Chalkboards to Keyboards: The Role of Computers in the Digital Evolution of Education

Dr Rajni Bala, *Assistant Professor, Ramesh Chand Sharia Teachers' Training College, Tangla, Assam*

Abstract

This paper explores the paradigm shift of computer technology on education, specifically its impact on Knowledge transfer and acquisition. In this information age the incorporation of digital tools has shifted the educational landscape from traditional teacher-centred approaches to student-centred dynamics. The paper discusses how computer technology has evolved in the field of education by highlighting its benefits such as increased engagement, personalized learning and immediate feedback to meet diverse learning needs. Additionally, it addresses the challenges of implementing computer technology in the classroom including inadequate training, infrastructure constraints and psychological barriers. By focusing on current literature this paper emphasizes the crucial function of the teacher as a facilitator and guide in the learning process.

Keywords: *Education, Computer, Teacher, Student, Benefits of Computer, Challenges*

Introduction

Technology is essential in contemporary education, reshaping how teaching and learning take place. As we navigate the information age, rapid technological advancements are transforming the operations of various sectors, including business, communication, and management. Education is no exception. As a fundamental pillar in the progress of society, ensuring the quality of education is crucial (Ali et al., 2024). One effective way to strengthen this quality is through the integration of computer technology, which can support more interactive, collaborative, accessible, and efficient learning environments.

In the early 1990s, educational technology was quite limited, with tools like radio, television, VCRs, and overhead projectors regarded as innovative. However, the landscape of education has witnessed a remarkable transformation. Today, a wide array of digital technologies including computers, the internet, email, video conferencing, smart boards, tablets, and smart phones have become integral to teaching and learning. Rashid (2001), as cited in Hussain &

Safdar (2008), highlighted that tools such as interactive videos, CD-ROMs, and teleconferencing are now core elements of modern educational environments. The integration of these computer-based technologies not only enhances student engagement and access to information but also helps to reduce the administrative and instructional responsibilities of teachers (Kucuk, 2023).

Computers have expanded education beyond the traditional classroom, reaching even the most remote corners of society. They have dramatically transformed education, making computer literacy a fundamental part of school curricula. The introduction of computers into education has opened up new opportunities for interactive, flexible, and self-paced learning, reshaping traditional methods. As a result, learners are empowered to advance their skills, while teachers can tailor their instructional methods and content delivery options to meet learners' needs (Chuaungo et al., 2022)

Watts-Taffe et al. (2003) suggested that teachers can serve a vital role in catalyzing the integration of technology into education. Kent & Facer (2004) further emphasized that schools serve as essential environments where students can engage in a diverse range of computer activities. Given that the future of a nation rests in the hands of its educators, it is essential for teachers to recognize the significance of integrating technology into the teaching and learning process.

Objectives of the Study

The primary objectives of this study are:

1. To define the concept of computer.
2. To examine how computer support teachers in enhancing instructional quality.
3. To inspect how computer technology enhances student learning.
4. To highlight the role of computers in school administration.
5. To identify various challenges hindering effective computer integration in education.

Methodology

This study utilized a qualitative research approach, employing literature analysis as the fundamental method of data collection. A number of research papers published in various journals, books, and other academic literature related to the role of computers in education

from the perspectives of teachers, students, administration, and the challenges in implementation were systematically analyzed to draw meaningful insights.

Results and Discussion

The findings from literature analysis are given below.

What is computer?

Computer has infinite potential that can be called as miracle (Singh, 2024). The word computer is derived from Latin word "Compute" whose meaning is "to calculate". It is an electronic device which store information on instruction, analysed supplied data and processed it to produce information. Adekomi (2001) defined computer as a combination of related devices competent of solving problems by accepting data, performing described operations on data, and supplying the results of these operations. Computer has mainly four functions:

i. Input (Accepts of data)
ii. Processing
iii. Output (Produces data)
iv. Storage

The data given in form of raw facts is called Input. The information that is result of processing is known as output and storage allow storing information fed up in it.According to Oak (2011) computer education means to know the basic concepts related to a computer and acquiring the fundamental knowledge of computer operation. This computer knowledge should be followed by practical experiences of computer use.

