban (2010) and Jalloh (2021) insisted that learning innovations in education are considered as compulsory as water and power nowadays for human beings to find a new era of educational research for the creation of a better instructor and learner-centered environment. The Internet has become the most effective tool for the teaching-learning process as it provides a powerful source of information for students, so it can help them achieve their educational targets. It also helps to connect and make and interlink harmony among students and also between instructor and pupils, as it expands your learning to the whole world by making them all as your classroom, so real-life context can be established (Hassan et al., 2020). Teaching tools and technology have long been used in education to aid instruction. However, recent advances in information and communication technology have greatly expanded the possibilities for technology-enabled learning (Deng & Benckendorff, 2022). Platforms like the Internet and e-

learning systems now allow more engaging, accessible, and efficient educational experiences (Shurygin et al, 2021).

Whereas past learning innovations focused more on supplementary audiovisual aids, 21st-century innovations have transformed schools by creating connected, student-centered virtual learning spaces (Yusuf, 2005; Auliyah et al., 2021). The internet specifically powers opportunities for self-directed research, remote collaboration, and bridging classroom lessons to real-world contexts. This digital transformation of education is now seen as essential, not optional (Sriram, 2015; Rosário & Dias, 2022). Technologies uphold new models of instruction and assessment better suited for today's more visual, collaborative learners (Cueva & Inga, 2022). They dismantle geographical barriers allowing customization. With careful implementation, integrated platforms promise to benefit both teachers and pupils amidst learner diversity (Ali & Kaur, 2020).

The current study has provided an empirical contribution by gathering quantitative data and students' perceptions across different key learning innovation categories from the students of technical colleges. It illuminates the ground reality from the students' perspective regarding different elements like software as well as hardware access. The data-driven approach for informed recommendations grounded in stakeholder viewpoints contributes to a confirmation base currently missing. Most technological research concentrates on comprehensive settings rather than technological education. Attaining position adoption arrangements both highlight wider challenges and reveal a diverse dynamic range based on specialized tools for professional training. Following is the research objective of the current study.

1. To assess students' perspectives about the use of learning innovations, including computers, software, Internet, CDs/DVDs, and multimedia in TEVT colleges.

2. Literature Review

Research shows that integrating technology innovations into teaching and learning can enhance student engagement and academic outcomes when executed effectively. In particular, online learning platforms promote self-directed development and collaborative participation that learners find empowering (Abrahams, 2010; Abrams, 2022). However, simply purchasing gadgets or software is insufficient - institutions must incorporate tools strategically through updated curricula, assessments, and teaching policies that leverage technology to enrich skills building (Manchanda & Arora, 2023). Success requires addressing financial limitations, execution planning with stakeholders, and teacher readiness alongside technical infrastructure (Alenezi, 2023).

Additionally, leaders must view technology not as an automatic solution, but as an enabler of deeper pedagogical transformation regarding learner-centric, real-world-focused education (Yusuf, 2005). Used judiciously, integrated digital environments can personalize experiences and build critical thinking for the 21st century (Thaha Abdullateef, 2021). However, integration remains uneven across contexts, with many institutional barriers inhibiting adoption. In the Pakistani context, there are few studies regarding technical education (Pirzada et al., 2022a, 2022b;

Pirzada et al., 2022b; Pirzada et al., 2023; Tariq et al., 2019). In the international context, there are also few studies regarding technology integration for effective learning (Barrett et al., 2019), and learning through collaborative multimedia with innovations in technical subjects was found effective (Rao et al., 2020).

The current study was carried out for the assessment of the recent level of technology integration and innovation readiness among the students of technical and vocational education institutions since it is the age of technology. After exploration of the students' perspective, habits, and self-reported skill levels for innovation categories i.e. internet, computers, software, multimedia, etc. the current study provides the baseline for the technology integration that is needed in the current 21st century.

3. Research Methodology

A randomized survey design was implemented to evaluate the adoption of learning innovations among technical and vocational students across Punjab. A random sampling technique was used to select 406 total respondents proportionally representing relevant demographics. Participants completed a 28-item Likert scale questionnaire coded to quantify utilization and attitudes regarding classroom technologies like software, internet resources, multimedia, and computer access. A questionnaire was self-developed keeping in view the relevant literature and expert opinion. The students' perspective was assessed on the basis of 5-point Likert scale items within different aspects. Reliability analysis via Cronbach's alpha ($\alpha = .79$) demonstrated an acceptable level of internal consistency. Descriptive statistics illuminated students' current integration practices through means and standard deviations. Quantitative data analysis entailed compiling questionnaires, data cleaning, classification, and coding using SPSS version 20.0. This software enabled statistical testing correlations plus generating explanatory visualized outputs of the technological readiness landscape. Findings inform recommendations for policies, pedagogies, and cultures bridging students' technological access to fully immersive, digitally powered technical education programs reflecting workplace innovation.

