Research Article

ICT Integration in Teaching-Learning Process for Sustainable Education: A Study

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Abstract

Integrating "Information and Communication Technology (ICT)" into education is essential for achieving sustainable education in line with the National Education Policy (NEP) 2020. ICT enhances personalized learning, boosts student engagement, and equips students with necessary digital-era skills. Utilizing interactive multimedia, online resources, and collaborative tools nurtures critical thinking and problem-solving abilities. Education must instil knowledge, mindsets, interests, and competencies that support sustainable development. Foundational education focusing on functional literacy, vocational skills, environmental awareness, and responsible citizenship is crucial for sustainable progress. ICT improves education quality by making educational content and best practices more accessible. Challenges in sustainable educational development can be effectively addressed through ICT interventions. ICT-based strategies, such as social networking, promote constructivist learning and facilitate transformative changes, making ICT a powerful tool for advancing sustainable education. This research paper investigates the use of ICT in Meghalaya's schools for sustainable education and identifies obstacles schools face in utilizing ICT for Sustainable Development. A descriptive survey approach was used, involving questionnaires distributed to secondary school teachers in East Khasi Hills, Meghalaya. Data analysis through percentage calculations highlights the need for appropriate measures to enhance education quality through ICT integration.

Keywords: Information and Communication Technology (ICT), Sustainable Development, Quality Education, School Education.

Introduction

Technology and information are the key drivers in the 21st century. The utilization of technology has actively contributed to enhancing efficiency, advancement, and flawlessness in the realm of education, enabling the dissemination of vast amounts of information in a shorter span of time, thereby making the learning process more interactive. UNESCO asserts that the integration of technology into education can elevate the learning environment, foster active collaboration, nurture creativity, and pave the way for the provision of quality education to all. It states - "the vision of education stresses upon a holistic, interdisciplinary approach to the development of knowledge and skills required for a sustainable future as well as changes in values, behavior and lifestyles (UNESCO, 2003)." There is a firm belief that acknowledging innovative "Information and Communication Technology (ICT)" practices in education can catalyze further educational advancements (Dkhar, 2013). ICT promotes access to educational material in a more sustainable manner wherein individuals can access the information directly from the database in a digitized format. Additionally, it can also enable access

to information beyond the traditional limitations of borders and regions. In this manner, ICT is representative of a deep and pervasive revolution that is impacting human existence as a whole by breaking down the barriers to education and access to learning and knowledge by allowing people to tap into new information sources, ultimately allowing them to expand their knowledge base while at the same time sparking student interest in new areas (Oni, et.al. 2013).

Information and Communication Technology (ICT) Advancements in Education

"The phrase ICT is very wide in its ambit and it encompasses a wide variety of technologies within itself, including but not limited to computers, the Internet, mobile phones, e-learning, and video conferencing technologies, etc. These technological tools have brought forth a revolution in the manner in which information is generated, stored, reused, and also communicated on a global scale, thus impacting all relevant sectors of human society. ICT also functions as an integrating and enabling technology. By acting as integrating and enabling technologies, ICT plays a revolutionary role in enhancing productivity for sustainable development (Shadap, 2013)."

"Sustainable Development Goal (SDG 4)" mandates that universal access to high-quality and inclusive education must be provided to all to ensure continuous development in the educational sector by the year 2030. To attain universal accessibility in the educational sector, existing disparities in the financial status of individuals and social problems such as gender disparities are to be addressed to provide uniform access to appropriate job-related education (Abdin, 2018). A dynamic role is played by ICT in promoting sustainability in the development of education through a refinement of educational levels and by removing constraints, thereby enabling the application of scientific knowledge in order to meet societal purposes. Therefore, ICT is a real and substantial tool for promoting sustainable education (Kadir, 2014).