Computer and Teacher

By exploring digital technologies, educators can create engaging learning opportunities that benefit both students and teachers, leading to improved and innovative teaching methods (Alenezi et al., 2023).The classroom educator can never be replaced by programme of self-instruction (Kersh, 1995). But his main role is to guide the learning experiences of students. In using computer for instruction the function of teacher is changed from informant to learning facilitators, and problem solver (Abass et al., 2010). The students and teachers both should decide what should be learned and how learning objectives can have achieved but

main responsibility is on shoulders of a teacher. He should check what each student is doing, what is his performance & how performance of each student can be improved? Computer can help a teacher in following ways:

1. **Entering Behaviour:** Computer is used to determine entering behaviour of students. It helps to classify students according to their abilities and needs.
2. **Effective Teaching:** As computer utilize continues to increase in society, educators must also accommodate by integrating computers into the classroom (Asan, 2003). Computers are capable to address some of the fundamental challenges of the teaching process. They enable students to study with the teacher, rather than solely from the teacher.

   Computers allow educational material to be presented in a more engaging and visually attractive manner. The use of colored images, graphs, and multimedia can capture students' attention and enhance their interest in learning. With access to internet, teachers can provide a wider range of information on any topic.

   When using computers in instruction, teachers should not remain passive observers. Instead, they should proactively guide discussions and collaborate with students in the learning process.

3. **Drill work:** The computer can play the role of a teacher with great efficiency. It can help teachers engage students in drill exercises and provide ample opportunities for practice. Drill work is particularly important in subjects like Mathematics and Languages, and teachers can make it a regular part of instruction with the help of computers.

   Computers also promote laboratory work and hands-on practice, especially in science subjects. Tutorial, drill, and repetitive programs have been shown to have a positive impact on student learning and attitudes (Ehman & Glenn, 1991).

4. **Individual Differences:** No two individuals are the same, and each student has different learning abilities. By using computers, effective learning materials can be developed to cater to individual differences through personalized instruction. Step-by-

step learning strategy can support slow learners. Computers can also generate individualized instructions tailored to every student's needs.

This allows teachers to focus their instruction and devote more time to students who truly need additional help. Technology has proven to be an efficient tool for providing such students with opportunities to engage in fundamental drills, practice activities, simulations, exploratory learning, and communication tasks that are aligned with their individual needs and abilities (Baby, 1992).

5. **Evaluation:** Teachers use computers to prepare tests, record, and calculate students' grades. Computers also assist in the analysis, interpretation, and maintenance of test records. Becker et al. (1999) considered the computer a routine tool that helps teachers accomplish their professional tasks.

Computer and Student

Incorporating technology into the learning process enhances pupil learning and academic achievement by serving as a multifaceted support tool (Gupta & Goel, 2024). According to Branson (1991), students gain knowledge not only from the teacher but also alongside the teacher and through interactions with their peers.

Students can often achieve more through computer-assisted learning than in traditional learning environments. With the help of computers, they can make decisions about their studies, including when, where, and how to study. They can also work in a supportive environment by seeking assistance from teachers and peer groups while sharing their learning experiences. Computers facilitate the learning process by encouraging students' active participation.

1. **Flexibility:** Computer technology can be a strong and flexible tool for learning (Bereiter, 2002). It brings both flexibility and personalization to the learning process by enabling direct interaction between students and the subject matter. This allows learners to study according to their individual needs and interests. Additionally, it nurtures self-directed learning habits, enabling students to study at their own pace and at times that suit them best.
2. **Immediate Feedback:** Digital learning tools surpass traditional classroom methods by offering immediate feedback, enhanced engagement, and greater efficiency in the

learning process (Haleem et al., 2022). Computers play a key role in this by providing immediate feedback to students. In computer-assisted instruction, the computer interacts directly with the learner and delivers immediate responses based on their inputs. This quick response system enhances reinforcement and supports more effective learning.