4. Results and Discussions

4.1 Information Related to Demographic Variables

Table No 1: Percentage of the sample of students regarding their gender.

Gender	Frequency	Percentage
Male	320	78.8
Female	86	21.2

Table 1 depicts that 320 students of the total respondents were male, which is 78.8 % of the total sample. There were 86 females in the respondents, which is 21.2 % of the total sample collected.

4.2 Findings of the Study

The findings of the study are described as follows.

Table No 2: Students' perceptions of the use of computers for learning purposes

Sr.#	Statement	Mean
1.	I use a Desktop computer without internet access.	3.70
2.	I use a computer system for completing my assignments.	3.29
3.	I have internet access for searching required information.	3.92
4.	I use e-mails for the submission of my assignments.	2.86

This table presents data on students' use and perceptions of computers for learning purposes. A 5-point Likert scale was used, with higher mean scores indicating greater agreement with the statement. The data shows that students have relatively high access to desktop computers (mean=3.70) and internet access (mean=3.92) for educational purposes. This indicates that the necessary infrastructure and access are available for utilizing technology in the classroom. However, actual utilization seems more mixed. Students moderately agreed that they use computer systems to complete assignments (mean=3.29), suggesting they have some level of integration of technology into the learning process. However, the use of more advanced educational technology like email for assignment submission has a lower level of agreement (mean=2.86), indicating this area has room for further development. Overall, the accumulative mean score of 3.44 shows a moderate level of technology usage for learning. There are clear foundational elements (like hardware access and internet connectivity) present to support educational technology. Leveraging those resources to greater effect by integrating more digital tools into teaching and learning workflows seems a logical next step for development.

Table No 3: Students' attitude toward the use of application software for learning purposes

Sr.#	Statement	Mean
1.	I use system applications for my assignment completion.	3.10
2.	I work on Microsoft Word to accomplish my assignments.	3.14
3.	I use PowerPoint for the preparation of my presentation.	3.25
4.	I apply software for my course-related work. (e.g. Auto CAD or CAD CAM)	3.15

This table presents data on students' attitudes and use of various software applications for learning purposes. A 5-point Likert scale was again used, with higher means indicating greater agreement. The data indicates that students moderately utilize common productivity software like Microsoft Word (mean=3.14) and PowerPoint (mean=3.25) for their coursework and assignments. This suggests some integration of basic software tools into the learning process. PowerPoint specifically may be used more often for giving multimedia presentations. Interestingly, students reported a similar level of agreement with using more specialized software applications that are

tailored to their field of study (mean=3.15). Examples were AutoCAD and CADCAM. This indicates that beyond just basic software, some specialized tools are being incorporated. However, the lower score for overall use of computer applications (mean=3.10) suggests that software utilization is not being maximized across subject areas. There may be opportunities to further adopt educational software and applications into the curriculum. The cumulative mean score reinforces the moderate level of software adoption (mean=3.16). Students appear open to using both common and subject-specific apps in their coursework, but actual adoption levels could still be expanded.

Table No 4: Students' response about sufficient computer knowledge for learning purposes

Sr. #	Statement	Mean
1.	I attend computer training classes.	3.34
2.	I use a computer for the completion of daily tasks.	3.23
3.	I have acquired knowledge of computer applications.	4.21

This table explores students' self-reported level of computer knowledge and skills for learning purposes. Again, a 5-point Likert scale was utilized. The data indicates that students have relatively high confidence in the computer knowledge they have acquired (mean=4.21). This suggests they believe they have developed good digital literacy skills. Attendance of specific computer training classes has a moderately high level of agreement (mean=3.34). This indicates that formal instruction in using computer technologies is somewhat available. Though participation could potentially still be expanded. Interestingly, simply using computers regularly to complete daily tasks showed a slightly lower level of agreement (mean=3.23). So while acquired knowledge is perceived as strong, ongoing informal skill development through regular technology usage seems lower. With an accumulative mean score of 3.59, students largely feel their computer capabilities are sufficient for their learning needs. However additional computer access and integration outside of academic settings could further enrich skill levels.