Introductory academic education, which promotes functional knowledge, livelihood abilities, and understanding of the immediate wisdom and values of responsible citizenship, is a precondition for sustainable development (Saha, 2012). "Education for Sustainable Development (ESD)" means preparing learners for present challenges that the world is facing and also future challenges that the world will face, primarily in consideration of technological interventions and growth. Added connectivity brought forth by an ICT regime can be instrumental in enabling students to access educational assets even in regions and areas that are remote and low–income in nature. as well as fostering innovation and growth. Educators can now prepare materials for students across the globe without consideration of the regions, including backward ones, and can approach valued educational and learning resources. Thus, the inclusion of new technology can be instrumental in opening up new avenues for advancing the ESD- recommended modifications that deal with educational practices (Paas & Creech, 2008, as cited by Adu and Adeyinka, 2009).

Sustainable education is a phrase that aims to bestow upon children and learners of all ages the knowledge, skills or values that are necessary for holistic development of the learners. It is focused on the promotion of awareness and the understanding of environmental, social and economic issues with a focus on encouraging responsible behavior as well as decision-making. The integration of ICT has enabled the inculcation and incorporation of innovative standards of teaching into education. It has also allowed the simplification of complicated topics through audio-visual inputs and has allowed educators

to dilute traditional boundaries of geography by allowing access to a vast plethora of academic resources. It can also foster collaborative learning among the students wherein the educators can focus on individualized teaching standards through ICT to cater to the various needs of the learners. Furthermore, long-distance learning is also enabled through the introduction of ICT into this domain. All this has enabled greater achievement of sustainable education standards.

In conclusion, ICT is vital for sustainable education, providing access to environmental information, interactive learning through educational apps, simulations, and virtual labs and facilitates collaborative learning through online platforms, real-time data analysis, energy-efficient technologies, global awareness, teacher professional development, equipping students and teachers with digital knowledge and critical thinking abilities. It also facilitates collaborative learning, connects teachers to global initiatives, and enhances teacher skills. The integration of ICT in education enhances accessibility, improves the quality of education, supports lifelong learning, promotes scientific knowledge, and prepares learners to tackle global challenges. By leveraging ICT, education systems can become more inclusive, effective, and adaptable, ensuring that all individuals have the opportunity to thrive in the digital age.

Review of Related Literature

Kadir et al. (2014) identified ICT as crucial for sustainable education in Nigeria, facilitating scientific knowledge application. Gidadawa and Dogondaji (2014) concluded that ICT-based education supports sustainable development. Saidu et al. (2014) emphasized the role of ICT in sustainable education, noting the need to address curriculum, infrastructure, capacity building, language, content, and financing barriers. Nevin (2008) highlighted the high quality and diversity of current ESD programs. Moodly and Adu (2014) highlighted ICT's potential for knowledge distribution and effective learning, expanding access to ICT resources.

Tyagi et al. (2020) noted ICT's impact on sustainable education through job creation and economic participation. Mohanty and Dash (2018) advocated for a "Whole School Approach" for sustainable change in schools. Paul and Mehera (2016) showed a positive relationship between education and sustainable development, impacting income, women's status, population growth, environmental protection, living standards, and decision-making. Kanvaria (2011) revealed that ICT-integrated teaching promotes professional growth and sustainable education. Singh (2010) identified four major ESD thrusts: expanding basic education, reorienting education for sustainability, improving public awareness, and enhancing training and skill development.

Bera (2020) stated that ICT improves education quality by supporting challenging subjects. Olita and Orong (2023) found that teachers face challenges such as lack of skills, poor internet connection, insufficient computers, outdated ICT equipment, and students' difficulty with technology. Lantaron et al. (2022) observed improved learning outcomes and student engagement when using apps and social media like WhatsApp.

It is evident from various studies that ICT plays a vital role in sustainable school education. Numerous studies have demonstrated that the use of ICT significantly improves the quality of education, not just in India but in many regions worldwide. However, while there is substantial evidence of ICT's positive impact on education, there is a notable gap in the specific application and challenges of ICT in the teaching-

learning process within Meghalaya.