3. **Education to disable students:** Hasselbring (2001) highlighted the significant role of word processing and word prediction software in the education of students with disabilities. Word processing software serves as an effective learning tool for children with special needs, offering features that facilitate text revision and produce clean, readable documents, which can lead to improved writing skills. Parette & McMahan (2002) noted that such software ensures clear, consistent text display and includes functionalities like spell check and basic grammar assistance. Additionally, word prediction software helps students to enhance their written language by suggesting words as they type; a list of options appears based on the letters entered, allowing students to select and insert the desired word easily. Many students with autism also benefit from augmentative and alternative communication (AAC) methods, which include picture symbols, communication boards, and speech-generating devices (Biggs, 2023). These technologies assist individuals with limited or no speech in overcoming communication challenges, thereby enhancing their speaking capabilities. Moreover, optical character recognition (OCR) technology can scan and read text aloud, aiding visually impaired students in accessing materials independently (Kurzweil, 1992). Braille note takers further support students with visual impairments by storing Braille characters and reading text aloud, ensuring they have the necessary tools for effective communication and learning.
4. **Storage and Repetition:** According to Adekomi (2001), information can be stored manually in files or on a computer's magnetic disk and retrieved when needed. One of significant benefit of computers is their capability to repeat content. If a student does not fully understand a lesson, they can replay the lecture as many times as necessary. This feature is particularly beneficial for slow and average learners, allowing them to learn at their own pace.
5. **Problem-Solving and Creativity:** Computers can be effectively used to develop problem-solving skills and foster creativity among students. A wide range of educational computer games and puzzles are available on the internet to support this purpose. Research has shown that computer- and internet-supported teaching

strategies play a crucial role in facilitating the development of students' critical thinking, problem-solving, and decision-making skills (Berson, 1996; Rice & Wilson, 1999).

6. **Educational Research:** Computers' ability to store huge amounts of information, along with their high-speed capacity for analysis and perfect interpretation, makes them highly valuable tools in research work.
7. **Distance Learning:** The use of computer technology is rapidly becoming an essential tool in open and distance learning institutions (Hussain& Farooq, 2013). In distance education, computers can be used in two main modes: the local (offline) mode and the transmitted (online) mode. The offline mode refers to the self-regulating use of a computer system, allowing learners to study on their own without the need for an internet connection. In contrast, the online mode involves connecting one computer to other through communication networks. Through interconnected computers, a learning network can be established, linking distance learners with instructors and facilitating interactive learning.

Computer and Administration

Integrating computers into school administration offers significant benefits, including enhanced service delivery through accurate accounting reports, reduced loss of books by improving tracking of items on loan, and better monitoring of student and teacher attendance (Ocharo et al., 2015).The uses of computer in administration are given as:

- Budgeting and Monitoring of Finance
- Keeping Students Records
- Preparing and Maintaining Bills Records
- Maintaining Statistics of Institutions.

Challenges in Integration of Computer in Education

Despite its many advantages, successful implementation of computers in classroom practices remains rare. One major hurdle is teachers' professional development. Effective use of computers in the classroom requires specific skills and knowledge, but many teachers having lack of sufficient computer literacy (Asan, 2003).

Additionally, some teachers worry that computers may replace them, or they find handling computers to be a complicated process. Many also perceive computer use as an extra burden in their already demanding workload. Teachers' reluctance or ineptitude in using computers for teaching remains a significant obstacle to integrating technology into daily classroom activities (Sadık, 2006).

Psychological factors such as computer anxiety, computer phobia, and low computer self-efficacy further contribute to the challenge (Halder & Chaudhuri, 2011).