Table No 5: Students' attributes toward the use of CD/ USB for learning purposes

Sr. #	Statement	Mean
1	I watch CDs/DVDs to increase my understanding of the lesson.	2.51
2	I use CD/DVD for storing lectures.	3.29
3	I watch CD/DVD lectures for the revision of lessons.	2.47
4	I use CD/DVD to make my studies convenient.	2.76

This table explores students' usage and attitudes towards CDs/DVDs and USB drives for learning purposes. The pattern of responses indicates that this is an area with much room for further development. Specifically, the data shows low levels of students watching CD/DVD content to initially understand concepts (mean=2.51) or review lessons (mean=2.47). This suggests that multimedia content delivery via CD/DVD is rarely used as a core teaching tool. Slightly higher

agreement exists regarding using discs/drives for storage (mean=3.29). This indicates they have some role in data backup/archiving uses, though still not widespread adoption. In terms of supporting convenience and accessibility of materials (mean=2.76), there is little indication that students view these as strongly enhancing access or learning. With an overall accumulative mean score of just 2.75, CD/DVD/USB drive usage appears very limited from the student's perspective. These storage media do not seem to be key elements supporting technology-enabled education. Institutions may want to re-evaluate policies, infrastructure, and curricula supporting these older systems as they work toward more modern educational technology models. While they once informed core components supporting computer use in education, increasingly online systems appear better positioned to enable technology-driven learning based on this dataset.

Table No 6: Students' attributes toward the use of the Internet for learning purposes

Sr. #	Statement	Mean
1.	I use the internet for different learning purposes.	4.0
2.	I use the internet for helping to understand my course.	3.80
3.	I find helpful material about my course work from the internet	3.91
4.	I watch videos on YouTube to understand my coursework.	3.55

This table explores students' usage and perceptions of the internet for educational purposes. In contrast to the previous table, the data here indicates far broader and more meaningful usage amongst students. Students strongly agreed that they utilize the internet for a variety of learning goals (mean=4.0), spanning from enhancing understanding of coursework (mean=3.80) to accessing helping materials (mean=3.91). This underscores how the internet offers a versatile source of information to aid learning. Additionally, multimedia sites like YouTube offer content to clarify concepts (mean=3.55). So informational and explanatory videos supplement learning. With an overall high cumulative mean score of 3.90, the data highlights students' reliance on the internet broadly for self-directed study and as a utility supporting classroom teaching. It appears a vital component of the modern educational technology ecosystem. For institutions seeking to increase technology integration in teaching and learning, leveraging internet-enabled resources appears an impactful opportunity. From digital content delivery to online collaboration tools, the connectivity and content richness the internet offers allow customized enhancement of instruction. These survey results indicate that students enthusiastically use the medium to enrich their knowledge. Schools can potentially translate students' independent usage into more formal classroom adoption with complementary learning management platforms, blended instruction models, and web literacy skills development.

Table No 7: Students' attitudes toward the use of multimedia for learning purposes

Sr. #	Statement	Mean
1.	I have good interaction in lectures at multimedia.	3.61
2.	I understand lectures as displayed on a big screen.	3.85
3.	I understand lectures taught at multimedia.	3.84

This table summarizes student attitudes toward using multimedia technologies for educational purposes. This includes systems like overhead projectors, interactive whiteboards, and digital screens for display and collaboration. The data indicates moderately high agreement with the effectiveness of multimedia systems across the areas assessed. This includes facilitating good interaction and engagement in class lectures (mean=3.61), aiding understanding of concepts displayed visually (mean=3.85), and comprehension of lectures overall (mean=3.84). With an accumulative mean score of 3.76, students react favorably to multimedia integration in the classroom. The interactive, visually engaging nature appears to resonate well. As educational institutions continue technology modernization efforts, these results provide a case for prioritizing multimedia upgrades like digital whiteboard systems and large format displays for classrooms and lecture halls. Students perceive these technologies as enriching understanding and participation. The visual and collaborative affordances also align well with constructivist approaches to active learning. Allowing students to interact directly with content on-screen can complement pedagogical methods focused on the experiential and team-based building of knowledge.