Existing research highlights the benefits of ICT, such as enhancing personalized learning, boosting student engagement, and equipping students with necessary digital skills. Despite these advantages, there is limited understanding of how ICT is practically implemented in the classrooms of Meghalaya. Furthermore, the specific problems teachers face when integrating ICT into their teaching practices remain underexplored. This research gap is particularly significant in the context of Meghalaya's unique educational and socio-cultural landscape. The East Khasi Hills district, being diverse and distinct, offers a valuable case study for understanding the practicalities and hurdles of ICT integration in education. Addressing this gap is crucial for developing tailored strategies that can effectively harness ICT for sustainable educational development in this region.

Therefore, the present study was undertaken to investigate the application of ICT in the teaching-learning process in Meghalaya. It aims to identify the specific challenges teachers encounter when using ICT in their classrooms. By focusing on these aspects, the study seeks to provide comprehensive insights that can inform educational policies and practices, ultimately enhancing the quality of education through effective ICT integration in Meghalaya.

The state of Meghalaya has been selected for the present study because it presents a unique position since it is a state that sits at the cusp of technological innovation. Presently, the state is transforming the realm of ICT and while some regions have integrated ICT into their teaching style, other regions remain deprived of the same primarily because of a lack of technological development vis-à-vis ICT. In this regard, it is important to understand the existing applications of ICT within the education sector in the state of Meghalaya to try and understand the challenges and shortcomings being faced by the various stakeholders. The information thus gathered from this research can become a pertinent source of data for the future implementation of ICT within the educational sector of the state and improve its efficacy and efficiency.

Need and Significance of the Study

The fundamental purpose of education is to empower learners to understand life and coexist peacefully with nature, fostering justice and responsibility. Moodly and Adu (2014) showed that ICTs enhance information sharing, productive learning, and effective educational programs. "Education for Sustainable Development" (ESD) should be included in curricula to provide everyone with the knowledge, skills, and values essential for a sustainable future. ESD promotes creative thinking, innovation, problem-solving, and decision-making, engaging formal, informal, and non-formal education modes. The pandemic highlighted ICT's crucial role in education. Mohanty and Dash (2018) found that ESD fosters awareness of global complexities and drives positive changes. Recent ESD literature on SDGs for 2030 supports a Whole School Approach for sustainable change in school practices and policies.

This study aims to inform educational designers, curriculum creators, academics, policymakers, and stakeholders, driving positive developments in Meghalaya's school education. The East Khasi Hills district, chosen for its diversity, needs research on ICT's role in sustainable education. Understanding ICT access and utilization for sustainable education will aid in the overall development of students.

Research questions

1. How is ICT applied in the teaching-learning process for Sustainable school education?

2. What type of problems do school teachers face with regard to ICT in teaching-learning?

Objectives of the study

1. To study the application of ICT in the teaching-learning process for Sustainable school education.
2. To study the problem faced by Teachers with regard to ICT integration in the teaching-learning process.

Delimitation of the study

The study is delimited to the Secondary Schools of Meghalaya Board of Secondary Education (MBOSE), in East Khasi Hills District, Meghalaya.

Methodology

The Descriptive survey study method was implemented for the present study. Data has been collected through a self-constructed questionnaire from teachers of secondary schools in East Khasi Hills, Meghalaya. The data was collected from Government, Government Aided and Private school teachers. For the analysis of data, frequencies and percentages were calculated.

Population and Sample of the Study

The population of the present study comprised of Government, Government Aided and Private Secondary Schools affiliated to Meghalaya Board of Secondary Education (MBOSE) in East Khasi Hills District, Meghalaya.

Sample and Sampling Technique

The sample of the study was comprised of teachers of Government, Government-aided and Private schools affiliated with MBOSE at the secondary level. A total of 100 teachers were selected for the study including 19 teachers from Government schools, 41 teachers from Govt. Aided and 40 teachers from private schools were taken as samples. Disproportionate stratified random sampling technique was adopted for the present study.

Data Collection

The data was collected from the secondary school teachers of the East Khasi Hills district, Meghalaya, in the month of October-November 2023.