In India, lack of infrastructure is also a major challenge to the effective integration of technology in education. Most schools, particularly in rural areas, operate in old buildings that lack suitable physical infrastructure to support modern technology. Frequent power cuts, improper electrical wiring, and the absence of backup power systems further hinder the consistent use of computers and digital tools in classrooms

Another significant problem is content development. Most existing computer-based study materials are in English, while the medium of instruction in many government schools is Hindi. Therefore, there is a pressing need to develop computer-based learning materials in regional languages to make digital education more accessible.

Conclusion

Computers have revolutionized nearly every sphere of human life, including industries, medicine, scientific research, and the film industry. Nowadays, computers are also widely used in the field of education across many countries. Their integration has shifted education from a teacher directed approach to a more learner directed model. However, this shift does not diminish the significance of the teacher.

In a computer-based teaching and learning environment, the role of the teacher transformed rather than disappears. The teacher becomes an initiator or mentor who plans learning activities and guides students throughout the process. As Wyan (1999) stated, the teacher cannot be eliminate from the central instructional role he or she occupies, regardless of the technological level, due to the active role teachers play in the teaching-learning process.

Ultimately, computers are reshaping the educational landscape, helping to transforming teaching and learning methods in order to meet the desired goals of education.

References

1. Abass, B., Lawunmi, Olalakan, O., & Ajibade, A. (2010). Uses of computer and its relevance to teaching and learning in nigerian education system, *An International Multi-Disciplinary Journal, Ethiopia,* 4, 519-528.
2. Adekemi, A. A. (2001). *Introduction to computer education* [Unpublished monograph]. Obafemi Awolowo University.https://www.sciepub.com/reference/261816
3. Alenezi, M., Wardat, S., & Akour, M. (2023). The need of integrating digital education in higher education: challenges and opportunities. *Sustainability*, *15*(6), 4782.https://www.mdpi.com/2071-1050/15/6/4782
4. Ali, M., Aini, M. A., & Alam, S. N. (2024). Integrating technology in learning in madrasah: towards the digital age. *Indonesian Journal of Education (INJOE)*, *4*(1), 290-304.
5. Asan, A. (2003). Computer technology awareness by elementary school teachers: a case study from turkey, *Journal of Information Technology Education*, 2, 153-164.
6. Baby, J. (1992). Curriculum applications in special education computing. *Journal of Computer-Based Instruction,* 19, 1–5.
7. Becker, H. J., Ravitz, J. L., & Wong, Y. T. (1999). *Teacher and teacher-directed student use of computers* (Teaching, Learning, and Computing National Survey Report No. 3). Center for Research on Information Technology and Organizations, University of California, Irvine.www.crito.uci.edu/tlc/findings/computeruse/
8. Bereiter, C. (2002). *Education and mind in the knowledge age*. Lawrence Erlbaum Associates. https://www.taylorfrancis.com/books/mono/10.4324/9781410612182/education-mind-knowledge-age-carl-bereite
9. Berson, M. J. (1996). Effectiveness of computer technology in the social studies: A review of the literature. *Journal of Research on Computing in Education*, *28*(4), 486–499. https://doi.org/10.1080/08886504.1996.10782179
10. Biggs, E. E. (2023). Strengthening professional networks to serve students with autism who have communication needs. *Intervention in School and Clinic*, *58*(3), 173–182. https://eric.ed.gov/?id=EJ1359586