Table 8: Mean scores to show the use of learning innovations by the students enrolled in Technical Education and Vocational Training (TEVT) Colleges

Sr.#	Indicators of use of learning innovations	Mean	SD
1.	Use of computers	3.44	0.85
2.	Use of application software	3.16	1.07
3.	Sufficient computer knowledge	3.59	1.02
4.	Use of CD/DVD	2.75	1.19
5.	Use of Internet	3.90	1.21
6.	Use of multimedia Projector	3.76	1.16

This table aggregates the mean scores and standard deviations across the previous six tables to summarize students' usage and attitudes toward various educational technologies at Technical Education and Vocational Training (TEVT) Colleges. Overall, the data indicates that foundational elements like computer access (mean = 3.44) and sufficient knowledge levels (mean = 3.59) are moderately decent to support the adoption of classroom learning innovations. Internet connectivity likewise seems to enable students to utilize online materials (mean = 3.90) However, the actual integration of technology into academics appears more variable across categories. While

multimedia projection systems seem well-received (mean = 3.76), leveraging software tools into assignments (mean = 3.16) or use of CD/DVD content (mean =2.75) is more limited. Standard deviations across the categories range from 0.85 to 1.21, indicating some variability in students' responses. But means consistently showing room for additional incorporation of education technologies into instruction and coursework. Synthesizing these results: students at TEVT colleges demonstrate baseline technical access and skills to utilize classroom innovation. Priorities for development should include 1) expanded software integration into projects and assessments, 2) multimedia hardware upgrades where lacking, 3) online materials utilization, and 4) potentially reducing reliance on lagging technologies like CD/DVD. Upgrading the curriculum to capitalize on students' technological capabilities and drive more immersive blended learning appears the biggest opportunity. TEVT institutions are well positioned to build upon current infrastructure and readiness to achieve more advanced, innovation-driven technical education programs.

4.3 Discussion

The purpose of the current study was to assess the usage of learning innovation in technical and vocational institution students to enhance technology integration and digital literacy. According to the findings of the study, for the students, there is foundation access to computing infrastructure, yet more advanced instructional technology in educational and technical domains is needed. Particularly, findings strengthen past analyses highlighting infrastructure readiness at technical colleges as a starting point for technology-enabled learning (Barrett et al., 2019). Yet, realizing transformation needs meaningful initiatives spanning policy, pedagogy, and culture. Updating curricula itself risks having minimal impact without corresponding teacher training in constructivist, tool-leveraging techniques (Abrahams, 2010). Hopefully, students' proactive internet usage for self-directed study reveals their desire for online materials. It mirrors the growing implementation of blended models balancing physical as well as virtual tools to enhance vocational engagement among students. With students already skilled independently online, formal integration into class workflow is a logical next step. Certainly, active learning through collaborative multimedia is exactly where innovations can be evidence richly for technical subjects. Whether strengthening motor repair diagrams through 3D overlays or narrating workflows digitally, education technologies promise more experiential, competency-building approaches reflecting real-world practices (Rao et al., 2020). Transitioning TEVT institutions toward state-of-the-art, industry-mimicking learning environments remains critical for recruitment and skills development. Moreover, readiness for technology readiness is strong, signifying leaders now must activate adoption through policies addressing multifaceted integration barriers.

6. Conclusion

This research explored students' utilization and perceptions of educational technologies across several categories related to adoption for teaching and learning purposes. The sample focused on technical and vocational education training (TEVT) colleges specifically. The key findings of the study revealed that the students have good access to the infrastructure i.e. computers, and internet connectivity that suggest decent digital literacy. Moreover, there is more

variation in the usage of direct learning applications like software tools, multimedia, and online resources. It seems these colleges have essential technology components but there is a need to integrate them in the curriculum as well as instructional approaches. There should be upgradation of multimedia hardware, incorporation of projects, transformation of assessment methods as well as facilitation in online collaboration tools. With the help of these measures, TVET colleges can enhance students' technical readiness for the achievement of the advanced blended learning environment. Academic programs can also be updated for the capitalization of educational technologies to produce the skilled graduates that are in demand today.

5.1 Recommendations

Following are the recommendations based on the findings of the study.

- There should be an upgradation of multimedia hardware including digital whiteboards, classroom displays, and overhead projection to enhance collaborative, visual learning experiences reflecting real-world technical environments.
- Incentivize integration of productivity software tools (Microsoft Office, CAD programs, etc.) into assignments, assessments, and projects to drive adoption across curricula.
- There should be a transformation of assessment methodology focusing on online collaboration, virtual modeling, and multimedia demonstrations to showcase applied skills.
- Online tools should be used for content delivery, discussion forums, virtual demonstrations, and remote meeting solutions to enable blended learning at scale.
- There should be policy development for universal LMS adoption to centralize courseware access, standardize digitally-enabled instruction, and facilitate competency-based flexible pacing.
- There should be the promotion of web literacy, digital citizenship, and cybersecurity skills alongside domain knowledge to cultivate safe, ethical digital fluency.
- Phase out aging CD/DVD-based resources and physical media infrastructure in favor of cloud-based content delivery for sustainable, scalable models reflecting workplace reliance on networked systems.

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