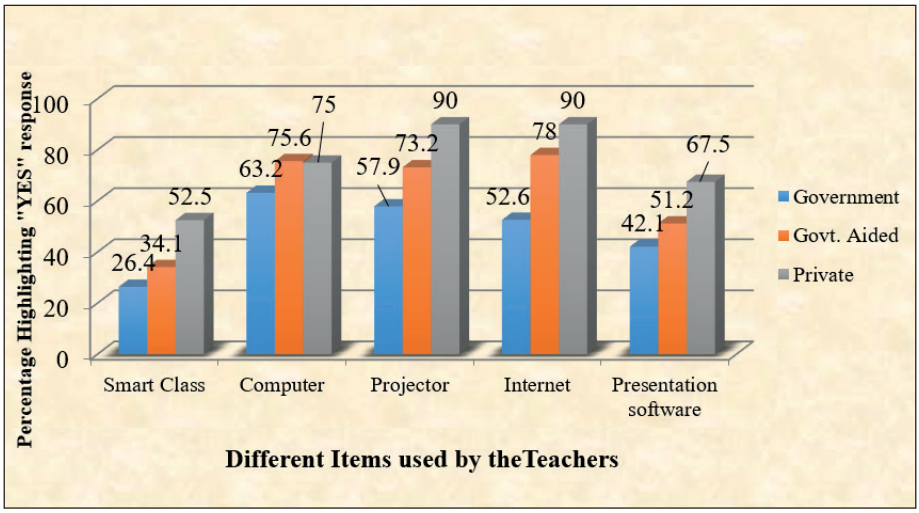
Data Analysis and Interpretation

Objective 1. To study the application of ICT in the teaching-learning process for Sustainable school education.

Tables-1: Showing the Application of ICT by teachers for teaching - learning

Management	Government				Govt. Aided				Private			
	Responses											
Items	Frequency		Percentage		Frequency		Percentage		Frequency		Percentage	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Smart Class	5	14	26.4	73.7	14	27	34.1	65.9	21	19	52.5	47.5
Computer	12	7	63.2	36.8	31	10	75.6	24.4	30	10	75	25
Projector	11	8	57.9	42.1	30	11	73.2	26.8	36	4	90	10
Internet	10	9	52.6	47.4	32	9	78	22	36	4	90	10
Presentation software	8	11	42.1	57.9	21	20	51.2	48.8	27	13	67.5	32.5

Figure-1: Showing the Application of ICTs by teachers for teaching - learning

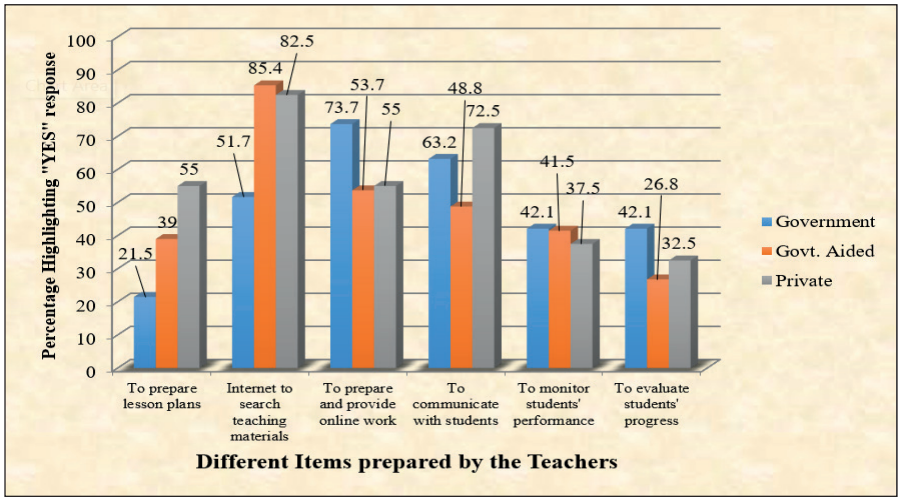


The above Table 1 and Figure 1 showed the result of the application of ICT by teachers, which indicated that only 26.4 per cent of government school teachers were using smart classes, and a maximum of 63.2 per cent of government school teachers used computers for learning purposes. The study found that a minimum of 34.1 per cent of govt aided teachers used smart classes for teaching, while a maximum of 78 per cent govt aided teachers used the Internet for teaching learning, whereas 52.5 per cent of private school teachers made use of smart classes and a maximum of 90 per cent of private school teachers were using projector and internet for teaching purpose. This clearly showed that there was less use of ICTs by govt school teachers.