11. Chuaungo, M. L., Lalnunsiami, K., & Mishra, L. (2022). Opportunities and barriers in ict integrated education: a critical analysis. *International Journal of Engineering Technology and Management Sciences*, *6*(5), 753-759. http://ijetms.in/Vol-6-issue-5/Vol-6-Issue-5-117.pdf
12. Ehman, L. H., & Glenn, A. D. (1991). Interactive technologies in the social studies. In J. P. Shaver (Ed.), *Handbook of research on social studies teaching and learning* (pp. 513–522). Macmillan Publishing Company
13. Gupta, K., & Goel, S. (2024). Integration of technology into education and its effects on student learning.*International Journal for Multidisciplinary Research*, 6(2), 1-6.https://www.ijfmr.com/papers/2024/2/15586.pdf
14. Halder, S., & Chaudhuri, S. (2011). Computer self-efficacy and computer anxiety of trainee teachers: Issue of concern. In *Proceedings of epiSTEME 4 – International Conference to Review Research on Science, Technology and Mathematics Education*. Homi Bhabha Centre for Science Education. http://episteme4.hbcse.tifr.res.in/proceedings
15. Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers, 3*, 275–285. https://www.sciencedirect.com/science/article/pii/S2666412722000137
16. Hasselbring, T. S. (2001). A possible future of special education technology. *Journal of Special Education Technology*, *16*(4), 15-21.
17. Hussain, I., & Safdar, M (2008). Role of Information Technologies in Teaching Learning Process: Perception of the Faculty. *Turkish Online Journal of Distance Education-TODJE*, 8, 47-56. https://dergipark.org.tr/tr/download/article-file/156261
18. Hussain, M. A., & Farooq, M. S. (2013). Computer technology skills used by student teachers in open and distance learning: Implications for teacher education in ODL. In *Proceedings of the 3rd International Conference on E-learning & Distance Education*.
19. Kent, N., & Facer, K. (2004). Different worlds? A comparison of young people's home and school ICT use. *Journal of Computer Assisted Learning, 20*(6), 440–445. https://doi.org/10.1111/j.1365-2729.2004.00102.x
20. Kersh, C. (1995). *Implementing computer assisted instruction in a technical writing course: Effects on students' attitudes*. McMillan
21. Kucuk, T. (2023). Technology integrated teaching and its positive and negative impacts on education. *International Journal of Social Sciences & Educational*

Studies, 10(1), 46–55. https://eprints.tiu.edu.iq/1412/1/Technology-Integrated-Teaching-and-Its-Positive-and-Negative-Impacts-On-Education-1.pdf

22. Kurzweil, R. (1992). *The age of intelligent machines*. MIT Press.
23. Oak, M. (2011). Article on importance of computer education. http://www.buzzle.com/articles/importance-of-computereducation
24. Ocharo, M. C., Nyakweba, I., Kandie, K., & Momanyi, O. B. (2015). Impact of computers' implementation on administration use in public secondary schools in nyamira north district, nyamira county-kenya. *International Journal of Recent Research in Social Sciences and Humanities*, 2(1), 17-30. https://www.paperpublications.org/upload/book/Impact%20of%20Computers%20Implementation-145.pdf
25. Parette, P., & McMahan, G. A. (2002). What should we expect of assistive technology? Being sensitive to family goals. *Teaching Exceptional Children*, *35*(1), 56-61. https://journals.sagepub.com/doi/abs/10.1177/004005990203500108
26. Rice, M. L., & Wilson, E. K. (1999). How technology aids constructivism in the social studies classroom. *Social Studies*, 90 (1), 28-33.https://www.learntechlib.org/p/63991/
27. Sadik, A. (2006). Factors influencing teachers' attitudes toward personal use and school use of computers: new evidence from a developing nation. *Evaluation Review*, 30 (1), 86-113.https://pubmed.ncbi.nlm.nih.gov/16394188/
28. Singh, S. (2024, January). Use of computer technology in research. *Procedure International Journal of Science and Technology*, *1*(3), 31–38. https://doi.org/10.62796/pijst.2024v1i304
29. Watts-Taffe, S., Gwinn, C.B., & Horn, M.L. (2003). Preparing preservice teachers to integrate technology with the elementary literacy program.*The Reading Teacher*, 57, 130-138. https://eric.ed.gov/?id=EJ676032
30. Wynn, C. (1999). The relative merits of distributed computing systems. In *Proceedings of the International Computing Symposium*.