Table-2: Showing the Use of ICT by teachers for teaching-learning

Management	Government				Govt. Aided				Private			
	Responses											
Items	Frequency		Percentage		Frequency		Percentage		Frequency		Percentage	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
To prepare lesson plans	4	15	21.5	78.9	16	25	39	61	22	18	55	45
Internet to search teaching materials	10	9	51.7	47.4	35	6	85.4	14.6	33	7	82.5	17.5
To prepare and provide online work	14	5	73.7	26.3	22	19	53.7	46.3	22	18	55	45
To communicate with students	12	7	63.2	36.8	20	21	48.8	51.2	29	11	72.5	27.5
To monitor students' performance	8	11	42.1	57.9	17	24	41.5	58.5	15	25	37.5	62.5
To evaluate students' progress	8	11	42.1	57.9	11	30	26.8	73.2	13	27	32.5	67.5

Figure-2: Showing Use of ICT by teachers for teaching –learning

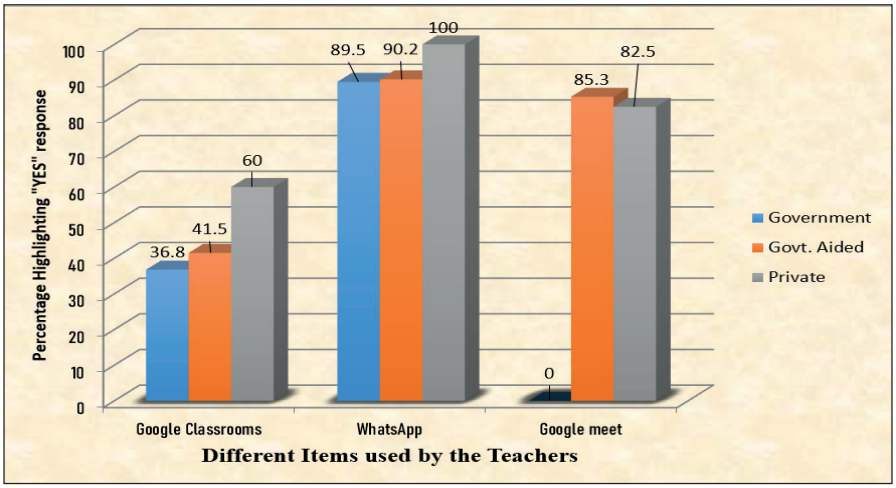


With regards to the use of ICTs by teachers the above Table 2 and Figure 2 revealed that only 21.5 per cent of teachers from govt schools use ICTs for lesson plans and a maximum of 73.7 per cent of government school teachers were using to prepare and provide online work to students, while a maximum of 85.4 per cent teachers from govt aided schools were using the internet to search study materials and a minimum of 26.8 per cent govt aided school teachers were using ICTs to evaluate students' progress. 82.5 per cent of private school teachers were using the Internet to search study materials whereas a minimum of 32.5 per cent of private school teachers were using ICTs for evaluation purposes. The result showed that more ICTs were used by government-aided school teachers and private school teachers than government-school teachers.

Table-3: Different Apps used by teachers for teaching learning

Management	Government				Govt. Aided				Private			
	Responses											
Items	Frequency		Percentage		Frequency		Percentage		Frequency		Percentage	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Google Class-rooms	7	12	36.8	63.2	17	24	41.5	58.5	24	16	60	40
WhatsApp	17	2	89.5	10.5	37	4	90.2	9.8	40	0	100	0
Google meet	0	0	0	0	35	6	85.3	14.7	33	7	82.5	17.5

Figure-3: Different Apps used by teachers for teaching learning



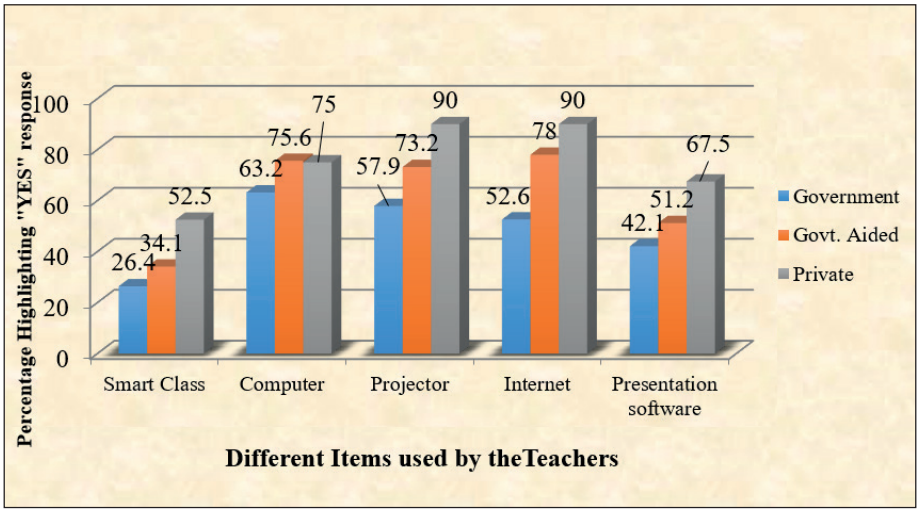
With regards to Table 3 and Figure 3, different Apps used by teachers, the study showed that a maximum number of govt school teachers, 89.5 per cent, use WhatsApp while no teachers from government schools were using Google Meet. 41.5 per cent of govt aided teachers were using Google Classrooms, while a maximum of 90.2 per cent of govt aided school teachers were using WhatsApp; however, 100 per cent of private school teachers used WhatsApp, and 60 per cent of private school teachers used Google Meet. This clearly showed that most of the teachers are not aware of Google Meet, which is an integral part of ICT for teaching the teaching-learning process.

Objective 2. To study the problem faced by Teachers with regard to ICT integration in teaching teaching-learning process.

Table-4: Problems faced by teachers during the use of ICT in teaching-learning

Management	Government				Govt. Aided				Private			
	Responses											
Items	Frequency		Percentage		Frequency		Percentage		Frequency		Percentage	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Infrastructure	17	2	89.5	10.5	36	5	87.8	12.1	32	8	80	20
Lack of e-resources	15	4	78.9	21.1	35	6	85.4	14.7	18	22	45	55
Constraints of time	6	13	31.6	68.5	23	18	56.1	43.9	21	19	52.5	47.5
Lack of electronic devices	17	2	89.5	10.5	38	3	92.7	7.3	23	17	57.5	37.5
Lack of technical support	17	2	89.5	10.5	35	6	85.4	14.7	29	11	72.5	27.5
Lack of maintenance	17	2	89.5	10.5	38	3	92.7	7.3	33	7	82.5	17.5

Figure-4: Problems faced by teachers during use of ICT in teaching –learning



According to the above Table 4 and Figure 4, regarding problems faced by teachers, 31.6 per cent of school teachers said constraints of time as they have to finish the syllabus, while a maximum of 89.5 per cent of govt school teachers said about infrastructure, lack of electronic devices, lack of technical support and lack of maintenance. A maximum of 92.7 per cent of government-aided educators said lack of electronic devices and lack of maintenance of available devices, whereas a minimum of 56.1 per cent of government-aided school teachers talked about constraints of time. 45 per cent of private school teachers said lack of e-resources, while 82.5 per cent of private school teachers said about lack of maintenance of the ICT devices in school.

Findings and Discussions

Objective 1. To study the application of ICT in the teaching-learning process for Sustainable school education.

1. The findings of the study indicated that teachers from all three managements were using computers in the computer lab as there were no computers in the classroom. The teachers use PowerPoint presentations to help their students understand difficult subjects in simpler terms, which encourages creativity and improves learning outcomes. Shaikh (2013) and Chatterjee and Nath (2015) also found the same result in their respective studies. It has been seen, that teachers use multimedia materials and presentation tools like Google Slides and PowerPoint to teach a variety of subjects. A vast number of educators have been accessing study materials over the Internet. The use of new technology can present intriguing new opportunities to encourage the modifications in teaching strategies demanded in "Education for Sustainable Development" (Paas & Creech, 2008 as cited by Adu and Adeyinka, 2009, January).
2. The findings of the present study suggested that teachers from all three types of management used the Internet for making lesson plans and assigning online work to students as well as to get study materials. However, a limited

number of teachers were utilizing ICTs to create lesson plans, track student progress, and observe student performance. The main utilization of ICTs was for communication with other instructors and students. These results were supported by Koc (2005), who found that "ICT-enabled study interconnects, assigns and works collaboratively anywhere anytime" and Bera (2020)." who cited that "Educators need to be involved in cooperative endeavours, which would include teaching partnerships with ICT as a tool."

3. The findings showed that teachers from all three kinds of management shared assignments, grades, and other information online using Google Classroom and Google Meet, which are online learning management systems. Educators also utilized WhatsApp by creating groups specifically for each class or subject and then using these groups to communicate with students regarding assignments, multimedia content, instructional films, and other visual materials. It is found that instant communication like this increases student involvement and informs them of upcoming events and deadlines. "Lantaron et al. (2022), in their study, recognized better learning outcomes by students who used the apps." With free online resources, students can find any kind of information on any topic (Angadi, (2015).

Objective 2. To study the problem faced by Teachers with regards to ICT integration in the teaching-learning process:

1. The outcomes of the study indicated that teachers had a sturdy desire for the incorporation of ICT into education but they faced many difficulties with it. According to the study, teachers were having a variety of issues when integrating ICTs for teaching and learning, including inadequate infrastructure, a lack of e-resources, time constraints, and a shortage of electronic equipment like computers and projectors in the classroom. It was discovered that a lack of technical assistance, including fewer employees with ICT training and inadequate tool maintenance, was making it difficult to utilize. Aside from these, slower networks, improper power backup, and power outages were a few issues in incorporating ICTs into teaching and learning. Olita, and Orong (2023) found the same problem as educators faced challenges such as a lack of ability to teach with ICT incorporation, modest Internet connection, inadequate computers in the classroom, unavailability of the latest ICT equipment and pupils' difficulty with technological devices. Habibu, Mamun, and Clement, (2012) also found the same in their study that if educators were to be made aware of the importance of ICT in their teaching and learning processes, then their training in pedagogical concerns need to improve

Conclusion

From the above study, it is clear that teachers used a variety of ICTs in the teaching and learning process. Teachers are sharing assignments and messages using social media platforms like WhatsApp and various online classroom management systems like Google Classroom and Meet. The study

concludes that there are a number of problems that come up when integrating ICTs for teaching and learning, such as inadequate infrastructure, lack of electronic resources, time constraints, and a shortage of electronic equipment like projectors and computers in the classroom. It is found that lack of technical support including fewer employees with training in ICT and inadequate maintenance of ICT equipment is hindering easy access to ICTs. To make use of new opportunities offered by ICT, the school should be provided necessary infrastructure with ICT equipment to enhance quality education.

The government of Meghalaya has implemented various plans and initiatives to endorse the use of ICT in education. These initiatives include providing schools with ICT infrastructure, training teachers, and developing digital content. However, the success and effectiveness of these efforts may vary. Several hurdles may deter the seamless integration of ICT in education in Meghalaya, such as insufficient funding, absence of technical support, and struggles in maintaining the ICT infrastructure. Furthermore, the state's cultural and linguistic diversity may present challenges in creating and deploying digital content that caters to the diverse needs of students. While there are ongoing efforts to promote ICT in education in Meghalaya, it is crucial to address issues related to infrastructure, connectivity, teacher training, and resource allocation to guarantee an equal approach to high-quality ICT-enabled education for all students in the state.

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